



PREVALENCE AND DETERMINANTS OF ANAEMIA AND EFFECT OF DIFFERENT INTERVENTION AMONG ADOLESCENT GIRLS OF TEA GARDEN POPULATION IN DIBRUGARH, ASSAM

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ABSTRACT

Background: Over 66.4% women and 57.2% adolescent girls are suffering from anemia in India as per NFHS-5. Anemia in adolescent has a negative impact on overall growth, cognitive development and academic performances.

Objective: To assess the prevalence and determinants of anemia among adolescent girls before and after intervention in tea gardens of Dibrugarh, Assam.

Methods: Before and after community-based intervention study was conducted from 2015 - 2020. Face-to-face interview using predesigned and pretested questionnaires, anthropometric measurements and Hemoglobin estimation by Cyno-meth Hb method was done. Intervention was given by monthly nutrition health education sessions, IFA supplementation, deworming and holding quarterly cooking demonstration. SPSS v. 25, used to analyze the results and presented as frequencies, ratios and p-value and difference in proportion presented using chi-square test.

Results: Response rate was 97.6% (3383 out of 3465) in baseline and 94.8% (3285) in end-line. Mean age was 15 years. Prevalence of anemia was 96.3% in baseline study and declined by 13.5% after intervention and worm infestation declined from 69.5% in baseline study to 50% in end-line study. Significant association was found with worm infestation, insanitary water sanitation, poor housing and low BMI.

Conclusion: Anemia prevalence was found to be quite high among adolescent girls which needs immediate attention. Community intervention was found effective.

KEYWORDS : Anaemia, adolescent girls, tea garden population, Dibrugarh, Assam

INTRODUCTION

Anaemia is the most common nutritional disorder and world's nineteenth leading risk factor for death and disability adjusted life year (DALY).¹ According to WHO, Adolescent group is age group between 10-19 years.² Adolescence is the formative period of life, where the velocity of growth is faster and adequate nutrition is very important at this age to gain maximum amount of physical, psychological and behavioral changes.³ Nutritional anemia in adolescents have negative impact on growth, mental development and learning.⁴ Anemia is one of the major consequences of the physiological changes and nutritional neglect during adolescence.⁵ According to ICMR study, communicable, non-communicable and nutritional disorders was found to be very high among tea-garden population leading to increase maternal morbidity and mortality.⁶ Tea-garden community comprises of approximately 17% of Assam's population and 27% of Dibrugarh district.⁷ The major risk factors of anemia found in different studies were found to be socio-economic status, blood loss during menstruation, nutritional status, hand hygiene and worm infestation.⁸

According to study done amongst adolescent girls in tea gardens of Dibrugarh, Assam, prevalence of anemia reduced from 96.3% to 82.8% after interventions like IFA supplementations, deworming and nutrition health education sessions.⁹ Despite various interventions, prevalence of anemia is still 66% in women in Assam, particularly among rural women as per NFHS-5. Anemia among women has increased by 20 percent since NFHS-4.¹⁰ Hence, identifying the prevalence of anemia among adolescents and its determinants including nutritional status will help in reducing the burden of anemia among adolescents. So this study was undertaken to assess the prevalence of anemia and its determinants among adolescent girls in tea-garden community of Dibrugarh district and the effectiveness of community-based interventions.

METHODS:

Carried out in 63 Tea estates included under nutrition health education

program (NHED) and cooking demonstration project, to give end-line comparison and assessing the impact of Child Protection-Nutrition interventions between 2015-2020.

Sample size: Taking Prevalence of anemia amongst 15-49 years women in Assam was 46.1% as per NFHS 4.¹⁰ Considering 5% relative precision, 95% Confidence interval and design effect of 2, the minimum sample size was 3594.

Ethical Considerations:

Ethical Clearance was taken from Institutional Ethics Committee of Assam Medical College, and necessary permissions were obtained from District Health Authority and Assam Branch of Indian Tea Association. Written informed consent were taken from all the eligible participants along with assent for inclusion of below 18 years participants.

