



## HEALTH & NUTRITIONAL STATUS AND IMPACT OF IRON FOLIC ACID SUPPLEMENTATION ON HEMOGLOBIN LEVELS IN TRIBAL ADOLESCENT BOYS(10 -19 YRS) IN JHAGADIYA TALUKA , GUJARAT

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### ABSTRACT

Adolescents are the future generation of any country and their nutritional needs are critical for the well being of the society. In underprivileged adolescent boys, the nutritional and health status are compromised because many of them have to financially support their families at a vulnerable and tender age. **Objectives:** Situational analysis of health & nutrition and assessment of the impact of IFA supplementation on tribal adolescent boys of Jhagadiya taluka, Gujarat. **Design:** This was an intervention study: an efficacy trial to assess the impact of IFA supplementation on adolescent tribal boys. **Setting:** Two schools & two free living groups of adolescent boys in the age group of 10-19 years were randomly included in the study. **Intervention:** All the subjects were given NHE (12 sessions) & IFA (100 mg elemental iron + 0.5 mg folic acid) weekly with deworming tablets (Albendazole – 400 mg) once at the beginning. Hemoglobin was assessed using cyanmethemoglobin method. **Results:** Majority of the subjects were in mid adolescence (55.6%), all belonging to Vasava (Scheduled) tribe. 69.5% belonged to medium Standard Living Index. Overall prevalence of stunting was 42.6%. Maximum stunting was seen in early adolescents (60%). 63.4% were undernourished out of which, 4.3 % subjects were thin grade I and 59% were thin grade II of undernutrition. All subjects under study in early adolescence were severely malnourished(100%). It was seen that overall 69.3% subjects were anemic, out of which 55% were mildly anemic and 14% were moderately anemic. Prevalence of anemia was highest in early adolescents (89%). No severe anemia was reported. There was an increment of only 0.2 gm/dl in Hb levels after

supplementation. The mean post Hb level was 11.3 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 perception, inadequate food intake etc. play a major role in the prevalence of malnutrition. There is a need to involve parents also along with adolescent boys to bring about behavior changes in this promising group.

## **Introduction**

Tribals are economically and socially backward sections of the society isolated from elite communities. The problems of tribal adolescents are multidimensional and require a holistic approach. The wide spread poverty, illiteracy, malnutrition, absence of safe drinking water and sanitary conditions, poor maternal and child health services, ineffective coverage of national health and nutritional services, etc. are the factors contributing to their dismal health conditions. Many of the infections and parasitic diseases can be prevented with timely intervention, health awareness and IEC activities.

Malnutrition is common among tribal adolescents and is usually coupled with iron deficiency anemia. There is a need to assess the nutritional determinants of malnutrition in adolescents of tribal areas to further develop the strategies to improve their health and nutritional status. Nutritional intervention is very important to address the unmet needs of these adolescents. Keeping this in mind the present study reports in the following manner :

### Phase I: Situational Analysis.

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

### 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 Hb. levels of the subjects.

## **Sampling Frame and Sample Selection**

The study was carried out in the tribal areas of Jhagadia taluka of Bharuch district in the state of Gujarat, India. From these four places, two schools and two villages were randomly

selected. Medium of instruction in both the schools was Gujarati. Since the study focusses on adolescents -10 to 19 years of age, subjects selected from Dariya School were of 8<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> standards and from Malpor School of 6<sup>th</sup> and 7<sup>th</sup> standards( since it was a primary school only),while from the villages, they were selected age wise and were enrolled in the study for anthropometric measurements. The total sample size was 115 (including dropouts) from the four selected places(**Table:1**).

### **Data Collection**

The anthropometric measurements: height and weight were taken using standard methods, and body mass index(BMI) was calculated and assessed according to WHO 2007 standards.The information on adolescents was collected using self administered questionnaire under guidance.

### **Data Analysis**

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.

