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TRIBAL ADOLESCENT GIRLS IN JHAGADIA TALUKA, GUJARAT- ROLE OF IRON FOLIC ACID SUPPLEMENTATION ON HEALTH & NUTRITIONAL STATUS

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ABSTRACT

Lack of knowledge and awareness pertaining to health and nutrition aspects, limited education and deprived of health care, tribal adolescents face a slow pace of growth. ***Objectives:*** *Situational analysis and to assess the impact of weekly iron-folate (IFA) supplementation on tribal adolescent girls in Jhagadia taluka.* ***Design:*** *This was an intervention study: an efficacy trial to assess the impact of IFA supplementation on adolescent tribal girls.* ***Setting:*** *Two school going & two free living groups of adolescent girls in the age group of 10-19 years were included for IFA supplementation.* ***Intervention:*** *All the study subjects were given IFA tables (100 mg elemental iron + 0.5 mg folic acid) after deworming (albendazole 400 mg) once a week for three months.* ***Methods:*** *At the beginning anthropometric measurements in terms of height, weight and BMI was taken. Blood was collected for hemoglobin estimation using cyanmethaemoglobin method.* ***Results:*** *All the subjects belonged to Vasava scheduled tribe. Most of the girls were in mid adolescent group. The mean age at menarche observed was 13.4 years. Stunting was more prominent among late adolescents (50%) and undernutrition among mid adolescents (57%). Majority of the girls (95%) were anemic. Early adolescent girls were more anemic (98%). Moderate and mild anemic levels were prevalent with majority in mild category (60%). 2% of the subjects were severely anemic.The sanitation and hygiene practices in tribal areas were satisfactory. IFA supplementation was insufficient to change the anemic status of the girls as*

*mean Hb value was 10.1 gm/dl and 10.4 gm/dl before and after intervention respectively with an increment of 0.3 gm/dl.**Conclusion and Recommendations:** The study thus highlights the prevalence of malnutrition and anemia. Not only socio-economic factors but also other important barriers like wrong perceptions, food taboos, inadequate food intake etc. play a major role in the prevalence of malnutrition.There is a need to counsel parents also along with adolescent girls to bring about behavior changes in this promising group.*

Introduction

The period of adolescence comprises nearly half of the growing period. With the profound growth, there is also an increased demand for nutrients like protein, energy, vitamins & minerals.Paucity of documentation on many health and nutrition related problems of the tribal adolescent girls like nutritional deficiencies, communicable diseases, genetic disorders, etc especially in the tribal regions of Gujarat was the reason to conduct this study. Thus, this study seeks to fill the information gap by discussing the primary issues relating to adolescent nutrition and growth by mapping the prevalence of malnutrition, anemia and evaluating the impact of IFA supplementation.The present study was planned with the following objectives:

Phase I: Situational Analysis.

1. To study the socio-economic status of the subjects.
2. To measure the growth pattern of tribal girls in terms of anthropometric measurements.
3. To assess the prevalence of anemia in the subjects (10-19 yrs) by estimating blood Hb levels.
4. To assess the prevalence of morbidity.

Phase II: Intervention period for 3 months.

1. To supplement Iron Folic Acid tablets (100mg of elemental iron & 0.5 mg of folic acid) weekly with deworming tablet i.e. Albendazole (400 mg) once at the beginning.

Phase III: Impact evaluation.

1. To assess the impact of IFA tablets on hemoglobin Levels of the subjects.

Methodology

Jhagadia is a tribal taluka having nearly 168 villages with a population of 1.75 lakh people. Four villages were randomly selected which included- two schools (Malpor and Dariya) from 2

villages & free living population from other two villages (Khariya and Nana-anadra). The medium of instruction in both the schools was Gujarati. Malpor School had only primary section (up to 7th std.) while Dariya School had only secondary section (8th onwards). Data on a total of 133 adolescent girls were included in the study**.**

The study included subjects aged 10 to 19 years having nearly the same family background: socio-economically disadvantaged class (ST), similar household characteristics and living conditions.