Study Design:

A community-based intervention study was conducted in 63 Tea Estates. A minimum of 55 adolescent girls aged between 10-19 years were selected using simple random sample from the list of adolescent girls in each tea estates. Data collection was done by house-to-house survey. Demographic, socio-economic and environmental history was taken along with clinical assessment. Anemia and related morbidities were assessed using predesigned, pretested schedule. Standard case definition for morbidity was used and a recall period of fifteen days was taken for morbidity assessment along with clinical examination.

Nutritional Assessment:

24-hour recall method and food-frequency questionnaire were used for collecting the dietary history of the adolescent girls.

Anthropometry:

Height was measured using anthropometric rod (SECA Scale) with accuracy 0.1cm. Weight was measured using calibrated weighing

machines with accuracy 0.1 kg. Body mass Index (BMI) was calculated and WHO Growth standards were used for interpretation of nutritional status. WHO Anthro Plus Software was used for interpretation of nutritional status.

Laboratory Investigations:

Hemoglobin estimation using Cyan-meth-hemoglobin method for all consenting girls was conducted in a sub-group of population. Hemoglobin cut off of less than 12gm/dl was considered as anemia.

Stool examination:

Worm infestation was assessed through stool examination in a sub-sample of study population.

Statistical Analysis:

The distribution of the various risk factors was summarized as mean (SD) and frequency (proportion) depending on the type of variable. Pearson's chi-square test and Fischer's test is used to see if there is any

association between categorical variables. Difference between more than two groups were evaluated using ANOVA test. Statistical analysis was performed with IBM SPSS version 25 software. p-value less than or equal to 0.05 was considered as statistical significance.

RESULTS:

A total of 3257 participated in the study with a non-response rate of 9%. Mean age of the study participants was 15 years in both baseline and end-line assessment. Majority of them were of OBC caste 3096(95.1%), unmarried 3248(99.7%) and unemployed 2973(91.3%). Majority of the participants studied in high school 803(53.2%) and majority were drop-out 703(91.3%). Reasons for not going to school was found to be personal problems in majority 394(51.2%) and reasons for absent in school was found to be health problem in majority 639(65.1%). Good opinion about need of education was seen in majority 2992(91.9%) and 2741(84.2%) parents were supportive about education. Father was found to be the person taking decision about girl's education in majority 1087(33.4%). (Table 1)