### **The Major Findings of this Intervention study are as follows:**

#### **Background information:**

In early adolescent group (10 – 12) there were 10 (8.6%) subjects. In mid adolescent group there were 64 (55.6%) subjects and in late adolescents 41(35.6%) subjects were there.50.4% of subjects were from Dariya School and Malpor School had only 9 subjects(**Table:1**). From Khariya and Nana Anadra Villages 26.1% & 15.7% subjects respectively were enrolled. It is seen that 94.7% subjects were from Hindu families of Vasava tribe. Out of all the subjects 73.9% subjects were school going, 5.2 % had never attended any school and 20.9% were dropouts. Out of the dropouts, maximum no. of subjects (15) left school because they failed in examinations of the previous class, six subjects had to earn a living for their families, so they left school and one subject stated that he frequently suffered from illnesses. The main reasons for school dropouts were: (a) Failure in classes, (b) Adolescents were forced to work to financially support their families much against the child labor act (1986). Children continue to be employed and occupied in work. According to the 1991 census estimates, of about a total of 200 million children in the age group of 5-14 years, some 11.28 million children are child laborers. However, NGO estimates of child labor in India range from 40

million to over 100 million (Common Position Paper of the UN System in India on Child Labor, 1998). Child Labor constitutes a violation of children's rights, and results in injurious and long-term effects on the health and education status of children.

In terms of literacy fathers were better than Mothers(**Table:2**).

#### **Socio economic status & standard of living index:**

39.1% of the households had an average monthly income between 500 to 1000 rupees, 21.7% earned more than 1000 rupees.91.3% lived in kuchha houses and the rest in half pucca and pucca houses. Only 7% had permanent ( pucca ) decent dwellings. 98.2% were using open space for defecation(**Table:3**). No public toilet facility was available.69.5% belonged to medium SLI.

#### **Anthropometric data**

Boys in all the age groups (10-19years) had height which was 89% to 95% of WHO 2007 standards. The mean height for boys was 151.9 cms.

Overall prevalence of stunting was 42.6%(**Table:4**). Maximum stunting was seen in early adolescents (60%)(**Table:5**).

Stoltzfus et al suggested that school based programs aimed at improving health and nutrition status may have the potential to bring about catch-up growth in stunted adolescents. Though the prevalence of stunting was nearly the same (39%), as in the present study, the results were contrary in a study in Myanmar by Vijayaraghavan et al, where stunting increased with age.

The prevalence of stunting was 47.4% among adolescent boys in a study on 605 tea garden workers in Assam. (Medhi et al,2006). Stunting was highly prevalent in adolescent boys and girls, ranging from 32% in India to 65% in Philippines (Kurz 1996).

Although stunting was similar in boys and girls, the prevalence of thin boys was more than the girls (75% vs 59%) in rural Bangladesh (Shahabuddin et al, 2006)

Overall 63.4% of subjects were undernourished out of which, 4.3 % subjects were thin grade I and 59% were thin grade II undernutrition. All subjects under study in early adolescence were severely malnourished (100%). It is clear from the data that grade II undernutrition is more prevalent in the whole sample under study(**Tables:6&7**). Similar results reported by Venkaiah et al showed that the prevalence of under nutrition was higher (53.1%) in boys than girls (39.5%). The primary findings of the ICRW (International Center for Research on Women) also revealed the similar results where younger adolescents were more undernourished than older adolescents, and boys were almost twice as undernourished as girls (Kurz KM 1996,Benefice E et al 2003).

Similar results were obtained by Cordeiro LC et al in Tanzania's largest rural districts where it was found that pre-pubescent adolescents (early adolescents) were more likely to be undernourished than those reporting that they had attained pubertal landmarks (74.2% vs. 25.8%). Younger adolescents (10-14 years) were more undernourished than those who were older (83.7% vs. 16.3%).

Funke & Olumakaiye, in Osun state, Nigeria found that the prevalence of underweight was significantly higher in boys at mid adolescence (24.2%), boys who were involved in jobs after school hours (13.7%) and who do not travel regularly (22.5%).

Prevalence of thinness was higher among boys (59.5%) than girls 41.3% in a study done among adolescence of tea garden in Assam (Medhi et al, 2006).

Another cross sectional survey carried out in rural areas of Tanzania (Africa) on children aged (7-18 yrs.) had a prevalence of 52.5% stunting and 43% underweight, with stunting & underweight more significant in boys than girls (Lwambo et al 2000). In the present study the overall prevalence of undernutrition was 63.4% whereas in a study done in West Bengal, the overall prevalence of undernutrition was half (37.59 %) as compared to the present study (Das and Bisai, 2009).