The anthropometric measurements: height, weight and BMI were taken using standard methods. The information on adolescents as regards socio-economic status, morbidity profile, was collected using self administered questionnaire under guidance.
Both the qualitative and quantitative data was first entered in CSpro 4 software and was verified by the statistician. The data was analyzed using Statistical Package for Social Sciences (SPSS) software version 17.

Major Findings Of The Study

Out of 133 subjects, majority (70%) of them was from school settings and 30% of them were from free living village settings. Out of 70% of girls, 47% of girls were from Dariya School and 23% from Malpor School while out of 30% of village subjects, 16% were from Khariya and 13% from Nana-Anadra village. School settings are easy to deal with as students are easily available during the school timings and added advantage of school teacher's supervision makes work easy but in village settings, accessibility and availability of the subjects was difficult & there was no motivation from elders and parents either because they were not available or they were illiterate. **Thus, school settings always have an advantage over free living population for any intervention.**

All the subjects (100%) were Hindus of vasava tribe (**Table 1)**. About 72% of the families were nuclear, while 26% were in joint families. The average family size was 6. Almost 41% subjects were not aware about their family income and 26% subjects had family income less than Rs. 500/- and few of them (17.3%) had above Rs. 1000/- per month. About 57% mothers were illiterate and only 33% mothers studied till the primary section. A majority of the mothers (47%) were agricultural labourers, 38% were housewives and the rest were engaged in other activities like papad making or masonry work.

25% fathers were illiterate and about 47% of the fathers completed their schooling till primary section (7^{th} STD.). The major occupation of the head of the household (64%) was agricultural labourers, while 18% were industrial laborers.

The land was very dry & desolate with very few trees. Most of them lived in huts. 97% had their own houses out of which 81% lived in kuchcha houses (floor, walls and roof were made up of cow dung, clay and wood), 10% were in semi-pucca houses (walls were made up of bricks) & only 6% were in pucca houses (floor was made up of cements/stones/sand while walls were of cement/bricks and roofs were of cement). Out of 133 study subjects, 3% did not have their own houses. Most of them (48%) had only one room with a partition for kitchen & 13.5% had 3 rooms in their house (one room partitioned into 3 compartments). 4 rooms is a luxury which only 6% of the subjects had. 10% of the houses were female headed – either widowed or men not earning.

Around 83% of the subjects were having their own land for farming, while 16% did not possess any agricultural land. As regards to water supply, 58% of the subjects use tap water and 42% use hand pump as a source of drinking water .The gram panchayats provide the water. 88% of them had drinking water facility within 0.5km from their place of residence. 11.3% of them had water facility within 0.5 to 1 km and 0.8% had water facility more than 1 km. The main source of drinking water was tap water (58%). 81% households strain the water through cloth for drinking while 8% use other process (alum & sedimentation) & 8% household boiled water for drinking. Wood was the main fuel for cooking in most of the houses. None of the families had toilet facilities within their house. Open defecation was seen among 79% of the subjects and 19% had public toilet facility (soak pits). All the houses had open drainage facility for kitchen and bath water.Equal percentage of subjects preferred Government hospital & traditional healing by mid-wives (35%).

The study included subjects aged 10 to 19 years having nearly the same family background: socio-economically disadvantaged class (ST), similar household characteristics and living conditions.The maximum study subjects were in their mid adolescence (62%). 28% of the subjects were first born & 47% were second in birth order. Most of them completed their primary education. About 83% of the subjects were studying in schools and 16% were dropouts with different reasons(**Table:2).**

Table: 3 shows the age at menarche of the study subjects. Only 35% of the girls had attained menarche. 30% of the girls (n=14) attained menarche at the age of 13 year which was followed by 12 year (28%) and 14 year (23%) respectively) (**Table:4**). Further, 13% of the girls attained menarche at the age of 15 years which was late when compared with the mean average age of menarche (12.4 yrs.) of a healthy adolescent (Krause & Mahan).The mean average age at menarche in the present study was 13.4 years. This shows that the growth of girls in terms of pubertal maturity is 1 year behind the normal growth. This also indicates the state of malnutrition which hinders the growth of the girls and affects the overall development. Only 4% (n=2) subjects attained menarche at 11 years out of 47 subjects.

