International Journal of Advance Research in Nursing

Iron deficiency anaemia and effect of nutrition education on change in dietary behavior among the adolescent girls of tea garden area in Nagaon district, Assam

Das Devi Bhagya and Dr. Goswami Kr Dipak

[1] Ph.D. Scholar, Srimanta Sankar University of Health Sciences, Guwahati, Assam, India
[2] Assistant Professor, Department of Prasuti Tantra and Stree Roga, Government Ayurvedic College and Hospital, Guwahati, Assam, India

Corresponding Author: Das Devi Bhagya

Abstract

Anemia stands as a prevalent and challenging nutritional issue on a global scale, impacting both developing and developed nations and carrying significant implications for human health, as well as social and economic progress. In the condition of Anaemia the total haemoglobin (Hb) level or number of red blood cells (RBCs) becomes poorly lowered [1].

Iron deficiency anaemia is characterized by incomplete synthesis of hemoglobin, leading to the formation of microcytic and hypochromic red blood cells. Insufficient hemoglobin levels compromise the blood's capacity to effectively transport oxygen to various cells and tissues throughout the body [2].

Children and women in their reproductive years face the highest susceptibility, with worldwide prevalence estimates indicating 47 percent of children under 5 years, 42 percent of pregnant women, and 30 percent of non-pregnant women aged 15–49 years experiencing anemia. The impact of anemia is significant, contributing to over 115,000 maternal deaths and 591,000 perinatal deaths annually on a global scale [2]. On a global scale, approximately one-third (33%) of women in the reproductive age bracket (15–49 years) are affected by anemia, indirectly putting the nutritional and health well-being of their children [3]. The highest prevalence of anaemia (56%) was found among pregnant women in low- and middle-income countries, and the lowest (24.1%) was reported among pregnant women in South America [4].

Therefore, to address this strategic gap, the researcher would like to conduct a participatory nutrition education and intervention on Iron rich diet study to improve the dietary behavior status, and reduce the prevalence of anemia among unmarried adolescent girls [1]. The main objective of the study was to assess the haemoglobin level among adolescent girls before nutrition education on Iron rich food. To assess the dietary practices among the adolescent tea garden Girls in selected Tea Garden of Nagaon District, Assam and to find out the effectiveness of Nutrition education on changing dietary practices among the adolescent girls of Tea Garden, Nagaon District Assam.The research approach is Descriptive Evaluative approach and Research design adopted was pre-experimental one group pre-test post-test design. The total sample for the study is 440. The data were collected from 11 numbers of different tea gardens of Nagaon District Assam. Simple random technique was used to to select the 11 tea gardens out of 30 numbers of tea gardens and study samples were selected by using non probability convenient sampling technique. The study results showed that there was high prevelance of anaemia among the adolescent girls of tea garden. It was found that, total 92.95% of study participants were having any type of anaemia with 28.63% mild, 56.36% moderate, 7.95% severe anaemia. The mean post test hemoglobin level was 10.70 gm/dl which was higher than the mean pre-test 10.03 gm/dl. There is significant association between the pretest level of Hb with the selected Demographic Variable such as religion, occupation of father, type of family, availability of toilet facility,sources of water, roaming without chappal as the tabulated value is less than the calculated value of Chi-square at $s<0.05$ level.

Keywords: Iron, anaemia, haemoglobin

1. Introduction

Iron deficiency anaemia is a certain anaemic condition arising due to the inadequate iron to form normal Red blood cells. It is usually caused by insufficient iron intake, chronic blood loss, and increased iron demand. The prevalence of IDA varies across the world. Recognizing the original aetiology and the relevant diagnostic and therapeutic issues are primary keys in the management and assessment of this disorder [2].

Anaemia is a key public Health concern prevalent among low middle as well as high –income countries worldwide.

As per Global database on Anaemia almost 1.62 billion people are affected from Anaemia, which approximate to 24.8% of the world's population. It is supposed that fifty percent of anemia instances are attributed to deficiency of iron It is most frequent among children of preschool-age (47.4%), followed by pregnant (41.8%) and non-pregnant (30.2%) women [5].

Iron is an important dietary mineral associated with many body functions like oxygen transport in the blood. Iron deficiency anaemia is characterized by incomplete haemoglobin synthesis that results in microcytic and

hypochromic red blood cells. Due to inadequate haemoglobin, the ability of blood to deliver oxygen to the other body cells and tissues is reduced [6].

Iron deficiency anaemia has detrimental effects on the health of children, adolescent girls, women of reproductive age, and pregnant women. In children it can result in impaired cognitive performance, behavioral and loco-motor development, coordination, language development, and scholastic achievement, thereby severely implicating human development, besides increasing morbidity from infectious diseases.

An adolescent girl who enters the reproductive age with low iron stores and becomes pregnant during adolescence or later is at greater risk of giving birth to a low birth weight and preterm baby. The baby is also born with low iron stores and due to poor infant feeding practices is more likely than ever to enter adolescence with low iron stores in the body. Thus this vicious cycle of iron deficiency anemia continues. Women in general are more prone to anaemia than men because of smaller stores of iron and the onset of menstruation imposes additional requirement of Iron to compensate for menstrual blood loss. In Indian girls, the highest prevalence of anaemia is reported between the ages of 12-13 years which also coincides with the average age of menarche. In girls, the lower total food intake or energy intake by compared to boys, combined with menstrual losses cause adolescent girls to be at greater risk of Iron deficiency and IDA [7].