#### **Anemia:**

The data reveals that 69.4% subjects were anemic, out of which 55% were mildly anemic and 14% were moderately anemic(**Table:8**). No severely anemic subjects were reported.30.5% were normal. The prevalence of anemia was 89% in early adolescents, 83% in mid adolescents and 40 % in late adolescents. In early adolescents mildly anemic subjects (67%) were more than moderately anemic(22%). In mid adolescents 64% were mildly anemic and 18.5% were moderately anemic. In late adolescents also more subjects were mildly anemic (35%). Prevalence of anemia was more in early adolescents (10 to 12 yrs). Anemia was present in mild degree in the present study(**Table:9**). No severely anemic subjects were seen. Figure 4.9 shows the overall prevalence of anemia. Soekarjo et al ,2001 had reported similar results where anemia was more (24.5%)in **pre pubertal** (early adolescents) than pubertal adolescents (late adolescents) in Indonesia. Nearly similar results were obtained in Myanmar where the prevalence of anemia was 75% . (WHO, 2008).

Almost similar results were obtained in the overall prevalence of adolescent boys in a cross sectional study carried out among the tribal adolescents of Madhya Pradesh in which overall 78.6% boys were anemic. Moderate and severe anemia was observed in 59% of adolescents (VG Rao et al, 2003).

### **Determinants of anemia:**

Father's education, mother's education, occupation of father and mother's occupation did not significantly influence the prevalence of anemia. Among the other socioeconomic variables only type of family had a positive effect on prevalence of anemia. Anemia was more prevalent in nuclear families probably because the food intake was less, as it gets divided due to more number of mouths to be fed (**Table:12**).

### **Impact of IFA supplementation on Hb levels:**

Overall an increase of 0.2g/dl in the mean hemoglobin levels was seen in boys and it was not significant(**Table:13**). No visible change was seen in overall prevalence of anemia in the post analysis. However, a positive shift was seen from moderate to mild levels. 15% moderate anemia reduced to 8% where as 58% mild anemia increased to 64%. Thus there was a shift from moderate to mild category of anemia after the IFA supplementation(**Table:14**).

### **Conclusion**

Lack of knowledge & awareness pertaining to health & nutrition aspects, limited education, and deprived of adequate health care, good nutrition and good schooling, the tribal adolescents are a disadvantaged lot, facing a slow pace of growth. They lag behind nutritionally and lack knowledge and awareness in many aspects of health and nutrition. It is thus clear from the data that,

- 73.9% subjects were school going, 5.2 % had never attended any school and 20.9% were dropouts.
- 70.4% subjects were living in nuclear families.
- Wood was the main fuel for cooking in most of the houses (95.6%).
- No one had independent water connections in their residence.
- 42.6% subjects were stunted. Maximum stunting was seen in early adolescents.
- 63.4% were undernourished. 4.3 % subjects were thin grade I and 59% were thin grade II of undernutrition. All subjects in early adolescence were severely malnourished(100%). grade II undernutrition was more prevalent in the whole sample.
- 69.4% subjects were anemic, out of which 55% were mildly anemic and 14% were moderately anemic. Prevalence of anemia was more in early adolescents (10 to 12 yrs). Anemia was present in mild degree in the present study. No severely anemic subjects were seen.

- 23.5% were prone to various addictions. A positive association is seen between addiction and age of the adolescent and it was significant. Addiction is more in late adolescents
- The mean value of Hb was 11.1gm/dl before intervention and 11.3 gm/dl after intervention with an increment of only 0.2 gm/dl. The increment was not statistically significant.
- There was a shift in subjects from moderate to mild category of anemia after the IFA supplementation.

### **Recommendations**

- Long term continuous nutrition health education is needed to bring about behavioral changes among adolescent boys 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 the parents through effective counseling and communication strategies.
- For late adolescents or dropouts, teenage friendly nutrition education training centers should be initiated.
- Promoting kitchen gardens near the neighborhood would make the boys more involved in the cause of reducing malnutrition thereby motivating them to change their dietary habits.
- The compliance in the intervention was very good as the investigators were of their age and so could empathise with them. The respondents will open up and interact better if young investigators counsel them.