Table 1: Social And Demographic Factors Of The Study Participants

Variables	All total	Anemia			
		Normal	Mild	Moderate	Severe
N	3257	314 (9.6%)	1319 (40.5%)	1360 (41.8%)	264 (8.1%)
Age group					
10 - ≤13 yrs	656 (20.2%)	78 (2.4%)	281 (8.6%)	258 (7.9%)	39 (1.2%)
14 - <16 yrs	900 (27.6%)	67 (2.1%)	350 (10.7%)	394 (12.1%)	89 (2.7%)
≥ 16 yrs	1701 (52.2%)	169 (5.2%)	688 (21.1%)	708 (21.7%)	136 (4.2%)
Caste					
General	34 (1.0%)	2 (0.1%)	15 (0.5%)	16 (0.5%)	1 (0.0%)
OBC	3096 (95.1%)	301 (9.2%)	1261 (38.7%)	1283 (39.4%)	251 (7.7%)
MOBC	127 (3.9%)	11 (0.3%)	43 (1.3%)	61 (1.9%)	12 (0.4%)
Marital Status					
Married	9 (0.3%)	2 (0.1%)	5 (0.2%)	2 (0.1%)	0 (0.0%)
Unmarried	3248 (99.7%)	312 (9.6%)	1314 (40.3%)	1358 (41.7%)	264 (8.1%)
Occupation					
Permanent	19 (0.6%)	2 (0.1%)	4 (0.1%)	11 (0.3%)	2 (0.1%)
Temporary	265 (8.1%)	26 (0.8%)	90 (2.8%)	121 (3.7%)	28 (0.9%)
Non worker	2973 (91.3%)	286 (8.8%)	1225 (37.6%)	1228 (37.7%)	234 (7.2%)
Reason of employment					
NA	2973 (91.3%)	286 (8.8%)	1225 (37.6%)	1228 (37.7%)	234 (7.2%)
Monetary	106 (3.3%)	8 (0.2%)	33 (1.0%)	55 (1.7%)	10 (0.3%)
Parents asked to work	38 (1.2%)	5 (0.2%)	13 (0.4%)	17 (0.5%)	3 (0.1%)
Personal choice	140 (4.3%)	15 (0.5%)	48 (1.5%)	60 (1.8%)	17 (0.5%)
Type of school (n=2487)					
Middle school	803 (32.3%)	85 (3.4%)	330 (13.3%)	334 (13.4%)	54 (2.2%)
High school	1322 (53.2%)	119 (4.8%)	563 (22.6%)	540 (21.7%)	100 (4.0%)
Above	362 (14.6%)	41 (1.6%)	157 (6.3%)	142 (5.7%)	22 (0.9%)
If not going to school (n=770)					
Never been to school	67 (8.7%)	10 (1.3%)	16 (2.1%)	26 (3.4%)	15 (1.9%)
Drop out	703 (91.3%)	59 (7.7%)	253 (32.9%)	318 (41.3%)	73 (9.5%)
Reasons for not going to school (n=770)					
Health problem	112 (14.5%)	10 (1.3%)	42 (5.5%)	44 (5.7%)	16 (2.1%)
Personal problem	394 (51.2%)	37 (4.8%)	139 (18.1%)	177 (23.0%)	41 (5.3%)
Monetary problem	192 (24.9%)	17 (2.2%)	66 (8.6%)	86 (11.2%)	23 (3.0%)
No reason/ don't like	72 (9.4%)	5 (0.6%)	22 (2.9%)	37 (4.8%)	8 (1.0%)
Absent in last month (n=982)					
≤ 7 days	840 (85.5%)	76 (7.7%)	348 (35.4%)	352 (35.8%)	64 (6.5%)
8 - ≤ 15 days	91 (9.3%)	6 (0.6%)	37 (3.8%)	38 (3.9%)	10 (1.0%)
16 - ≤ 30 days	44 (4.5%)	5 (0.5%)	23 (2.3%)	15 (1.5%)	1 (0.1%)
> 30 days	7 (0.7%)	0 (0.0%)	4 (0.4%)	2 (0.2%)	1 (0.1%)
Reasons of being absent (n=982)					
Health problem	639 (65.1%)	61 (6.2%)	277 (28.2%)	251 (25.6%)	50 (5.1%)
Personal problem	206 (21.0%)	14 (1.4%)	83 (8.5%)	92 (9.4%)	17 (1.7%)
Other reasons	137 (14.0%)	12 (1.2%)	52 (5.3%)	64 (6.5%)	9 (0.9%)

Moderate, mild and severe anemia was more prevalent in girls whose father had permanent job 624 (19.2%), 586(18.0%) and 119(3.7%) respectively. Similarly, girls whose mothers were doing permanent job had high prevalence of anemia, severe anemia 152(4.7%), moderate anemia 645(19.8%) and mild anemia 658(20.2%). Majority of girls were of Hindu religion 2907(89.3%). Anemia was found to be high among girls whose parents were illiterate. Prevalence of anemia among illiterate father, severe anemia 109(3.3%), moderate anemia 436(13.4%) and mild anemia 411(12.6%). Prevalence of anemia among illiterate mother, severe anemia 185(5.7%), moderate anemia 878(27.0%) and mild anemia 827(25.4%). (Table 2)

Table 2: Table Of Family Background

Variables	All total	Anemia			
		Normal	Mild	Moderate	Severe
Occupation of the father Deceased	483 (14.8%)	47 (1.4%)	183 (5.6%)	204 (6.3%)	49 (1.5%)
Skilled	357 (11.0%)	39 (1.2%)	150 (4.6%)	142 (4.4%)	26 (0.8%)