World Nutritional Assessment conducted in 2016 stated that India has the highest incidence of iron deficiency anemia, ranking 170th out of 180 nations of women with anemia and Malnourishment and poverty are both linked to iron deficiency anemia [8]. In today the government has set out Rs 36,707 crore for nutrition-related programs such as the Integrated Child Development Scheme of the National Health Mission. The adoption and scaling up of the IFA Supplementation programme to the most vulnerable populations - children, adolescents, pregnant and breastfeeding mothers and would be the method for IDA prevention and management [9].

A Water-Sanitation-Hygiene Situation Analysis was conducted by UNICEF, in 8 nos of Tea Garden Districts Assam reveled that among tea garden workers Iron deficiency anaemia is widespread across all the gardens. Major cause of Iron deficiency is the poor intake of nutritional food and lack of awareness among the women on what constitutes a nutritious meal are some of the factors besides, continuous and long working hours in the field which makes it difficult for women to look after their health and nutrition. Early marriage, early pregnancies, and low birth babies are the another concern of Tea Graden Areas which also influences increased rate of Anaemia [10].

According to National Family Health Survey (NFHS-4,) survey, about 40% of women are mildly anaemic, 12% are moderately anaemic, and 1% is severely anaemic. among men, 12% are classified as mildly anaemic, 10% moderately anaemic, and 1% severely anaemic. During the NFHS –V the prevalence of Adolescent Anaemia (15-49 age group) increases from 46.0% (NFHS4) to 65.9% (NFHS V).68% of children age 6-59 months are anaemic in Assam. This includes 36% who are mildly anaemic, 32% are moderately Anaemic and 1% is severe anaemic.The overall prevalence of Anaemia in children increased from 36% in NFHS-4 to 68% in NFHS -5 [11].

2. Objectives
2.1 The objectives of the study are
- To assess the haemoglobin level among adolescent girls before nutrition education on Iron rich food.
- To assess the dietary practices among the adolescent tea garden Girls in selected Tea Garden of Nagaon District, Assam
- To find out the effectiveness of Nutrition education on changing dietary practices among the adolescent girls of Tea Garden, Nagaon District Assam
- To find out the association between Pre-test level of Heamoglobin with their selected socio-demographic variables.

3. Methodology
3.1.1 Research Design and Type
The research approach selected for the present study was Descriptive Evaluative approach

In order to achieve the objectives the Pre- Experimental Design with One group pre test-post test study design Approach is used for the present study to evaluate the effect of Nutrition Education on change in Dietary behavior. A Cross sectional study designed is obtained to collect information from the population regarding the food habits, heamoglobin level, and lifestyle of these populations.

Group of Adolescent girls N=	Pre-test (before trial)	Intervention	Post-test (After trial)
Study Group	0_1	X	0_2

Key
N =sample number
0_1= Assessment of Anthropometric measurement and Hemoglobin level, serum ferritin, food frequency and Dietary practices among adolescent girls
X= Nutrition Education on Iron deficiency Anaemia and Iron rich food.
0_2= Assessment of Hemoglobin level, food frequency and Dietary practices, among adolescent girls.

3.1.2 Hypothesis
H_{01} = There is significant difference between the food consumption level before and after nutritional education

H_{02}: There is significant association between the pretest haemoglobin level and the selected demographic variables ie. age, religion, caste, educational Status, Family income, location of housing, type of house, toilet facility, sources of water supply, purification of water, puberty, duration of menstrual bleeding, availability of cattle shed, Kitchen facility, consumption of Iron tablet and consumption of Albendazole tablet.

3.1.3 Variable
3.1.3.1 Independent Variable: Nutrition Education on Iron rich food

3.1.3.2 Dependent Variable: It includes the dietary practices of Adolescent tea garden girls and Heamoglobin level of adolescent Tea Girls

3.1.3.3 Socio Economic and demographic Variable
1. **Socio-economic indicator:** It includes age, religion, caste, educational Status of respondents, occupation of the parents,marital Status, occupation of Self, type of family, size of family,total family income.
2. **Environmental Factor/Indicator:** It includes location of housing, type of house, toilet facility at home, sources of water supply, purification of water, availability of cattle shed, Kitchen facility, type of fuel used for cooking, sources of lighting, availability of education facility availability of Health Facility.
3. **Behaviroural Indicator:** It includes Smoking /drug abuse/alcohol abuse by respondents, Habit of Hand washing, Cleaning of perineum after toilet uses, roaming with bare foot/ without chappal.

3.1.4 Description of the study setting
Tea community represents approximately 17% of Assam's. Population and 10% of Nagaon district. Nagaon District has 30 registered tea estates in contributing to 10% of Assam production.
In this present study 11 tea Garden out of 30 registered tea Gardens are selected.

3.1.5 Population
In this study it refers to adolescent tea Garden girls residing in selected tea gardens of Nagaon District Assam. The total population of the adolescent girls in 11 selected tea gardens are nearly 2500.

3.1.6 Sample
In this present study the sample size is consists of 440 adolescent girls age between 10-19 years in selected Tea Gardens of Nagaon District Assam.
Data has been collected from the 440 numbers of tea garden adolescent girls from 11 (Eleven) numbers of Tea Garden respectively the baseline (1st week) study to endline study (12th week).

3.1.7 Study tools: The tool was divided in to three section. Tool I deals with Socio economic and Demographic characteristics of Adolescent girls. Tool II: Checklist for Health and Nutritional status of Tea Garden Adolescent Girls which consist of Anthropometric measurement, Signs and symptoms of anaemia and Heamoglobin level and serum ferritin level. Tool III: Checklist list for Assessment of food frequency and dietary practices (24 hours dietary recall method).

3.1.8 Content validity: Content validity of the tool was established from the field of Community Health Nursing, field of Nutrition, field of Peadiatric Nursing and from the field of Ayurvedic Medicine.