**Limitations of the Study:** Subjects were not available easily in free living group as most of them were employed till 7:30pm in the evening. 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. Poor cooperation and compliance of the students during Hb estimation. No motivation and encouragement by the parents and elders.

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**Table:1 AGE-WISE DISTRIBUTION OF THE SUBJECTS**

<b>Age (years)</b>	<b>Boys</b>
10 – 12	10
13 – 15	64
16 – 19	41
10 – 19	115

**Table:2 BACKGROUND INFORMATION OF THE SUBJECTS**

<b>Variables</b>	<b>Category</b>	<b>n</b>	<b>%</b>
<b>Age (yrs)</b>	<b>10 – 12</b>	<b>10</b>	<b>8.6</b>
	<b>13 - 15</b>	<b>64</b>	<b>55.6</b>
	<b>16 - 19</b>	<b>41</b>	<b>35.6</b>
<b>Village name</b>	<b>Khariya</b>	<b>30</b>	<b>26.1</b>
	<b>Nana Anadra</b>	<b>18</b>	<b>15.7</b>
	<b>Malpor</b>	<b>9</b>	<b>7.8</b>
	<b>Dariya</b>	<b>58</b>	<b>50.4</b>
<b>Religion</b>	<b>Hindu</b>	<b>109</b>	<b>94.7</b>
	<b>Muslim</b>	<b>5</b>	<b>4.3</b>
	<b>Others</b>	<b>1</b>	<b>0.8</b>
<b>School status</b>	<b>School going</b>	<b>85</b>	<b>73.9</b>
	<b>Never attended school</b>	<b>6</b>	<b>5.2</b>
	<b>Drop out</b>	<b>24</b>	<b>20.9</b>
<b>Reasons for dropouts:</b>	<b>Failed in exams</b>	<b>15</b>	<b>62.5</b>
	<b>Needs to support family financially</b>	<b>6</b>	<b>25</b>
	<b>Frequent illness</b>	<b>1</b>	<b>4.1</b>
	<b>Dislike studies</b>	<b>2</b>	<b>8.3</b>
<b>Ordinal position</b>	<b>First</b>	<b>30</b>	<b>26.1</b>
	<b>Second</b>	<b>45</b>	<b>39.1</b>
	<b>Third</b>	<b>21</b>	<b>18.3</b>
	<b>Fourth</b>	<b>10</b>	<b>8.7</b>
	<b>Fifth</b>	<b>7</b>	<b>6.1</b>
<b>Education of Father:</b>	<b>Illiterate</b>	<b>65</b>	<b>56.5</b>
	<b>Primary education</b>	<b>34</b>	<b>29.5</b>
	<b>Secondary education</b>	<b>12</b>	<b>10.4</b>
	<b>Others</b>	<b>6</b>	<b>5.2</b>
<b>Occupation of Mother:</b>	<b>Agricultural Labourer</b>	<b>64</b>	<b>55.6</b>
	<b>Housewife</b>	<b>35</b>	<b>30.4</b>
	<b>House maids</b>	<b>6</b>	<b>5.2</b>
	<b>Small scale industrial labourer</b>	<b>8</b>	<b>6.9</b>
	<b>Others</b>	<b>2</b>	<b>1.7</b>
	<b>Is female headed (widowed)</b>	<b>3</b>	<b>2.6</b>