Permanent Job	1474 (45.3%)	145 (4.5%)	586 (18.0%)	624 (19.2%)	119 (3.7%)
Temporary Job	416 (12.8%)	37 (1.1%)	164 (5.0%)	180 (5.5%)	35 (1.1%)
Farmer	62 (1.9%)	6 (0.2%)	23 (0.7%)	27 (0.8%)	6 (0.2%)
Home maker	217 (6.7%)	17 (0.5%)	91 (2.8%)	91 (2.8%)	18 (0.6%)
Others	248 (7.6%)	23 (0.7%)	122 (3.7%)	92 (2.8%)	11 (0.3%)
Occupation of the mother Deceased	221 (6.8%)	17 (0.5%)	83 (2.5%)	97 (3.0%)	24 (0.5%)
Skilled	240 (7.4%)	22 (0.7%)	115 (3.5%)	88 (2.7%)	22 (0.7%)
Permanent Job	1588 (48.8%)	152 (4.7%)	658 (20.2%)	645 (19.8%)	152 (4.7%)
Temporary Job	744 (22.8%)	75 (2.3%)	272 (8.4%)	338 (10.4%)	75 (2.3%)
Farmer	31 (1.0%)	0 (0.0%)	9 (0.3%)	19 (0.6%)	0 (0.0%)
Home maker	304 (9.3%)	35 (1.1%)	135 (4.1%)	114 (3.5%)	35 (1.1%)
Others	129 (4.0%)	13 (0.4%)	47 (1.4%)	59 (1.8%)	13 (0.4%)
Monthly income Mean $\pm$ SD	5377.47 $\pm$ 2548.05	5390.25 $\pm$ 2399.46	5422.16 $\pm$ 2593.42	5367.87 $\pm$ 2582.69	5188.48 $\pm$ 2303.81
Religion					
Hindu	2907 (89.3%)	282 (8.7%)	1180 (36.2%)	1209 (37.1%)	236 (7.2%)
Muslim	44 (1.4%)	5 (0.2%)	20 (0.6%)	19 (0.6%)	0 (0.0%)
Sikh	1 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)
Christian	300 (9.2%)	26 (0.8%)	115 (3.5%)	131 (4.0%)	28 (0.9%)
Buddhist	5 (0.2%)	1 (0.0%)	3 (0.1%)	1 (0.0%)	0 (0.0%)
Educational status of father					
Illiterate	1061 (32.6%)	105 (3.2%)	411 (12.6%)	436 (13.4%)	109 (3.3%)
Up to primary	752 (23.1%)	55 (1.7%)	325 (10.0%)	329 (10.1%)	43 (1.3%)
Up to middle	619 (19.0%)	67 (2.1%)	238 (7.3%)	254 (7.8%)	60 (1.8%)
Up to high	645 (19.8%)	72 (2.2%)	253 (7.8%)	277 (8.5%)	43 (1.3%)
Above	147 (4.5%)	14 (0.4%)	74 (2.3%)	53 (1.6%)	6 (0.2%)
Other	33 (1.0%)	1 (0.0%)	18 (0.6%)	11 (0.3%)	3 (0.1%)
Educational status of mother					
Illiterate	2060 (63.2%)	170 (5.2%)	827 (25.4%)	878 (27.0%)	185 (5.7%)
Up to primary	578 (17.7%)	69 (2.1%)	235 (7.2%)	233 (7.2%)	41 (1.3%)
Up to middle	298 (9.1%)	35 (1.1%)	116 (3.6%)	129 (4.0%)	18 (0.6%)
Up to high	257 (7.9%)	32 (1.0%)	110 (3.4%)	98 (3.0%)	17 (0.5%)
Above	59 (1.8%)	7 (0.2%)	29 (0.9%)	20 (0.6%)	3 (0.1%)
Other	5 (0.2%)	1 (0.1%)	2 (0.1%)	2 (0.1%)	0 (0.0%)
Family members $\leq$ 5 members	1771 (54.4%)	173 (5.3%)	709 (21.8%)	738 (22.7%)	151 (4.6%)
6 – 10 members	1455 (44.7%)	139 (4.3%)	595 (18.3%)	608 (18.7%)	113 (3.5%)
>10 members	31 (1.0%)	2 (0.1%)	15 (0.5%)	14 (0.4%)	0 (0.0%)
Male children (0-5 yrs) in the family					
1	208 (6.4%)	21 (0.6%)	85 (2.6%)	86 (2.6%)	16 (0.5%)
2	14 (0.4%)	1 (0.0%)	5 (0.2%)	5 (0.2%)	1 (0.0%)
3	4 (0.1%)	0 (0.0%)	2 (0.1%)	2 (0.1%)	1 (0.0%)
4	2 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Female children (0-5 yrs) in the family					
1	199 (6.1%)	23 (0.7%)	83 (2.5%)	78 (2.4%)	15 (0.5%)
2	28 (0.9%)	4 (0.1%)	11 (0.3%)	12 (0.4%)	1 (0.0%)
3 – 7	13 (0.4%)	0 (0.0%)	6 (0.2%)	7 (0.2%)	0 (0.0%)