3.1.9 Reliability of the tool: The reliability of the instrument was assessed by using interrator method (Karl Pearson's formula). The value was found to be reliable [r=0.9]. The reliability of the observational checklist was assessed by using interrator method (Karl Pearson's formula). The value was found to be reliable[r=0.9].

4. Pilot Study procedure
The Present pilot study the Researches has collected the Data from 10% of the total Population i.e 80 numbers of Adolescent girls of Lungsung and Chapanala Tea Garden area of Nagaon District by using non-probability purposive sampling technique. The data has been collected from the 40 numbers of adolescent girls from each Tea Garden of Lungsung Tea garden, 40 numbers of Chapanala Tea Garden respectively the baseline study to endline study.

4.1 Main Study
4.1.1 Section A: Analysis of socio-econmic and demographic status of the tea garden adolescent girls
The socio-demographic status of the study samples shown in Table 1 Majority (43.4%) of the adolescent girls were found to be in the age group between 13-15 years. More than (70%) study subjects were belongs to Hindu religion, (18.6%) of the subjects were Christian and (3.4%) were Muslim. Majority of the subjects (64.3%) of the study subjects were belongs to OBC Caste. Considering educational status majority (39.5%) of the subjects found to be completed Primary Education.

Table 1: shows frequency and percentage distribution of Age, Religion, caste, and educational level of study participants n=440

Variable		Frequency	Percentage
Age	10-12 Years	108	24.5%
	13-15 Years	191	43.4%
	16-19 Years	141	32.0%
Religion	Hindu	343	78.0%
	Christian	82	18.6%
	Muslim	15	3.4%
Caste	General	90	20.5%
	OBC	283	64.3%
	SC	43	9.8%
	ST	24	5.5%
Education level of Respondent	Illiterate	73	16.6%
	Primary	174	39.5%
	Middle Level	132	30.0%
	HSLC	51	11.6%
	HSSLC	10	2.3%

Table 2: Shows the frequency and percentage distribution of Occupation of father, occupation of mother, marital status, occupation of self etc. of tea garden adolescent girls

Variable		Frequency	Percentage
Occupation of Father	Regular tea garden labourer	186	42.3%
	Temporary tea garden labourer	171	38.9%
	Agriculture	24	5.5%
	Unemployment	20	4.5%
	Any Other	39	8.9%

Occupation of Mother	Regular tea garden labourer	112	25.5%
	Temporary tea garden labourer	135	30.7%
	Agriculture	8	1.8%
	Unemployment	165	37.5%
	Any Other	20	4.5%
Marital Status	Unmarried	440	100.0%
Occupation of Self	Regular tea garden labourer	15	3.4%
	Temporary tea garden labourer	17	3.9%
	Student	322	73.2%
	Unemployment	76	17.3%
	Any Other	10	2.3%

Table 2 depicts the occupation of father, occupation of mother, marital status, occupation of the adolescent girls. With respect to the occupation of father 186 (42.3%) were regular tea garden labourer, With respect to mothers occupation 135 (30.7%) were temporary tea garden labourer. Regarding adolescent girls occupation majority 322 (73.2%) study participants were students. 15 (3.4%) were working in tea garden as a regular labourer.

Table 3: shows the frequency and percentage distribution of type of family, size of family, monthly income, location house, type of house etc. of the adolescent girls. n=440

Variable	Sub Group	Frequency	Percentage
Type of Family	Nuclear	397	90.2%
	Joint	43	9.8%
Size of Family	1-2	4	0.9%
	3-4	130	29.5%
	5-6	248	56.4%
	7-9	50	11.4%
	> 9	8	1.8%
Monthly Income	< Rs.1000	1	0.2%
	Rs.1000-3000	61	13.9%
	Rs.3000-6000	113	25.7%
	Rs. 6000-9000	219	49.8%
	> Rs. 9000	46	10.5%

Table 3 depicts the type of family, size of family, monthly income, location of house, Type of house. With respect to the type of family majority 397 (90.2%) of study participants were belongs to nuclear family With respect to size of family majority 248 (56.4%) adolescent girls had 5-6 numbers of family members Regarding monthly family income 219 (49.8%) adolescent girls had monthly family income is of Rs.6000-9000.

Table 4: depicts the Environmental Factors /Indicators

Variable	Sub Group	Frequency	Percentage
Location of House	Tea garden line area	223	50.7%
	Tea Garden Quarter	217	49.3%
Type of House	Kutcha	161	36.6%
	Pucca	236	53.6%
	Semi Pucca	43	9.8%
Location of Kitchen	attached in separate room	247	56.1%
	Living room itself	114	25.9%
	Outside of main house	79	18.0%
Pet Animal	Yes	296	67.3%
	No	144	32.7%
Availability of Toilet facility	Own	176	40.0%
	Public/community/Shared	162	36.8%
	No facility, brush, field	102	23.2%
Type of Toilet /Latrine	No toilet facility	102	23.2%
	Sanitary	209	47.5%
	Kutcha	129	29.3%
Sources of Water	Public pipe /Common Tap	132	30.0%
	Well	78	17.7%
	Surface water -River, pond	52	11.8%
	Tube well/hand pump	178	40.5%
Water purification	None	200	45.5%
	Filtration	61	13.9%
	Boiling	179	40.7%

Table 4 depicts the environmental indicators like location of house, type of house, Toilet facility, type of toilet/latrine, sources of water, water purification, in respect to the location of house half of the 223 (50.7%) adolescent girls were residing in the tea garden line area. Regarding type of houses, more than half of the 236 (53.6%) study participants were having pucca houses in regards to location of kitchen more than 50% study participants had kitchen facility attached in separate room. With regards to availability of toilet facility 176 (40.0%) of study participants had toilets in their home Around 102 (23.2%) study participants had no toilet facility and they were having the habit of open defecation. Around 78 (17.7%) of them had well as a source of drinking water and 52 (11.8%) used river/ pond /stream etc. Nearly half 200 (45.5%) of the study participants were not using any filtered water. 179 (40.7%) used boiled water for drinking and only 61 (13.9%) were using filtered water for drinking.