**Table:3 SOCIOECONOMIC STATUS OF SUBJECTS (N=115)**

<b>Variable</b>	<b>Category</b>	<b>N</b>	<b>%</b>
<b>Type of family</b>	<b>Nuclear</b>	<b>81</b>	<b>70.4</b>
	<b>joint</b>	<b>34</b>	<b>29.5</b>
<b>Average monthly income</b>	<b>Less than 500 Rs.</b>	<b>1</b>	<b>0.8</b>
	<b>500-1000 Rs.</b>	<b>45</b>	<b>39.1</b>
	<b>More than 1000 Rs.</b>	<b>25</b>	<b>21.7</b>
	<b>Don't Know</b>	<b>44</b>	<b>38.2</b>
<b>Household having BPL Card</b>		<b>85</b>	<b>73.9</b>
<b>Owns a house</b>		<b>113</b>	<b>98.3</b>
<b>Type of house</b>	<b>Kucha</b>	<b>105</b>	<b>91.3</b>
	<b>Half pucca</b>	<b>2</b>	<b>1.7</b>
	<b>pucca</b>	<b>8</b>	<b>6.9</b>
<b>Fuel used for cooking:</b>	<b>LPG</b>	<b>1</b>	<b>0.9</b>
	<b>Kerosene</b>	<b>4</b>	<b>3.5</b>
	<b>Wood</b>	<b>110</b>	<b>95.6</b>
<b>Distance travelled to get drinking water</b>	<b>Within 0.5 Km</b>	<b>65</b>	<b>66.5</b>
	<b>0.5-1.0 Km</b>	<b>44</b>	<b>38.3</b>
	<b>More than 1.0 Km</b>	<b>6</b>	<b>5.2</b>
	<b>Individual water connection.</b>	<b>0</b>	<b>0</b>
<b>Main source of drinking water</b>	<b>Piped water which comes from tubewell.</b>	<b>32</b>	<b>27.8</b>
	<b>Hand pump</b>	<b>83</b>	<b>72.1</b>
<b>Process of water treatment to make it drinkable</b>	<b>Boil</b>	<b>0</b>	<b>0</b>
	<b>Use alum</b>	<b>5</b>	<b>4.3</b>
	<b>Strain through a cloth</b>	<b>95</b>	<b>82.6</b>
	<b>Use water filter</b>	<b>0</b>	<b>0</b>
	<b>Let it stand &amp; settle</b>	<b>8</b>	<b>6.9</b>
	<b>Don't know</b>	<b>7</b>	<b>6.0</b>
<b>Toilet facility</b>	<b>Private toilet(soak pits)</b>	<b>2</b>	<b>1.7</b>
	<b>No facility/use open space</b>	<b>113</b>	<b>98.2</b>
<b>Health facility:</b>	<b>Government</b>	<b>44</b>	<b>38.3</b>
	<b>Anganwadi/ICDS.</b>	<b>1</b>	<b>0.9</b>
	<b>NGO/Trust hospital/clinic</b>	<b>60</b>	<b>52.2</b>
	<b>Private hospital</b>	<b>8</b>	<b>7</b>
	<b>Traditional healer</b>	<b>2</b>	<b>1.7</b>

**TABLE:4 AGE WISE FREQUENCY OF STUNTING**

AGE (YRS.)	N	STUNTED (a)	NORMAL(b)
10	1	1	0
11	2	2	0
12	7	3	4
13	17	6	11
14	22	9	13
15	25	11	14
16	13	5	8
17	11	4	7
18	9	6	3
19	8	2	6
<b>Total</b>	<b>115</b>	<b>49</b>	<b>66</b>
<b>10-12</b>	<b>10</b>	<b>6(5.2%)</b>	<b>4(3.4%)</b>
<b>13-15</b>	<b>64</b>	<b>26(22.6%)</b>	<b>38(33.0%)</b>
<b>16-19</b>	<b>41</b>	<b>17(14.7%)</b>	<b>24(20.8%)</b>
<b>Total</b>	<b>155</b>	<b>49(42.6%)</b>	<b>66(57.3%)</b>

a-Height for age < 3<sup>rd</sup> percentile, b- Height for age between 3<sup>rd</sup> to 97<sup>th</sup> percentile

**TABLE:5 PERCENT PREVALENCE OF STUNTING (PERCENTILE)**

AGE (YRS.)	n	STUNTED		NORMAL		TOTAL	
		n	%	n	%	N	%
10-12	10	6	60	4	40	10	100
13-15	64	26	40.6	38	59.3	64	100
16-19	41	17	41.4	24	58.5	41	100

**TABLE:6 AGE WISE FREQUENCY OF MALNUTRITION**

Age (yrs)	N	Thin grade II (a)	Thin grade I (b)	TOTAL	Normal (c)
10	1	1	0	1	0
11	2	2	0	2	0
12	7	7	0	7	0
13	17	7	0	7	10