A positive association was found between family income and BMI with menarche (**$p<0.05$**). No discernible trend was seen (**Table:5**) in the association of age of attainment of menarche with other socio-economic indicators and stunting. On comparing the mean age at menarche (13.4years) with those of other studies (**Table:6**), it was seen that mean age at menarche was comparable to other studies, which reported menarche occurring in the age range of 13.16 years to 13.8years in under privileged girls. In fact, the tribal adolescent girls in the present study were comparable in this respect to rural adolescent girls whose age at menarche was also 13+ years. Acharya et al (2006) carried out a study in New Delhi in urban settings and reported the mean age at menarche as 14.4 years while in Pune it was 12.62 years (Shrikant et al, 2003). Same findings were obtained where the age at menarche of the adolescent girls was 13.3 years in urban Vadodara (Vandana agrawal and Shubhada Kanani 1998).In a study conducted in, rural Hyderabad by Satyanarayana and Naidu (1978), it was observed that undernutrition in early life is associated with delay in age at menarche. The delay in menarche may be related to the delay in attaining a critical body size, and build. In this present study, the weight of the girls attaining menarche tended to be less i.e. **36 kg**. Several investigators have also reported that age at menarche varies greatly between different population and different socioeconomic groups in one country, and this difference is due to variation in socio-economic conditions, nutritional status, environmental condition and other factors (Deepali et al, 2004).

Though low socioeconomic status (SES) in general is associated with delay in menarche, it is difficult to isolate specific SES factors related to menarche. In the present study an attempt was made to find statistical association (**Table:5**) if any between the age at menarche and the following SES factors: family size, morbidity experienced by the subjects, anthropometric

measurements, calories and iron intake and Hb values. No statistically significant relationship could be established between age at menarche and the above factors. However, significant association between low family income and severe malnutrition (undernutrition) with delayed age at menarche was noted in the present

Anthropometric data

The girls of ages 10-19 years had height which was 89 to 95% of WHO 2007 standards. The mean height of the girls was 143.7 cms. The overall prevalence of stunting was 44% while 56% were normal. By looking at the percent prevalence of stunting, it was clear that stunting was more in late adolescence (50%)(**Table:7).**

Kurz (1996) has observed that short stature among adolescents is caused by infection and inadequate dietary intake during the first 3 years of life. Height is difficult to make up during the later childhood years and so children are still short when they reach adolescence.

The girls of ages 10-19 years had weight which was 61 to 76% of the NCHS standards & the mean weight was 33.0 Kgs. In all of the age groups, girls had their BMI values between 76 to 84% of WHO 2007 standards.

The overall prevalence of undernutrition was 55%, out of which 47% had grade II undernutrition while 7.5% had grade I undernutrition. Majority (57%) of the mid adolescents had severe degree of undernutrition followed by early (54.5%) and late adolescents (44.5%)(**Table:8).**Same results were observed in a cross sectional study carried out in Gujarat where underweight was about 66%, of which 27% had severe degree of undernutrition and about 49% of the children had various degrees of stunting. Severe stunting was 22% (K Venkaiah et al, 2005).

Young adolescents tend to be more undernourished than older adolescents (Kurz KM 1996, Benefice E et al 2003).

The same results were found in the study on nutritional status of rural adolescent school children in Paschim Medinipur district in West Bengal, where prevalence of undernutrition was higher among early adolescents (49%) and 21% among late adolescents (Bose & Bisai, 2008).

A study carried out in rural areas of Wardha showed the overall prevalence of thinness was 54% and it was significantly higher among early adolescents (57%) than late adolescents (48.6%) (P. R.Deshmukh, 2006).

Shahbuddin AK et al also reported that as age increases, thinness decreased (Shahbuddin AK et al, 2000; National Nutrition Monitoring Bureau, 2002).