Table 5: shows the frequency distribution of type of fuel and source of light used by adolescent tea garden girls. n=440

Variable	Sub Group	Frequency	Percentage
Type of Fuel use for cooking	Fire wood	147	33.4%
	Cow dung cakes	1	0.2%
	Kerosene	144	32.7%
	LPG	148	33.6%
Source of light	Electricity	296	67.3%
	Kerosene	84	19.1%
	Candle	60	13.6%

The table 5 depicts the source of fuel and light. Regarding type of fuel they used for cooking 147 (33.4%) uses fire wood. With regards to source of light more than 60% were having electricity in their house.

Table 6: Shows the availability of educational facility and health facility etc in the tea garden n=440

Variable	Sub Group	Frequency	Percentage
Availability of Education Facility	Yes	362	82.3%
	No	78	17.7%
If Yes Govt. or Non Govt.		78	17.7%
	Government	0	0.0%
	Non-Government /Bagan School	362	82.3%
Currently the girl is studying in	Govt. School/College	141	32.0%
	Tea Garden School	177	40.2%
	Other Private school	24	5.5%
	No school/ School Drop out	98	22.3%
Availing of Health Facility	Government	21	4.8%
	PPP Mode Tea Garden Hospital	106	24.1%
	Non PPP Tea Garden Hospital	313	71.1%

Table 6 depicts that with regards to education facility majority 362 (82.3%) study participants responded of having education facility and these are managed by tea gardens. All gardens had health facilities. Majority 21 (4.8%) study participants responded to avail health facilities from Govt. hospitals, 106 (24.1%) responded to avail from PPP mode tea garden hospitals and 313 (71.1%) responded to avail from non government hospitals managed by gardens.

Table 7: Shows the Hand washing habits, cleaning of perineum, roaming without slippers etc n=440

Variable	Sub Group	Frequency	Percentage
Hand washing habit before food	Yes	299	68.0%
	No	30	6.8%
	Sometime	111	25.2%
Habit of Hand washing after coming from Toilet	Yes	299	68.0%
	No	30	6.8%
	Sometime	111	25.2%
Cleaning of perineum after using toilet	With Soap and water	100	22.7%
	Only Water	340	77.3%
Habit of roaming without slippers /bare foot	Yes	112	25.5%
	No	155	35.2%
	Sometime	173	39.3%
Intake of Albendazole Tablet	Yes	198	45.0%
	No	242	55.0%
Total		440	100.0%

Table 7 depicts regarding the hand washing habits majority 299 (68.0%) study participants had the habit of hand washing before food and after coming from toilet. 100 (22.7%) of study participants cleans the perineum with only

water. 112 (25.5%) study participants had the habit of roaming without slippers or bare foot. Regarding taking of albandazole tablet 198 (45.0%) study participants had the habit of intake of albendazole tablets where as 242 (55.0%) reported of not taking albendazole.

Section B: Assessment of Nutrition and Health status of Adolescent tea garden girls
Anthropomatric Assessment and BMI

Table 8: Status of BMI

Age of the adolescent girls	Value	Underweight (<18.5)	Normal (18.5-23)	Overweight (23-27.5)	Obese (>27.5)	Total
10-19 years	count	142	290	8	0	440
	% of total	32.27%	65.90%	1.81%	0	100%

Table 8 depicts the BMI of adolescent girls. Considering the BMI majority 290 (65.90%) study participants had normal BMI. 142 (32.27%) were underweight and only 8 (1.81%) study participants were overweight.

Table 9: Categories of Anaemia

Haemoglobin level	Value	Normal (≥12 gm/dl)	Mild 11-11.9	Moderate 8-10.9gm/dl	Severe <8gm/dl	Total
Pre-Test	count	31	126	248	35	440
	% of total	7.04%	**28.63%**	**56.36%**	**7.95%**	100%

Table 9 shows that there was high prevalence of anaemia among the adolescent girls of tea garden. It was found that, total 92.95% of study participants were having any type of anaemia with 28.63% mild, 56.36% moderate, 7.95% severe anaemia.

Table 10: Assessment of prevalence of Iron deficiency Anaemia among the tea garden adolescent girls n=279

Serum Ferritin	Prevalence	Mean	Standard deviation
	55.19	28.06	25.94

Table 10 represent the prevalence of iron deficiency anaemia among the tea garden adolescent girls. Prevalence rate was found to be 55.19%. The mean rate is 28.06 with standard deviation of 25.954.

Table 11: shows the puberty status, monthly menstrual cycle, Reproductive infection etc. n=440

Variable	Frequency	Percentage
Puberty attained		
Yes	305	69.31
No	135	30.68
Duration of Menstrual Bleeding		
2-4 days	47	15.40
b. 5-7 days	220	72.13
c. More than 7days	38	12.45
Monthly Menstrual Cycle		
15-20 days	10	3.27
21-28 days	187	56.66
More than 28 days	108	35.40
Health Complains Painful Menstruation	157	51.47
Irregular Menstrual cycle	105	34.42

Table 11 shows the puberty status of the adolescent girls. 305 (69.31) study participants had attained puberty. Considering duration of menstrual bleeding 220 (72.13) were having duration of menstrual bleeding of 5-7 days. Around 56.66% of adolescent girls had 21-28 days menstrual cycle. Regarding painful menstruation 157 (51.47%) of study participants had health complains painful menstruation. 105 (34.42%) study participants had irregular menstrual cycle.