14	22	13	1	14	8
15	25	17	1	18	7
16	13	4	2	6	7
17	11	6	1	7	4
18	9	7	0	7	2
19	8	4	0	4	4
10-12	10	10(8.6%)	0(0%)	10(8.6)	0(0%)
13-15	64	37(32.1%)	2(1.7%)	39(33.9%)	25(21.7%)
16-19	41	21(18.2%)	3(2.6%)	24(20.8%)	17(14.7%)
<b>Total</b>	<b>115</b>	<b>68(59.1%)</b>	<b>5(4.3%)</b>	<b>73(63.4%)</b>	<b>42(36.5%)</b>

- Thin grade II – BMI for age < 3<sup>rd</sup> percentile of WHO (2007 standards)
- Thin grade I – BMI for age > 3<sup>rd</sup> but < 5<sup>th</sup> percentile (2007 standards)
- Normal – BMI for age between 5<sup>th</sup> to 85<sup>th</sup> percentile (2007 standards)

**Table:7 PERCENT PREVALENCE OF MALNUTRITION**

Age group	Thin grade II		Thin grade I		TOTAL		Normal		Total	
	n	%	n	%	N	%	n	%	N	%
10 to 12	10	100	0	0	10	100	0	0	10	100
13 to 15	37	57.9	2	3.1	39	60.9	25	39.0	64	100
16 to 19	21	18.2	3	7.3	24	58.5	17	41.4	41	100

d.

**TABLE:8 AGE WISE FREQUENCY OF ANEMIA**

Age (yrs)	Moderate Anemia(a)	Mild Anemia(b)	Total anemia	Normal (c)	Total
10	1	1	2	0	2
11	1	1	2	1	3
12	2	10	12	1	13

13	7	12	19	0	19
14	4	16	20	5	25
15	2	17	19	7	26
16	1	7	8	5	13
17	1	2	3	8	11
18	0	2	2	7	9
19	0	4	4	6	10
<b>Total</b>	<b>19</b>	<b>72</b>	<b>91</b>	<b>40</b>	<b>131</b>

Age (yrs)	Moderate anemia		Mild anemia		Total anemia		Normal		Total	
	n	%	n	%	N	%	n	%	N	%
10-12	4	3.0	12	9.1	16	12.2	2	1.5	18	13.7
13-15	13	9.9	45	34.3	58	44.2	12	9.1	70	53.4
16-19	2	1.5	15	11.4	17	12.9	26	19.8	43	32.8
<b>Total</b>	<b>19</b>	<b>14.5</b>	<b>72</b>	<b>54.9</b>	<b>91</b>	<b>69.4</b>	<b>40</b>	<b>30.5</b>	<b>131</b>	<b>100</b>

- a- Moderate anemia – Hb 7 to 9.9 gm /dl – WHO (2007) standards.
- b- Mild anemia – Hb 10 to 11.99 gm /dl – WHO (2007) standards.
- c- Normal – Hb> 12 gm /dl – WHO (2007) standards.

**TABLE:9 PERCENT PREVALENCE OF ANEMIA**

Age (yrs)	Moderate anemia		Mild anemia		Total anemia		Normal		Total	
	n	%	n	%	N	%	n	%	N	%
10-12	4	22.2	12	66.6	16	88.8	2	11.1	18	100
13-15	13	18.5	45	64.2	58	82.8	12	17.1	70	100
16-19	2	4.6	15	34.8	17	39.5	26	60.4	43	
<b>Total</b>	<b>19</b>		<b>72</b>		<b>91</b>		<b>40</b>		<b>131</b>	