Majority live in semi-pucca house 1578(48.4%), $p=0.004$ and number of living rooms was 2 in 1246(38.3%), $p=0.013$ cases. Majority of the cases used sanitary toilet 2958(69.3%), $p=0.009$. Firewood was used in majority for cooking 3029(92.8%), $p=0.038$ and majority used tube

well water for drinking 2982(91.6%), $p=0.000$ and no purification of water was done before drinking in majority cases 1550(47.6%), $p=0.012$. Majority of the cases had low BMI but showed improvement in the end-line study and is statistically significant ($p=0.008$). (Table 3)

Table 3: Distribution Of Anemia Prevalence According To Household Information, Sanitary Latrines And Drinking Water

Variables	All total	Anemia				p value*
		Normal	Mild	Moderate	Severe	
Type of house						
Kutcha	1023 (31.4%)	95 (2.9%)	433 (13.3%)	429 (13.2%)	66 (2.0%)	0.004*
Pucca	656 (20.2%)	76 (2.3%)	285 (8.8%)	247 (7.6%)	48 (1.5%)	
Semi Pucca	1578 (48.4%)	143 (4.4%)	601 (18.5%)	648 (21.0%)	150 (4.6%)	
No. of living rooms						
1 room	117 (3.6%)	14 (0.4%)	38 (1.2%)	62 (1.9%)	3 (0.1%)	0.013*
2 rooms	1246 (38.3%)	114 (3.5%)	528 (16.2%)	513 (15.8%)	91 (2.8%)	
3 rooms	1093 (33.6%)	103 (3.2%)	460 (14.1%)	436 (13.4%)	94 (2.9%)	
>3 rooms	801 (24.6%)	83 (2.5%)	293 (9.0%)	349 (10.7%)	76 (2.3%)	
Type of toilet facility						
Owned	2949 (90.5%)	293 (9.0%)	1204 (37.0%)	1219 (37.4%)	233 (7.2%)	0.127
Open air	127 (3.9%)	6 (0.2%)	47 (1.4%)	64 (2.0%)	10 (0.3%)	
Community / shared	181 (5.6%)	15 (0.5%)	68 (2.1%)	77 (2.4%)	21 (0.6%)	
Sanitary						
Yes	2958 (69.3%)	219 (6.7%)	956 (29.4%)	909 (27.9%)	174 (5.3%)	0.009*
No	999 (30.7%)	95 (2.9%)	363 (11.1%)	451 (13.8%)	90 (2.8%)	