Section C. Effectiveness of Nutrition Education on changing dietary practices among the adolescent girls of tea garden

Table 12: Meal Frequency per day

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Twice a day	267	60.7	260	59.09	257	58.4
Thrice a day	166	37.7	173	39.31	176	40
> Thrice a day	7	1.6	7	1.6	7	1.6
Total	440	100.0	440	100.0	440	100.0

Table 12 shows the per day meal frequency of the study participants. Regarding the meal frequency in the baseline assessment 37.7% of the participants had practices of having food thrice a day which was increases to 40% in the Final assessment at 12 weeks.

Table 13: No of Food items per meal per /day

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
1-2 food items	370	84.1	365	82.95	360	81.81
3-4 food items	70	15.9	75	17.05	80	18.19
Total	440	100.0	405	100.0	405	100.0

Table 13 shows the no of food items per meal per day of the study participants. With regards to no of food items in the baseline assessment 15.9% of the study participants had practices 3-4 numbers of food items per day which was increases to 18.19% in the Final assessment at 12 weeks.

Table 14: Post meal consumption of tea (within 30 min)

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Yes	219	49.8	133	30.23	106	24.09
No	221	50.2	307	69.77	334	75.91
Total	440	100.0	440	100.0	440	100.0

Table 14 shows the post meal consumption of tea (within30 min). With regards to post meal consumption of tea in the baseline assessment majority 219 (44.5%) of study participants had practices of post meal consumption of Tea (within 30 min) which was decreases to 106 (24.09%) in final assessment at 12 weeks.

Table 15: Consumption of green leafy vegetables

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Frequency	Percent	Frequency
None	113	25.7	88	20	46	10.45
1-2 times/week	78	17.7	136	30.90	138	31.36
3-4 times/week	70	15.9	139	31.59	179	40.68
>4 times /week	45	10.2	77	17.50	77	17.5
TOTAL	440	100%	440	100%	440	100%

Table 15 shows the consumption of green leafy vegetables by the study participants. Regarding the consumption of green leafy vegetables in the baseline assessment 78 (17.7%) of the adolescent girls had the habit of eating green leafy vegetables 1-2 times/week which was increases to 138 (31.36%) in post assessment 70 (15.9%) adolescent had the habit of eating green leafy vegetables 3-4 times /week which was increases to 179 (40.68%). 45 (10.2%) adolescent had the habit of eating green leafy vegetables >4 times/week which was increases to 77 (17.5%) in post assessment

Table 16: Consumption of other vegetables

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Daily	440	100.0	440	100.0	440	100.0
Total	440	100.0	440	100.0	440	100.0

Table 16 shows the consumption of other vegetables by the study participants. Considering the consumption of the other vegetables all of the study participants 440 (100%) had the habit of eating other vegetables in the baseline assessment and also in the post assessment

Table 17: Consumption of legumes (Beans /peas /nuts /lentils) /week)

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
None	50	11.4	30	6.81	28	6.36
Daily	60	13.6	71	16.13	72	16.36
1-2 times/week	119	27.0	110	25	110	25
3-4 times /week	33	7.5	55	12.5	58	13.18
> 4 times /week	76	17.3	88	20	90	20.45
Sometime	102	23.2	86	19.54	82	18.63
Total	440	100.0	440	100.0	440	100.0

Table 17 shows consumption of legumes by the study participants. Regarding the consumption of legumes in the baseline assessment 60 (13.6%) of the study participants had practices of consumption of legumes daily which was increases to 72 (16.36%) in the post assessment. 33 (7.5%) of the study participants had practices of consumption of legumes 3-4 times/week which was increases to 58 (13.18%) in the post assessment. 76 (17.3%) of the study participants had practices of consumption of legumes >4 times/week which was increases to 90 (20.45%) in the post assessment

Table 18: Consumption of meat /poultry/week

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Frequency	Percent	Frequency
None	1	0.2	1	0.2	1	0.2
1-2 times/week	202	45.9	206	46.81	208	47.27
3-4 times/week	195	44.3	195	44.31	196	44.54
Sometime	42	9.5	38	8.63	35	7.95
Total	440	100.0	440	100.0	440	100.0

Table 18 shows consumption of meat /poultry by the study participants. Regarding the consumption of meat /poultry almost all the study participants had the habit of eating meat on regular basis

Table 19: Consumption of Fish/week

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Frequency	Percent	Frequency
None	11	2.5	11	2.5	11	2.5
1-2 times/week	240	54.5	243	55.22	244	55.45
3-4 times/week	158	35.9	160	36.36	161	36.59
>4 times /week	5	1.1	5	1.13	6	1.36
Sometime	26	5.9	21	4.77	18	4.09
Total	440	100.0	440	100.0	440	100.0

Table 19 shows consumption of Fish by the study participants. Regarding the consumption of fish almost all the study participants 429 (87.5%) had the habit of eating fish in the baseline assessment and in the endline assessment

Table 20: Consumption of Vitamin C rich Fruit (Locally Availabale)

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
None	200	45.5	63	14.31	47	10.68
Daily			2	0.45	9	2.04
1-2 times/week	53	12.0	161	36.59	176	40
>2 times /week	32	7.3	108	24.54	128	29.09
Sometime	155	35.2	106	24.09	80	18.18
Total	440	100.0	440	100.0	440	100.0

Table 20 shows consumption of fruits by the study participants. Regarding the consumption of fruits almost half 200 (45.5.0%) of the study participants did not have any habit of eating vitamin C rich fruits in the baseline assessment which was decreasing to 47 (10.68%) in the post assessment after nutrition education and counseling. 53 (12.0%) of the study participants had practices of consumption of vitamin C rich fruits 1-2 times/week in the baseline assessment which was increases to 176 (40%) in the post assessment. 32 (7.3%) of the study participants had practices of consumption of vitamin C rich fruits more than (>2 times/week) in the baseline assessment which was increases to 128 (29.09%) in the post assessment.