**TABLE:10 DETERMINANTS OF ANEMIA**

		Anemic	%	non anemic	%	Chi square
<b>Education of Mother</b>	<b>Illiterate</b>	<b>57</b>	<b>72.2</b>	<b>30</b>	<b>83.3</b>	<b>2.4<sup>NS</sup></b>
	<b>Primary</b>	<b>11</b>	<b>13.9</b>	<b>2</b>	<b>5.6</b>	
	<b>Secondary</b>	<b>10</b>	<b>12.7</b>	<b>4</b>	<b>11.1</b>	
	<b>Higher Secondary</b>	<b>1</b>	<b>1.3</b>	<b>0</b>	<b>0.0</b>	
<b>Education of Father</b>	<b>Illiterate</b>	<b>44</b>	<b>55.7</b>	<b>21</b>	<b>58.3</b>	<b>0.344<sup>NS</sup></b>
	<b>Primary</b>	<b>23</b>	<b>29.1</b>	<b>11</b>	<b>30.6</b>	
	<b>Secondary</b>	<b>9</b>	<b>11.4</b>	<b>3</b>	<b>8.3</b>	
	<b>Higher Secondary</b>	<b>3</b>	<b>3.8</b>	<b>1</b>	<b>2.8</b>	
<b>Occupation Mother</b>	<b>Agri. Labourer</b>	<b>46</b>	<b>58.2</b>	<b>18</b>	<b>50.0</b>	<b>5.575<sup>NS</sup></b>
	<b>Housewife</b>	<b>23</b>	<b>29.1</b>	<b>12</b>	<b>33.3</b>	
	<b>House maids</b>	<b>5</b>	<b>6.3</b>	<b>1</b>	<b>2.8</b>	
	<b>Small scale Ind. Labourer</b>	<b>3</b>	<b>3.8</b>	<b>5</b>	<b>13.9</b>	
	<b>Others</b>	<b>2</b>	<b>2.5</b>	<b>0</b>	<b>0.0</b>	
<b>Occupation Father</b>	<b>Agri. Labourer</b>	<b>58</b>	<b>69.6</b>	<b>28</b>	<b>77.8</b>	<b>10.388<sup>NS</sup></b>
	<b>Ind. Labourer</b>	<b>17</b>	<b>7.6</b>	<b>2</b>	<b>0.0</b>	
	<b>Small scale shopkeeper</b>	<b>1</b>	<b>1.3</b>	<b>3</b>	<b>8.3</b>	
	<b>Others</b>	<b>3</b>	<b>3.8</b>	<b>3</b>	<b>8.3</b>	
<b>Family size</b>	<b>Less than 4</b>	<b>15</b>	<b>19.0</b>	<b>7</b>	<b>19.4</b>	<b>1.059<sup>NS</sup></b>
	<b>5 to 7</b>	<b>61</b>	<b>77.2</b>	<b>26</b>	<b>72.2</b>	
	<b>More than 7</b>	<b>3</b>	<b>3.8</b>	<b>3</b>	<b>8.3</b>	
<b>Type of Family</b>	<b>Nuclear</b>	<b>51</b>	<b>64.6</b>	<b>30</b>	<b>83.3</b>	<b>4.187*</b>
	<b>Joint</b>	<b>28</b>	<b>35.4</b>	<b>6</b>	<b>16.7</b>	
	<b>Extended</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	
<b>Birth Order</b>	<b>First</b>	<b>23</b>	<b>29.1</b>	<b>7</b>	<b>19.4</b>	<b>3.345<sup>NS</sup></b>
	<b>Second</b>	<b>31</b>	<b>39.2</b>	<b>14</b>	<b>38.9</b>	
	<b>Third</b>	<b>15</b>	<b>19.0</b>	<b>6</b>	<b>16.7</b>	
	<b>Fourth</b>	<b>5</b>	<b>6.3</b>	<b>5</b>	<b>13.9</b>	
	<b>Fifth</b>	<b>4</b>	<b>5.1</b>	<b>3</b>	<b>8.3</b>	
	<b>Sixth</b>	<b>1</b>	<b>1.3</b>	<b>1</b>	<b>2.8</b>	
<b>Main source of drinking water</b>	<b>Piped water</b>	<b>20</b>	<b>25.3</b>	<b>12</b>	<b>33.3</b>	<b>3.337<sup>NS</sup></b>
	<b>Hand pump</b>	<b>59</b>	<b>74.6</b>	<b>24</b>	<b>66.6</b>	