Fuel used						
Fire wood	3029 (92.8%)	295 (9.1%)	1198 (36.8%)	1283 (39.4%)	247 (7.6%)	0.038*
LPG	229 (7.0%)	18 (0.6%)	120 (3.7%)	74 (2.3%)	17 (0.5%)	
Kerosene	4 (0.1%)	1 (0.0%)	1 (0.0%)	2 (0.1%)	0 (0.0%)	
Others	1 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)	
Any sign of air pollution						
Yes	2495 (76.6%)	244 (7.5%)	989 (30.4%)	1059 (32.5%)	203 (6.2%)	0.337
No	762 (23.4%)	70 (2.1%)	330 (10.1%)	301 (9.2%)	61 (1.9%)	
Availability and utilization of soap						
Yes	3240 (99.5%)	312 (9.6%)	1322 (40.3%)	1354 (41.6%)	263 (8.1%)	0.911
no	17 (0.5%)	2 (0.1%)	8 (0.2%)	6 (0.2%)	1 (0.0%)	
Source of drinking water						
Tap water	149 (4.6%)	14 (0.4%)	68 (2.1%)	58 (1.8%)	9 (0.3%)	0.000*
Tube well	2982 (91.6%)	298 (9.1%)	1225 (37.6%)	1239 (38.0%)	220 (6.8%)	
Kutcha well	79 (2.4%)	1 (0.0%)	19 (0.6%)	38 (1.2%)	21 (0.6%)	
Pucca well	40 (1.2%)	1 (0.0%)	7 (0.2%)	22 (0.7%)	10 (0.3%)	
Spring water/ river	7 (0.2%)	0 (0.0%)	0 (0.0%)	3 (0.1%)	4 (0.1%)	
Water purification method						
None	1550 (47.6%)	146 (4.5%)	583 (17.9%)	687 (21.1%)	134 (4.1%)	0.012*
Filtration	600 (18.4%)	64 (2.0%)	279 (8.6%)	216 (6.6%)	41 (1.3%)	
Boiling	1090 (33.5%)	102 (3.1%)	450 (13.8%)	452 (13.9%)	86 (2.6%)	
Others	17 (0.5%)	2 (0.1%)	7 (0.2%)	5 (0.2%)	3 (0.1%)	
Anthropometric measurements						
BMI	18.2 ± 2.3	17.8 ± 2.1	18.2 ± 2.4	18.3 ± 2.4	18.4 ± 1.9	0.008*

Health related signs and symptoms were weakness, loss of appetite, gum bleeding, loose motion, passage of worms in stool, skin problems in the form of scabies and fungal infection mainly, which are directly or indirectly related to anemia, showing some improvement in the end-line assessment, but skin infections and weakness still persists. (Figure 1).



Figure 1. Clinical Signs And Symptoms (past 3 Months)

On physical examination, pallor, atrophied papillae, unhealthy teeth and gums, unhealthy hair were the commonest occurrence showing declining trend in end-line as compared to baseline, which are indirect indicators of anemia (Figure 2).

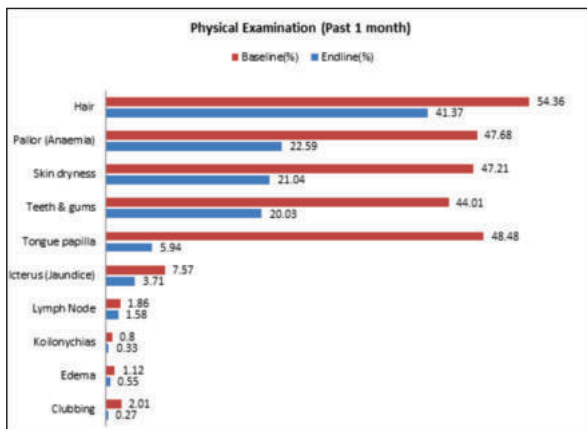


Figure 2: Physical Examination (past 1 Month)

Hemoglobin estimation was done in majority (97.3% vs 99.15%). Mean hemoglobin increased from 9.17 ± 1.6 mg/dl to 10 ± 1.5 gm/dl ranging from 2.21-16.25 gm/dl in baseline study to 1.77-14.35 gm/dl in end line. Regarding anemia category, severe anemia was in 20.78% vs 8.04%, moderate anemia in 46% vs 36.35% and mild 29.06% vs 32.72% in baseline and end-line respectively (Figure 3).