The overall prevalence of anemia was 95%. Majority of girls (60.0%) had mild anemia. Severely anemic girls were less (2%). The prevalence of anemia was 98% in early adolescents, 96% in mid adolescents and 89% in late adolescents. Early adolescents (10-12 years) were more anemic **(Table:9).**

Severely anemic subjects were also less (only one) in a study carried out in Western Kenya where the overall prevalence of anemia was 21.1% (Leenstra T et al, 2003).Study carried out among pregnant and adolescent girls in 16 districts of India found that overall prevalence of anemia was 90.1%, while only 7% had severe anemia (Toteja GS et al, 2006).

A departmental study carried out by S. Kanani and A. Vandana in 1996 also had the same conclusion that the overall prevalence of anemia was 90% and severe anemia was less (6%).

Determinants of anemia

Statistical association was calculated between anemic status with different factors i.e. education of mother and father, occupation of mother and father, birth orders, family size, type of family, age at menarche, source of drinking water, SLI, stunting, BMI, intake of Vit C, iron and calories. No statistical association was found between any of the above factors except family income. This shows that higher the family income, lower the prevalence of anemia(**Table:10**).

Impact of IFA supplementation on Hb levels

The mean Hb was 10.13gm/dl before intervention and 10.40gm/dl after intervention with an increment of only 0.3 gm/dl. The increment was not statistically significant(**Table:11**).There was no visible change in overall prevalence of anemia but a positive shift was seen from moderate to mild levels. 32% of moderate anemia decreased to 14% whereas 61% of mild anemia increased to 78%. Instead 2 more severely anemic subjects were reported, probably due to non-compliance of IFA tablets and/or any morbidity experienced during this intervention phase(**Table:12**).

The sanitation and hygiene practices in tribal areas under study were satisfactory. They were clean and kept their surroundings also clean.

General meal pattern

It was observed that all the subjects had similar and monotonous meal pattern. Generally the main meals cooked for lunch include rotla /roti with vegetable or dal with rice. Alternative meal pattern was seen at dinner time. From the study it was very clear that total food intake was far below the daily consumption of normal healthy adolescent girls. Though this tribal belt was known for its green leafy vegetables and cereals (jowar and bajra), they could not afford it.

The staple cereals of the subjects were wheat, jowar and rice. Red gram dal was consumed daily though in less quantity (15gms.). Despite the fact that the study site was an agricultural area, consumption of GLV's like fenugreek leaves (methi), shepu (suvani bhaji) and spinach (palak) by the subjects was rare. Frequency of consumption of vitamin C rich foods like lemon, tomato and guava was also very less (30%). A majority of the subjects consumed fruits either once in a week or less often. Consumption of milk was only 10% even though they had domestic animals (cows, buffaloes and goats) due to their poor economic status.

Similar results were seen in the study carried out on diet and nutritional status of adolescent tribal population in nine states of India, which showed the average intake of all the nutrients by adolescent girls was below the Recommended Dietary Allowances (RDA) in all the age groups (M Rao, et al, 2006).

Chaudhary et al (2003) reported that the mean energy intake was less than recommended dietary allowances. Nagi M (1995) reported that the mean daily intake of energy, protein, iron, calcium, vitamin C and vitamin A was inadequate as compared to ICMR standards.

Further, dietary intake of tribal adolescent girls was found to be very poor and much below the recommended dietary allowances (Sahoo SL et al, 2006). The calorie and protein intake of the school going adolescent girls in Delhi government and private schools were found to meet only 56% and 70% of the RDA (Sharma A K et al, 2005) respectively.