<b>Height/Age pc</b>	<b>stunted</b>	<b>33</b>	<b>41.8</b>	<b>16</b>	<b>44.4</b>	<b>0.072<sup>NS</sup></b>
	<b>Normal</b>	<b>46</b>	<b>58.2</b>	<b>20</b>	<b>55.6</b>	
	<b>Tall</b>	<b>0</b>	<b>0.0</b>	<b>0</b>	<b>0.0</b>	
<b>BMI/age pc</b>	<b>&lt; 3rd</b>	<b>52</b>	<b>65.8</b>	<b>16</b>	<b>44.4</b>	<b>6.488<sup>NS</sup></b>
	<b>3rd - &lt; 5th</b>	<b>3</b>	<b>3.8</b>	<b>2</b>	<b>5.6</b>	
	<b>5th - 85th</b>	<b>22</b>	<b>27.8</b>	<b>18</b>	<b>50.0</b>	
	<b>85th - 95th</b>	<b>1</b>	<b>1.3</b>	<b>0</b>	<b>0.0</b>	
	<b>&gt; 95th</b>	<b>1</b>	<b>1.3</b>	<b>0</b>	<b>0.0</b>	
<b>Standard of Living Index</b>	<b>Low</b>	<b>16</b>	<b>20.3</b>	<b>5</b>	<b>13.9</b>	<b>1.418<sup>NS</sup></b>
	<b>Medium</b>	<b>55</b>	<b>69.6</b>	<b>25</b>	<b>69.4</b>	
	<b>High</b>	<b>8</b>	<b>10.1</b>	<b>6</b>	<b>16.7</b>	
<b>VitaminC</b>	<b>&lt;25%</b>	<b>52</b>	<b>69.3</b>	<b>23</b>	<b>30.7</b>	<b>0.585<sup>NS</sup></b>
	<b>26-75 %</b>	<b>26</b>	<b>66.7</b>	<b>13</b>	<b>33.3</b>	
	<b>75 +</b>	<b>1</b>	<b>100.0</b>	<b>0</b>	<b>0.0</b>	
<b>Iron</b>	<b>&lt;25%</b>	<b>3</b>	<b>100.0</b>	<b>0</b>	<b>0.0</b>	<b>0.79<sup>NS</sup></b>
	<b>26-75 %</b>	<b>7</b>	<b>53.8</b>	<b>6</b>	<b>46.2</b>	
	<b>75 +</b>	<b>69</b>	<b>69.7</b>	<b>30</b>	<b>30.3</b>	
<b>Energy</b>	<b>&lt;25%</b>	<b>6</b>	<b>85.7</b>	<b>1</b>	<b>14.3</b>	<b>0.226<sup>NS</sup></b>
	<b>26-75 %</b>	<b>21</b>	<b>47.7</b>	<b>23</b>	<b>52.3</b>	
	<b>75 +</b>	<b>52</b>	<b>81.3</b>	<b>12</b>	<b>18.8</b>	

**Level of significance:**

- (i) **P < 0.05 - \***
- (ii) **P < 0.01 - \*\***
- (iii) **P < 0.001- \*\*\***
- (iv) **NS – Non Significant**

**TABLE:11 EFFECT OF SUPPLEMENTATION ON HEMOGLOBIN LEVELS (N = 107)**

<b>Variable</b>	<b>N</b>	<b>Mean</b>	<b>SD</b>	<b>SE</b>	<b>Mean diff.</b>	<b>T value</b>	<b>Sig.</b>
<b>Pre Hb.</b>	<b>107</b>	<b>11.1</b>	<b>1.3</b>	<b>0.1</b>	<b>106</b>	<b>-1.325</b>	<b>.188</b>
<b>Post Hb.</b>	<b>107</b>	<b>11.3</b>	<b>1.8</b>	<b>0.2</b>			



**TABLE:12 DIFFERENCES IN ANEMIA STATUS**

Age	N	Severe		Moderate		Mild		Normal	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
10	1	0	0	1	1	0	0	0	0
11	2	0	0	1	0	1	2	0	0
12	7	0	0	1	0	6	6	0	1
13	16	0	0	5	4	11	11	0	1
14	21	0	0	4	1	13	16	4	4
15	22	0	1	1	1	14	10	7	10
16	12	0	0	1	1	6	8	5	3
17	10	0	0	1	0	2	2	7	8
18	8	0	0	0	0	1	4	7	4
19	8	0	0	0	0	4	5	4	3
<b>Total</b>	<b>107</b>	<b>0</b>	<b>1</b>	<b>15</b>	<b>8</b>	<b>58</b>	<b>64</b>	<b>34</b>	<b>34</b>
<b>total</b> %	<b>100</b>	<b>0</b>	<b>0.9</b>	<b>14.0</b>	<b>7.5</b>	<b>54.2</b>	<b>59.8</b>	<b>31.8</b>	<b>31.8</b>