Table 21: Intake of Iron and Folic acid tab under WIFS n=440

	Baseline (1st Week)		Week 6th week		Endline (12th Week)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Yes	140	31.8	284	64.54	285	64.77
No	300	68.2	156	35.45	155	35.22
Total	440	100.0	440	100.0	440	100.0

Table 21 shows the intake of Iron and Folic acid tablets under the WIFS programme by the study participants. Regarding the intake of Iron and Folic acid tablets only 140 (31.8%) study participants had the habit of taking iron tablets which was increases to 285 (64.77%) in the post assessment after counseling.

Table 22: Irregular Intake of Iron Tablet n=440

	Baseline (week 1st)		Week 6th		Endline (Week 12th)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
No response	18	4.1	6	1.36	7	1.59
Other Reasons	36	8.18	13	2.95	13	2.95
Poor Knowledge	27	6.1	16	3.63	14	3.18
Misconception	31	7.0	15	3.40	14	3.18
In availability of the Tablet	43	9.8	14	3.18	18	4.09
Side effect of the tablet	85	19.3	53	12.04	51	11.59
Self Ignorance	60	13.6	39	8.86	38	8.63
Total	440	100.0	440	100.0	440	100.0

Table 22 shows the irregular intake of Iron and Folic acid tablets under the WIFS programme by the study participants. Majority 300 (68.2%) participants did not have any practice of intake of iron tablets in the baseline assessment. 85 (19.3%) study participants did not take the tablet due to side effect was decreases to 38 (8.63%) in the post assessment. 60 (13.6%) study participants did not take the IFA tablet due to self ignorance was decreases to 51 (11.59%) in the post assessment. 27 (6.1) did not take the IFA tablet due to poor knowledge was decreases to 14 (3.18%) in the post assessment. 36 (8.18%) participants did not take the iron tablet due to other reasons was decreases to 13 (2.95%)

Null Hypothesis H0₁: There is significant difference in Haemoglobin level among the adolescent girls after the nutrition education.

Table 23: Mean,standard deviation and t test

Paired Samples Statistics					t test			
Haemoglobin	Mean	N	SD	Diff	SD	t	df	*P*-value
Pre Test	10.03	440	1.42	-0.63	0.49	-25.13	440	<.001
Post Test	10.70	440	1.22					

Table 23 shows that the mean post level of Haemoglobin is 10.70 which is higher than the mean pretest level of Haemoglobin 10.03 with standard deviation of 0.49

Section D: Assessment of pretest level of Haemoglobin with their selected socio-demogrpahic variables.

Null Hypothesis

H_02: There is no significant association between the pretest haemoglobin level and the selected demographic variables ie. age, religion, caste, educational Status, Family income, working status, location of housing, type of house, toilet facility, sources of water supply,purification of water, puberty, duration menstrual bleeding, availability of cattle shed, Kitchen facility, consumption of Iron tablet and consumption of Albendazole tablet.

Table 24: Association between pre-test level of heamoglobin with their selected socio-demographic variables n=440

Variable	Sub Group	Statistics	Anaemic				Total	Chi Sq	df	*P*-Value (0.05)
			No Anaemia	Mild Anaemic	Moderate Anaemic	Severe Anaemic				
Religion	Hindu	Count	26	88	200	29	343	18.12	6	.006** Chi squar 18.12 df 6
		%	83.90%	67.70%	82.00%	82.90%	78.00%			
	Christian	Count	2	35	40	5	82			
		%	6.50%	26.90%	16.40%	14.30%	18.60%			
	Islum	Count	3	7	4	1	15			
		%	9.70%	5.40%	1.60%	2.90%	3.40%			
Caste	General	Count	6	28	51	5	90	11.89	9	.219NS Chi squar 11.89 df 9
		%	19.40%	21.50%	20.90%	14.30%	20.50%			
	OBC	Count	17	76	163	27	283			
		%	54.80%	58.50%	66.80%	77.10%	64.30%			

SC	Count	6	17	17	3	43				
	%	19.40%	13.10%	7.00%	8.60%	9.80%				
ST	Count	2	9	13	0	24				
	%	6.50%	6.90%	5.30%	0.00%	5.50%				
Education status of Respondent	Illiterate	Count	3	22	42	6	73	12.73	12	
		%	9.70%	16.90%	17.20%	17.10%	16.60%			.389^{NS} Chi Squar 12.73 df 12
	Primary	Count	13	49	95	17	174			
		%	41.90%	37.70%	38.90%	48.60%	39.50%			
	Middle Level	Count	6	41	74	11	132			
		%	19.40%	31.50%	30.30%	31.40%	30.00%			
	HSLC	Count	8	16	26	1	51			
		%	25.80%	12.30%	10.70%	2.90%	11.60%			
	HSSLC	Count	1	2	7	0	10			
		%	3.20%	1.50%	2.90%	0.00%	2.30%			
	Any Other	Count	2	14	22	1	39			
		%	6.50%	10.80%	9.00%	2.90%	8.90%			