Conclusion:

- The total food intake of the tribal adolescent girls was inadequate due to large family size and low purchasing power.
- The mean age at menarche of the girls was 13.4 years. A positive relationship was observed between family income and BMI with age at menarche. The reason could be that high family income contributed to adequate food purchasing and intake, indirectly affecting nutritional status. As nutritional status improves, the age of menarche is lowered.
- Faulty eating habits, superstitious beliefs and wrong perceptions play a major role in the prevalence of malnutrition.
- The growth pattern in terms of anthropometric measurements reflects on the prevalence of current undernutrition (wasting) and chronic undernutrition (stunting).
- Stunting was higher among late adolescents. As stunting is an indicator of chronic undernutrition which might have initiated at early adolescence but manifested during late adolescent age.
- Wasting was more among mid adolescents.
- As age increases nutritional demands are raised to meet rapid physiological development which has to be fulfilled through adequate diets. Due to poor economic conditions these needs would not have been met leading to poor nutrient intake contributing to undernutrition.
- The prevalence of morbidity was only 22.5% and all had taken treatment. Due to satisfactory sanitation and hygiene practices morbidities like diarrhoea, loose motion, vomiting was less common.
- Late adolescents tend to be more prone to tobacco chewing.
- Statistics proved significant association of family income with prevalence of anemia while rest determinants like education & occupation of father and mother, ordinal position, family size, family income, type of family, age at menarche, source of drinking water, nutritional status, intake of iron, energy and vit C were not statistically significant.

Recommendation

- Long term continuous nutrition health education is needed to bring about behavior changes among adolescent girls for adoption of healthy diets.
- There was no motivation or encouragement from elders and parents, to sustain the impact of the intervention so there is need to educate them through effective counseling and communication strategies.
- To improve nutritional status of adolescents, there is a need to involve both adolescents and their parents in nutrition health education.
- Food taboos and superstitious beliefs were the major setbacks for the poor nutritional status of the girls. Continuous & strong messages regarding various food taboos need to be provided to the community as a whole to stop them from further degradation.
- For late adolescents or dropouts, teenage friendly nutrition education training centers should be initiated**.**
- There is a need to evolve comprehensive programs for the overall development of the tribal adolescent girls.
- Effective & sustainable supplementation programs implemented on a larger scale would reduce the present malnutrition.
- Promoting kitchen gardens near the neighborhood would make the girls more involved in the cause of reducing malnutrition thereby motivating them to change their dietary habits.

Limitations of the Study: The typical tribal local language was a constraint. Villages far off and in the interiors and very difficult to access. Mode of transportation was very scarce. Subjects were not available easily in free living group as most of them were engaged in household activities till 7.30 p.m in the evening.Poor cooperation and compliance of the students during Hb estimation.No motivation and encouragement for the subjects- they had to be literally forced out from places of residence (in free living group).

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TABLE: 1 SOCIO-ECONOMIC STATUS OF SUBJECTS (N=133)

Variables	Percentage of subjects	
	No.	%
Name of the Villages/Schools		
Villages:	40	30
Khariya village	22	16.5
Nana-Anadra village	18	13.5
School settings:	93	70
Malpor School	31	23.3
Dariya School	62	46.6
Religion		
Hindu (Vasava Tribe)	133	100
Muslim	0	0
Type of Family		
Nuclear	96	72.2
Joint	34	25.6
Extended	3	2.3
Average Family Income		
< 500	35	26.3
500-1000	20	15.0
>1000	23	17.3
Don't know	55	41.4
Education of Mother		
Illiterate	76	57.1
Primary	44	33.1
Secondary	10	7.5

Higher Secondary	3	2.3
Occupation of Mother		
Agricultural labourer	63	47.4
House wife	50	37.6
Maid Servant	3	2.3
Self-employment	11	8.3
Others	6	4.5
Education of Father		
Illiterate	33	24.8
Primary	63	47.4
Secondary	31	23.3
Higher Secondary	6	4.5
Occupation of Father		
Agricultural labourer	85	63.9
Masonry work	13	9.8
Company/Industry worker	24	18.0
Others (Driver, Shopkeeper, etc.)	11	8.4
Type of House		
Kucha	108	81.2
Semi Pucca	13	9.8
Pucca	8	6.0
Houseless	4	3.0
Partition for kitchen		
Yes	84	63.2
No	49	36.8
No. of partitions		
1	64	48.1

