BARODA CITIZENS COUNCIL

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Introduction

Adolescence is the period of transition from childhood to adulthood and is characterized by efforts to achieve, related to the expectations of mainstream culture, and by spurts of physical, mental, emotional and social development (WHO 1986)

After infancy, adolescence is the most rapid phase of growth The physical and psychological changes that occur during the adolescent period place a great demand on their nutritional requirements In the life cycle of an individual, adolescence is a particularly vulnerable period for both macro and micro nutrient deficiencies

Though dietary and nutrient deficiencies can affect the growth and development of both adolescent boys and girls, but the demands of rapid growth and development on one hand and those of teenage pregnancy on the other, make the adolescent girls a high risk group for nutritional deficiency disorders (Aneja and Kapoor 1992) Among the nutritional deficiency disorders, iron deficiency anemia (IDA) appears to be a major health problem in adolescent girls

Studies reviewed by DeMaeyer and Adiels-Tegman in 1985 show that the estimated global prevalence of anemia (using <12 g/dl as the cut off value) in adolescents was 26% in developing countries and 6% in developed countries The overall prevalence was similar for both boys and girls

In studies co-ordinated by the International Center for Research on Women (ICRW 1994), prevalence of anemia was quite high (55%) among the Indian girls (11 to 15 years) using a cut off level of 11 5 g/dl

Several studies conducted in the Department of Foods and Nutrition, M S University of Baroda, in the past fifteen years have shown that more than half of the girl are anemic, with prevalence above 70% in most studies as shown in Table 1

Table 1

Prevalence Of Anemia In Adolescent Girls And Young Women Of Urban Vadodara Studies Conducted In The Department Of Foods And Nutrition, M S University of Baroda (1983 - 1997)

Author and Year	Age Group (Years)	N	Mean Hb (g/dl)	% Anemic (Hb<11g/dl)	% Anemic (Hb<12g/dl)
LOW INCOME GROUP					
Agarwal and Kanani (1997)	10 13	286	09 9	77	88
Kanani and Ghanekar(1995)	10 19	60	09 3	90	NR
Kanani and Parikh (1992)	13 15	133	10 7	46	77
Kanani and Mair (1992)	10 12	154	10 1	79	NR
Kanani and Baxi (1991)	10 18	105	09 0	97	NR
Kanani and Thakore (1989)	10 - 19	98	NR	NR	65
Bhardwaj and Gopaldas (1986)	11 - 15	83	NR	73	NR
Kanani and Gopaldas (1985)	10 - 15	156	NR	69	NR
Gopaldas et al (1983)	10 - 13	80	NR	92	NR
HIGH INCOME GROUP					
Kanani and Bhargava (1992)	10 - 12	166	11 3	41	71
Kanani and Sanghani (1990)	13 - 15	184	11 7	46	54