Variable	Sub Group	Statistics	Anaemic				Total	Chi Sq	df	P-Value (0.05)
			No Anaemia	Mild Anaemic	Moderate Anaemic	Severe Anaemic				
Occupation of Father	Regular tea garden labour	Count	16	55	109	6	186	38.54	12	<.001*** ChiSquare 38.54 df 12
		%	51.60%	42.30%	44.70%	17.10%	42.30%			
	Temporary tea garden labour	Count	7	43	97	24	171			
		%	22.60%	33.10%	39.80%	68.60%	38.90%			
	Agriculture	Count	5	12	7	0	24			
		%	16.10%	9.20%	2.90%	0.00%	5.50%			
	Unemployment	Count	1	6	9	4	20			
		%	3.20%	4.60%	3.70%	11.40%	4.50%			
	Any Other	Count	2	14	22	1	39			
		%	6.50%	10.80%	9.00%	2.90%	8.90%			
Occupation of Mother	Regular tea garden labourer	Count	10	32	62	8	112	8.53	12	.742^{NS} Chi square 8.53 df 12
		%	32.30%	24.60%	25.40%	22.90%	25.50%			
	Temporary tea garden labourer	Count	7	35	81	12	135			
		%	22.60%	26.90%	33.20%	34.30%	30.70%			
	Agriculture	Count	1	2	5	0	8			
		%	3.20%	1.50%	2.00%	0.00%	1.80%			
	Unemployment	Count	13	56	84	12	165			
		%	41.90%	43.10%	34.40%	34.30%	37.50%			
	Any Other	Count	0	5	12	3	20			
		%	0.00%	3.80%	4.90%	8.60%	4.50%			
Type of Family	Nuclear	Count	31	123	213	30	397	9.38	3	.025* Chi Sqaure 9.38 df 3
		%	100.00%	94.60%	87.30%	85.70%	90.20%			
	Joint	Count	0	7	31	5	43			
		%	0.00%	5.40%	12.70%	14.30%	9.80%			
Monthly Income	< Rs.1000	Count	0	0	0	1	1	42.83	12	<.001*** Chi Square 42.83 df 12
		%	0.00%	0.00%	0.00%	2.90%	0.20%			
	Rs.1000-3000	Count	0	20	27	14	61			
		%	0.00%	15.40%	11.10%	40.00%	13.90%			
	Rs.3000-6000	Count	8	36	61	8	113			
		%	25.80%	27.70%	25.00%	22.90%	25.70%			
	Rs. 6000-9000	Count	18	58	133	10	219			
		%	58.10%	44.60%	54.50%	28.60%	49.80%			
	> Rs. 9000	Count	5	16	23	2	46			
		%	16.10%	12.30%	9.40%	5.70%	10.50%			

Interpretation: Majority of indicators under socio-demographic indicators (caste, occupation, education, occupation of mother, type of family, etc do not have any significant association with Haemoglobin level except Religion (Significant at 1% CI),occupation of father (Highly significant at 1% CI), type of Family (significant at 1% CI),monthly income (Highly significant at 1% CI).

Table 25: Association of environmental Indicators with Pre-test Haemoglobin level

| Variable/Env Indicators | Sub Group | Statistics | Anaemic | | | | Total | Chi Sq | df | P-Value (0.05) |
			No Anaemia	Mild Anaemic	Moderate Anaemic	Severe Anaemic				
Location of House	Basti area	Count	15	66	120	22	223	2.36	3	0.501 Chi Square 2.36 df 3
		%	48.40%	50.80%	49.20%	62.90%	50.70%			
	Tea Garden Quarter	Count	16	64	124	13	217			
		%	51.60%	49.20%	50.80%	37.10%	49.30%			
Type of House	Kutcha	Count	10	54	78	19	161	12.53	6	0.051 Chi Square 12.53 df 6
		%	32.30%	41.50%	32.00%	54.30%	36.60%			
	Pucca	Count	16	69	137	14	236			
		%	51.60%	53.10%	56.10%	40.00%	53.60%			
	Semi Pakka	Count	5	7	29	2	43			
		%	16.10%	5.40%	11.90%	5.70%	9.80%			
Availability of Toilet facility (own/public /No facility,field)	Own	Count	16	51	103	6	176	18.19	6	0.006 Chi Square 18.19 df 6
		%	51.60%	39.20%	42.20%	17.10%	40.00%			
	Public/community/Shared	Count	8	49	93	12	162			
		%	25.80%	37.70%	38.10%	34.30%	36.80%			
	No facility, brush, field	Count	7	30	48	17	102			
		%	22.60%	23.10%	19.70%	48.60%	23.20%			
Sources of Water	Public pipe /Common Tap	Count	3	36	74	19	132	24.1	9	0.004 Chi square 24.1 df 9
		%	9.70%	27.70%	30.30%	54.30%	30.00%			
	Well	Count	6	18	49	5	78			
		%	19.40%	13.80%	20.10%	14.30%	17.70%			
	Surface water -River, pond	Count	7	20	25	0	52			
		%	22.60%	15.40%	10.20%	0.00%	11.80%			
	Tube well/hand pump	Count	15	56	96	11	178			
		%	48.40%	43.10%	39.30%	31.40%	40.50%			
Pet Animal	Yes	Count	19	100	164	13	296	20.44	3	0 Chi square 20.44 df 3
		%	61.30%	76.90%	67.20%	37.10%	67.30%			
	No	Count	12	30	80	22	144			
		%	38.70%	23.10%	32.80%	62.90%	32.70%			
Location of Kitchen	attached in separate room	Count	18	70	142	17	247	4.12	6	0.66 Chi square 4.12 df 6
		%	58.10%	53.80%	58.20%	48.60%	56.10%			
	Living room itself	Count	10	35	57	12	114			
		%	32.30%	26.90%	23.40%	34.30%	25.90%			
	Outside of main house	Count	3	25	45	6	79			
		%	9.70%	19.20%	18.40%	17.10%	18.00%			
Habit of roaming without chappal /bare foot	Yes	Count	8	38	62	4	112	19.64	6	0.003 Chi square 19.64 df 6
		%	25.80%	29.20%	25.40%	11.40%	25.50%			
	No	Count	16	49	83	7	155			
		%	51.60%	37.70%	34.00%	20.00%	35.20%			
	Sometime	Count	7	43	99	24	173			
		%	22.60%	33.10%	40.60%	68.60%	39.30%			
Intake of Albendazole Tablet	Yes	Count	17	66	105	10	198	7.16	3	0.067 Chi square 7.16 df 3
		%	54.80%	50.80%	43.00%	28.60%	45.00%			
	No	Count	14	64	139	25	242			
		%	45.20%	49.20%	57.00%	71.40%	55.00%			