2	51	38.3
3	18	13.5
Female headed house		
Yes	13	9.8
No	120	90.2
Is female headed widow		
Yes	6	4.5
No	127	95.5
Land Holding		
Own	111	83.5
Not Owned	22	16.5
Distance travelled for Drinking Water		
Within 0.5 Km.	117	88.0
0.5-1.0 Km.	15	11.3
> 1.0 Km.	1	0.8
Source of Drinking Water		
Tap Water	77	57.9
Hand Pump	56	42.1
Process of Drinking Water		
Boil	11	8.3
Strain with a cloth	108	81.2
Others (Sedimentation, alum, etc.)	11	8.3
No processing	3	2.3
Main source of water for other purposes		
Tap water	71	52.7
Hand pump	62	46.6
Toilet Facility		

Open Space	105	78.9
Public Toilet (Pit)	25	18.8
Private Toilet	3	2.3
Fuel for cooking		
Wood	133	100
Health facility for treatment		
Government hospital	48	36.1
Anganwadi centers	3	2.3
Mobile clinic (SEWA rural)	2	1.5
NGO/Trust	16	12
Private hospital	5	3.8
Traditional healers	46	34.6
Home treatment	11	8.3
Others (Pharmacy)	2	1.4

TABLE: 2 BACKGROUND INFORMATION OF THE SUBJECTS (N=133)

Variables	Category	Girls	Percent
Age of respondents (yrs.)	10-12	33	24.8
	13-15	82	61.6
	16-19	18	13.5
Ordinal position	1st	37	27.8
	2^{nd}	62	46.6
	3^{rd}	28	21.1
	4^{th}	4	3.0
	5^{th}	1	0.8

	6th	1	0.8
Education	Primary	60	45.2
	Secondary	72	54.1
	Higher Secondary	1	0.8
School Status	Studying	110	82.7
	Never attended school	2	1.5
	Drop outs	21	15.8
Reasons for dropouts	Failed in exams	10	47.6
	Needs to support family financially	8	38.1
	Frequently suffer from illness	1	4.8
	Dislikes studies	1	4.8
	They shift their residence place	1	4.8

TABLE: 3 MENARCHE ATTAINED AMONG ADOLESCENTS (n=133)

Menarche attained		**Menarche not attained**	
N	**%**	**N**	**%**
47	35.0	86	65.0

TABLE: 4 AGE OF MENARCHE ATTAINED (n=47)

Age Group	**Age of subject (yrs.)**	**N**	**%**
Early adolescence	11	2	4.2
	12	13	27.7
Mid adolescence	13	14	29.8
	14	11	23.4

	15	6	12.8
Late adolescence	16	1	2.1
10-19	**Total**	**47**	**100**

TABLE: 5 RELATIONSHIP OF AGE AT MENARCHE WITH VARIOUS INDICATORS

Variables		**Menarche status**				**Chi square value**
		Not Attained		**Attained**		
		N	**%**	**N**	**%**	
Family Income	<500	28	32.5	7	15.0	9.01*
	500-1000	11	12.8	9	19.1	
	>1000	10	11.6	13	27.6	
	Don't know	37	30.1	18	38.3	
SLI	Low	28	23.5	12	25.5	0.82NS
	Medium	50	58.1	31	65.9	
	High	8	9.3	4	8.5	
BMI Percentile	Thin grade II	48	55.8	15	31.9	7.95*
	Thin grade I	5	5.81	5	4.25	
	Normal	33	38.4	27	57.4	
Stunted	Stunted	39	45.34	19	40.4	0.30NS
	Normal	47	54.66	28	59.6	
Family size	<4	9	10.5	5	10.64	1.11NS
	5-7	62	72.1	37	78.7	
	>8	15	17.44	5	10.64	
Morbidity experienced	Yes	19	22.1	11	23.4	0.08NS
	No	67	78.0	36	76.5	