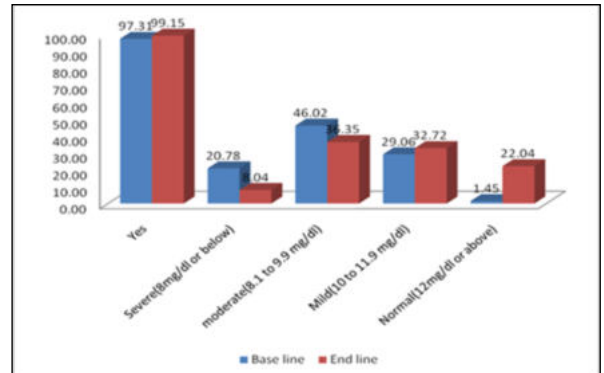


Figure 3: Comparison Between Hemoglobin Estimation In Baseline And End-line Assessment

Overall worm prevalence reduced from 69.5% to 50.1% from baseline to end-line study. Roundworm infestation was found in majority (29.9% vs 27.4%) which increased in end-line study (Figure 4).

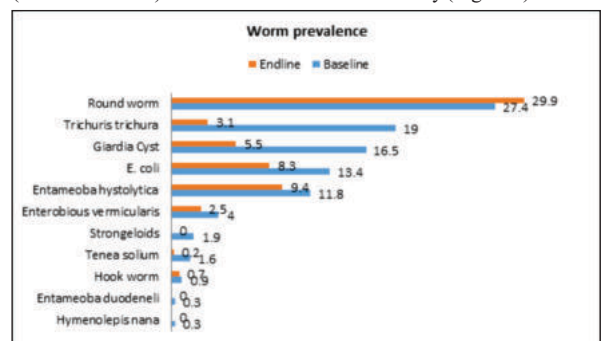


Figure 4: Classification Of Worm Prevalence

DISCUSSION:

Anemia is the most common public health problem among adolescent girls of age 10-19 years especially in tea garden population. ¹¹ Iron deficiency anemia is mostly responsible for about half of all anemia but anemia can also be caused by malaria, hookworm infestation, other nutritional deficiencies, chronic infections and genetic conditions. According to NFHS-5, over 66.4 women and 57.2 % adolescent girls are anemic. ¹⁰ In the present study the prevalence of anemia reduced from 96.3% to 82.8% in end-line assessment. Interventions done were monthly nutrition health education sessions, IFA supplementation, deworming and quarterly cooking demonstrations. The response rate was good and effective. In a study conducted among tribal women in Wayanad district, the prevalence of anemia was found to be 96.5%.

Undernutrition was the main cause of anemia found in the study.¹² Similarly in a study conducted by Meenal et al in urban slum, 90.1% adolescent girls were found to be anemic. Significant association between girl's education, mother's occupation and anemia was found.¹³ In a study done by Shiva et al in Central Kerala, the prevalence of anemia among adolescent girls was 21% and the risk factors associated with anemia were mainly worm infestation, hand hygiene and foot wear usage.⁸ In the present study, worm infestation was also found to be associated with anemia and statistically significant. In an earlier intervention done by Shirode et al, IFA supplement showed significant improvement in Hb concentration among adolescent girls which is similar to the result of this study.¹⁴ In an earlier study done by Verma et al, poor housing, sanitation and non-filtration of water was found to be significantly associated with anemia which is similar in this study.¹⁵ The prevalence of anemia among tribal adolescent girls is quite high in this study and as per NFHS-5 in Assam. There is evidence that anemia also affects reproductive health which is the main cause of morbidity and mortality among tribal women in India. Hence, improving nutrition education, maternal education about iron-rich foods, sanitation, personal hygiene, preventing worm infestations should be reinforced.

Limitations:

As this article is a part of MCH research project, the effectiveness of each intervention done in the study is not measured individually and all the interventions done in the project are not included in the study.

CONCLUSIONS:

This study shows that community-based interventions are effective in reducing the burden of anemia among adolescent girls as well as the associated risk factors like socio-economic factors, nutrition, hygiene etc. which are the most common factors causing anemia. An interventional program mainly focusing on improving the health and nutritional status of adolescent girls is needed.

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