NS Not Significant *p*>.05, ***Very Highly Significant *p*<.001

Interpretation: Majority of indicators under environmental factors like location of House, type of house, cattle shed, location of kitchen, intake of albendazaole tablet do not have any significant association with pretest haemoglobin level expect availability of toilet facility (significant at 1%CI),sources of water (significant at%CI), Roaming without chappal (significant at 1%CI).

Hence accepting the null hypothesis we conclude that caste,occupation, education, occupation of mother,type of family,location of House, type of house, cattle shed, location of kitchen, intake of albendazaole tablet among the tea garden adolescent girls under this study is not associated with pretest Haemoglobin level.

5. Conclusion
The present study assessed the effectiveness of nutritional education among adolescent girls with iron deficiency anemia. The study findings revealed that there was a significant difference in the pre and post test nutritional education score. ('t' value 31.54).Therefore it is evident that the nutritional education is effective in changing the dietary practices among the adolescent girlsThe study concluded that the nutrition education programme was effective in improving dietary behavior of Adolescent girls
The poor dietary practices, low socio-economic status, lack of personal hygiene and sanitation, worm infestation are the major causes of having high prevalence of Anaemia among

the tea garden adolescent girls. To reduce the iron deficiency anaemia in the tea garden areas, the food habits along with the behavioral risk factors to be corrected and knowledge on anaemia, its sign and symptoms, its effect on health may be disseminate among them.

It has been proven that nutrition education and counselling is one of the best strategy to changing the food habits, intake of medicinal iron supplements and to addressed the iron deficiency anaemia among the tea garden adolescent girls. But continues education, support, monitoring, home visits is required for sustaining and to improve the food habits more and reduction of anaemia from tea garden community.

Counselling to the Adolescent girls may be more strengthen by the ASHA and Aganwadi workers regarding weekly consumption of iron and Folic acid tablets under WIFS programme. Periodic de-worming and nutrition education regarding the food habits, hygiene and sanitation should be strengthened. Apart from the medicinal iron supplementation, other direct or indirect factors like regarding knowledge on iron rich foods, water and sanitation facilities, education, worm infestation etc to be addressed for preventing Iron deficiency anaemia

7. References
1. Andrew GF, Martin JW, Alistair MS, Brain SB. Guidelines for the management of iron Deficiency Anaemia. Gut. 2011;60:1309-1316. Available from: https://pubmed.ncbi.nlm.nih.gov/21561874/
2. Guideline for Control of Iron Deficiency Anaemia. National plus initiative. Available at: http://www.nhm.gov.in
3. FAO. IFAD. UNICEF. WFP. WHO. The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets. Food and Agriculture Organization of the United Nations; Rome, Italy; c2017.
4. World Health Organization. The Global Prevalence of Anaemia in 2011. World Health Organization; Geneva, Switzerland; c2015. Available online: https://apps.who.int/iris/handle/10665/177094
5. World Health Organization and Centers for Disease Control and Prevention Atlanta: Worldwide prevalence of anemia 1993-2005: WHO Global Database of anemia; c2008 [cited 2021 Jun 15]. Available from URL: http://whqlibdoc.who.int/publications/2008/978924159 6657_eng.pdf
6. Reducing anemia and changing dietary behavior among adolescent girls in Maharashtra, India. Available from: https://www.icrw.org/files/images/Reducing-Anemia-and-Changing-Dietary-Behaviors-among-Adolescent-Girls-in-Maharashtra-India.pdf
7. Bhanushali M, Mittal, Shirode R, Abhay, Joshi M, Yadunath, *et al*. An Intervention on Iron Deficiency anemia and change in dietary behavior among adolescent girls, Mumbai, Maharashtra. International Journal of Pharmacy and Pharmaceutical Sciences. 2007;3(1):40-42. Available from: www.ijppsjournal.com/Vol3Issue1/863.pdf. Accessed on Jan 2018.
8. Yadavar S. Anaemia Is the Biggest Cause of Disability in India, Worst in BRICS. Business Standard India Internet; c2016 Oct 27. Available from: https://www.business-standard.com/article/economy-policy/anaemia-is-the-biggest-cause-of-disability-in-indiaworst-in-brics-116102700695_1.html
9. Kumar P. Anaemia Rising Among Women and Children in NE. Outlook Poshan Internet. Available from: [https://poshan.outlookindia.com/.] (https://poshan.outlookindia.com/. 2021. https://poshan.outlookindia.com/story/poshan-news-anaemia-rising-among-women-and-children-in-ne/372999)
10. UNICEF for Assam and North East State. Wash Situation Analysis in Tea States of Assam; c2022 Jan. Available at: https://www.unicef.org/india/media/8981/file/WASH% 20Situational%20Analysis%20in%20Tea%20Gardens %20in%20Assam%20.pdf
11. International Institute for Population Sciences. National Family Health Survey (NFHS-4) Mumbai: IIPS; c2016. Available at: rchiips.org/nfhs/NFHS-4 Report shtml.