Anemic	Severe	1	1.2	1	2.1	2.40^{NS}
	Moderate	29	35.0	12	25.5	
	Mild	50	60.2	30	64.0	
	Normal	3	4.0	4	8.6	
Sickle cell trait	Yes	6	7.22	0	0	3.53^{NS}
	No	76	91.6	47	100	
Vit C intake	<25%	44	51.2	29	61.7	4.39^{NS}
	25-75%	38	44.2	13	27.7	
	>75%	4	4.6	5	10.6	
Iron intake	<25%	0	0	1	2.1	1.87^{NS}
	25-75%	14	16.3	8	17.0	
	>75%	72	83.7	38	81.0	
Energy intake	<25%	1	1.2	0	0	0.98^{NS}
	25-75%	32	37.2	15	31.9	
	>75%	53	61.6	32	68.1	

NS: Not significant *: Significant at $p<0.05$

TABLE: 6 MEAN AGE OF MENARCHE OF STUDY SUBJECTS COMPARE

Author	**Place**	**Sample**	**Mean age at menarche (years)**
Present study	**Jhagadia**	**Tribal**	**13.4**
Deepali S. Deo et al, 2000	Ambajogai	Rural	13.16
A. Acharya et al, 2004	New Delhi	Urban	14.4
Shrikant A Rokade et al, 2003	Pune	Urban	12.62
S. Chowdhury,et al, 1996	Bangladesh	Rural	13.0
Anita Malhotra	North India	Rural	13.8
Singh MMet al, 1999	Haryana	Rural	13.6

TABLE: 7 PERCENT PREVALENCE OF STUNTING

AGE (YRS.)	N0.	STUNTED		NORMAL		Total
		N	%	N	%	%
10-12	33	14	42.4	19	57.5	100
13-15	82	35	42.7	47	57.3	100
16-19	18	9	50	9	50	100
Total	133	44%		56%		

TABLE: 8 PERCENT PREVALENCE OF MALNUTRITION

Age	No.	Thin grade II	Thin grade I	Total	Normal	Total
10-12	33	17 (51.5)	1 (3.0)	18 (54.5)	15 (45.5)	100
13-15	82	39 (47.5)	8 (9.7)	47 (57.3)	35 (42.7)	100
16-19	18	7 (39.0)	1 (5.5)	8 (44.5)	10 (55.5)	100
Total	**133**	**63(47%)**	**10(7.5%)**	**73(55%)**	**60**	

a. Thin Grade II=BMI for age <3rd percentile of WHO(2007) standards

b. Thin Grade I= BMI for age >3rd but <5th percentile of WHO(2007) standards

c. Normal= BMI for age between 5th-85th percentile of WHO(2007) standards

TABLE: 9 PERCENT PREVALENCEOF ANEMIA

Age (yrs.)	No.	Severe		Moderate		Mild		Total		Normal		Total
		N	%	N	%	N	%	N	%	N	%	%
10-12	41	2	4.9	17	41.5	21	41.2	40	97.6	1	2.4	100
13-15	93	0	0	28	30.1	61	65.6	89	95.7	4	4.3	100
16-19	26	1	4.0	8	30.8	14	53.8	23	88.5	3	11.5	100
Total	**160**	**3(2%)**		**53**		**96(60%)**		**152(95%)**		**8**		**100**

Value in Parenthesis denotes Percentage

WHO (2007) standards

a Severely anemic= Hb <7 gm/dl

b Moderately anemic= Hb 7-9.99 gm/dl -

c Mildly anemic= Hb 10-11.99 gm/dl -WHO (2007) standards

d Normal = Hb ≥ 12 gm/dl - WHO (2007) standards

TABLE: 10 DETERMINANTS OF ANEMIA

Variables		Anemia prevalence				Chi square value
		Anemic		Non-anemic		
		N	%	N	%	
Education of mother	Illiterate	71	57.7	3	42.9	2.29^{NS}
	Literate	52	42.3	4	57.1	
	Primary	39	31.7	4	57.1	
	Secondary	10	8.1	0	0	
	Higher Secondary	3	2.4	0	0	
Education of Father	Illiterate	30	24.4	3	42.9	3.17^{NS}
	Literate	93	75.6	4	57.1	
	Primary	61	49.6	2	28.6	
	Secondary	27	22.0	1	14.3	
	Higher Secondary	5	4.1	1	14.3	
Occupation Mother	Agricultural worker	56	45.5	7	100.0	7.86^{NS}
	Housewife	48	39.0	0	.0	
	Maidservant	3	2.4	0	.0	
	Service	6	4.9	0	.0	
	Industrial Labor	4	3.3	0	.0	
	Masonry	4	3.3	0	.0	
	Not applicable	2	1.6	0	.0	
Occupation	Agricultural worker	77	62.6	5	71.4	3.36^{NS}

Father	Masonry	12	9.8	1	14.3	
	Industrial/Company Labor	24	19.5	0	.0	
	Others (driver/ Shop keeper/Died)	10	8.1	1	14.3	
Ordinal position	1st	34	27.6	2	28.6	2.84^{NS}
	2nd	60	48.8	2	28.6	
	3rd	23	18.7	3	42.8	
	4th	4	3.25	0	0	
	5th	1	0.81	0	0	
	6th	1	0.81	0	0	
Family size	< 4	13	10.6	1	14.3	1.36^{NS}
	5-7	90	73.2	6	85.7	
	>7	20	16.3	0	0	
Family income	<500	60	48.8	2	28.6	14.8*
	500-1000	40	32.5	3	42.8	
	>1000	23	18.7	2	28.6	
Type of family	Nuclear	32	26.0	5	71.4	0.18^{NS}
	Joint	88	71.5	2	28.6	
	Extended	3	2.4	0	0	
Age of menarche	Not yet started	80	65.0	3	42.9	26.15^{NS}
	10 to 12 yrs.	14	11.4	1	14.3	
	13 to 15 yrs.	28	22.8	3	43	
	16 to 19 yrs.	1	0.8	0	0	
Source of drinking water	Hand Pump	48	39.02	6	85.7	6.01^{NS}
	Tap Water	75	61.0	1	14.3	

Stunting	Stunting	52	42.3	4	57.1	0.59^{NS}
	Normal	71	58.0	3	42.8	
BMI	Severe	56	45.5	4	57.1	0.83^{NS}
	Moderate	10	8.13	0	0	
	Normal	57	46.3	3	42.8	
SLI	Low	34	27.6	4	57.1	3.05^{NS}
	Medium	78	63.4	3	42.8	
	High	11	8.9	0	0	
Vit C intake	<25%	69	56.1	4	57.1	0.58^{NS}
	25-75%	45	36.6	3	42.9	
	>75%	9	7.3	0	0	
Iron intake	<25%	1	0.8	0	0	0.07^{NS}
	25-75%	20	16.3	1	14.3	
	>75%	102	82.9	6	85.7	
Energy intake	<25%	1	0.8	0	0	0.22^{NS}
	25-75%	43	34.9	3	42.8	
	>75%	79	64.2	4	57.1	

NS: Not significant, *p<0.05

TABLE: 11 EFFECTS OF IFA INTERVENTION ON HB LEVELS (N=119)

Phases	Mean	SD	SE	Mean diff.	T-test value	Sig.
Pre test	10.13	1.3	0.1	0.3	1.07	0.286
Post test	10.4	1.9	0.1			

TABLE: 12 DIFFERENCES IN ANEMIA STATUS

Age	No.	Severe		Moderate		Mild		Normal	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
10	4	0	0	2	1	2	3	0	0
11	10	0	0	3	1	7	9	0	0
12	18	1	1	8	4	8	13	1	1
13	34	0	1	11	6	21	26	2	2
14	25	0	0	7	2	16	19	2	2
15	15	0	0	5	3	10	12	0	0
16	6	1	1	0	0	5	5	0	0
17	2	0	0	2	0	0	2	0	0
18	3	0	1	0	0	2	2	1	0
19	2	0	0	0	0	2	2	0	**0**
Total	**119**	**2 (1.7)**	**4 (3.4)**	**38 (32.0)**	**17 (14.3)**	**73 (61.3)**	**93 (78.1)**	**6 (5.0)**	**5 (4.2)**

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