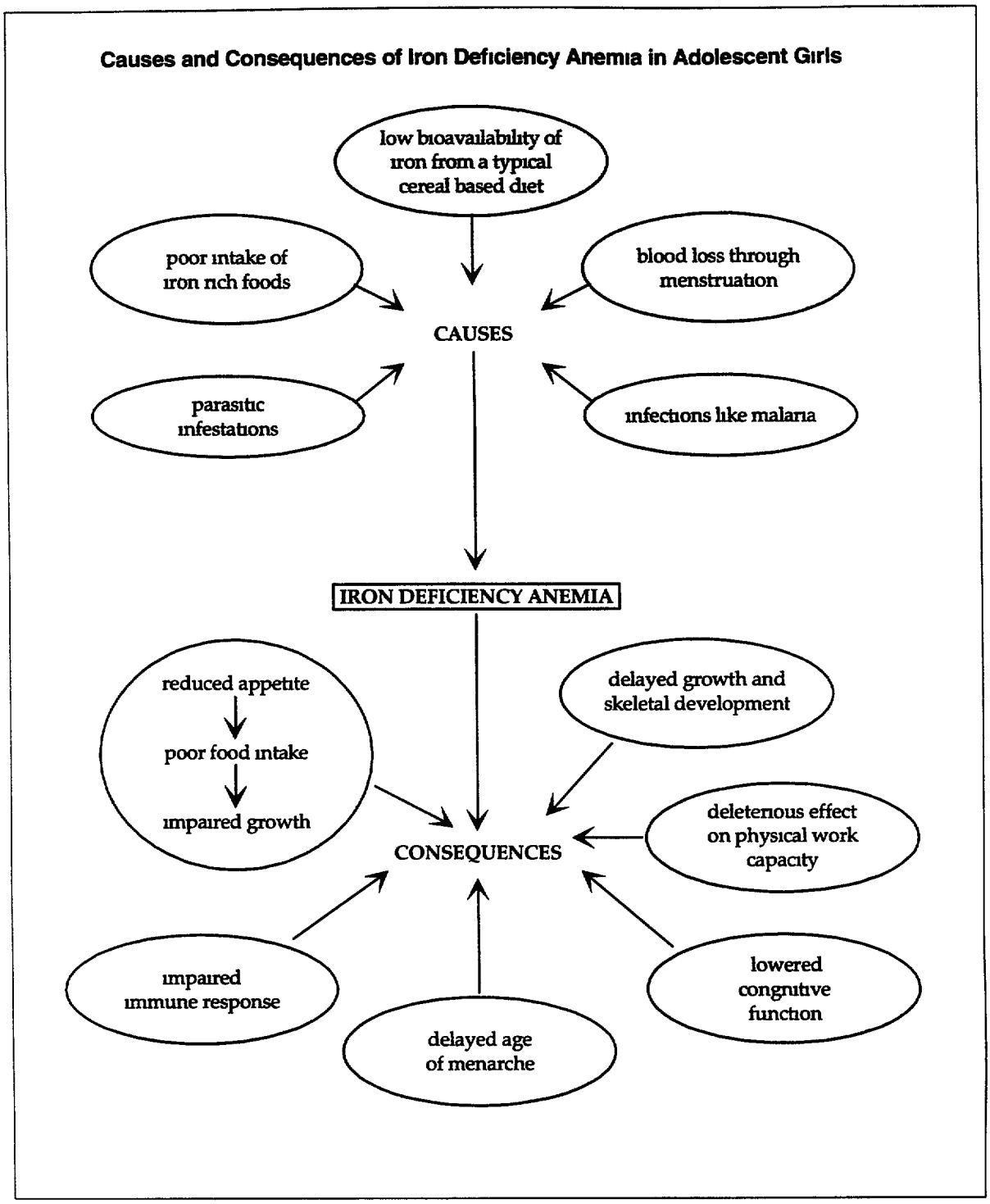
NR Not reported

Source Kanani and Ghanekar (1997)

Causes of Iron Deficiency Anemia in Adolescent Girls

Figure 1 sums up what is known from available research evidence regarding the likely causes and consequences of IDA in adolescent girls

Figure 1



The reasons for the high incidence of IDA in adolescent girls are summarized below

1 During adolescence iron requirements are increased, reaching a maximum at peak growth (Brabin and Brabin 1992)

2 In girls, menstrual blood loss means an extra loss of iron, which must be compensated for by a further increase in intake (Sjolin 1981)

3 Discrepancy between a high need of iron for hemoglobin formation and low iron content of the foods most commonly used is an important cause (Sjolin 1981)

4 Dislike of foods rich in iron, such as green leafy vegetables further reduce dietary iron intake Presence of iron absorption inhibitores like phytates and tanins in foods such as cereals and tea further decrease iron bioavailability Frequent dieting or general erratic eating behaviour also put the adolescent female at risk of developing iron deficiency (Food and Nutrition Board 1980, Monsen et al 1978)

Adverse Consequences of Iron Deficiency Anemia

1 One of the symptoms associated with IDA is loss of appetite, sometimes referred to as anorexia (Pollit 1976) Poor appetite is a cause for concern as it may lead to poor food intake which may adversely affect the pubertal growth spurt of adolescents

2 Weights of children with IDA tend to be lower than those of normal children (Lokeshwar et al 1990) It is known that low weights and heights of adolescent girls are among the risk factors for adverse pregnancy outcomes later in life (Gopalan 1989)

3 Anemia is strongly associated with poor reproductive health (Meda et al 1996) The most serious consequence of anemia are the effects on the health of mothers and newborns, because pregnancy related anemia is linked with a high risk of maternal and fetal deaths, premature delivery as well as an increase in low birth weight babies and perinatal mortality (WHO 1986)

4 Impairment in psychomotor development and cognitive function are among the most important deficits associated with iron deficiency (Dallman 1989, Lozoff 1987) which will adversely affect scholastic performance of our school children and adolescents

5 Maximal work capacity, work output and endurance are impaired in iron deficient states (Basta et al 1979 Viteri et al 1974)

6 Impaired bactericidal capacity and depressed cell mediated immune response have been demonstrated in severely anemic subjects (Srikantia 1976)

Perceptions of Adolescent Girls on Anemia

Research on perceptions of girls on anemia in India are scarce Summarized below are key perceptions of adolescent girls regarding health, nutrition and anemia as available from recent research studies in Vadodara

These studies were conducted among urban poor adolescent girls in the age group of 10 to 18 years using qualitative methods such as focus group discussions and open ended in-depth interviews (Kanani 1994)

- Several girls mentioned having experienced "*kamshakti*" or "*kamjori*" (weakness) saying that "*kamshakti*" is caused by inadequate food intake, frequent illnesses, too much work or "less blood or thin blood or pale blood" in the body
- Other symptoms cited along with weakness were tiredness (fatigue), breathlessness, poor appetite and frequent illnesses One girl said "*Kam khana khate hai to pandurog hota hai*" (Eating less food causes anemia)

- For reducing *"kamshakti"*, good food (e g green leafy vegetables, fruits, milk, meat), strength giving medicines (e g tonics) from the doctor, or a combination of these measures were considered important by the girls
- Fruits and green leafy vegetables were stated to be iron rich foods by almost half of the subjects One-fifth of the subjects reported non-vegetarian foods and dairy products to be iron rich

Rationale for Reducing Anemia in Adolescent Girls

It is frequently too late to begin to address anemia in pregnancy At the start of her pregnancy the woman is already anemic and in the interval of barely 12 weeks representing the time of contact by the health system and the delivery of her baby, even an efficient antenatal care service provider will find it extremely difficult to correct, to any significant degree, the fairly large pre-pregnancy iron deficit that she is already suffering from and, in addition, provide for her added demands of pregnancy Therefore, the opportunities provided by the precious years of adolescence should not be wasted by our health system Programs aimed at improving the health and nutritional status of girls during adolescence such as regular supply of iron and folate tablets right through adolescence are necessary so that girls can enter their pregnancy with no serious iron deficiency handicaps (Gopalan 1989) Perception data also indicate that there is a need to impart nutrition health education (NHE) to adolescent girls regarding anemia and other nutritional problems of especially adolescents as well as measures to overcome these problems

Iron Supplementation to Combat Iron Deficiency Anemia and Improve Health in Adolescent Girls

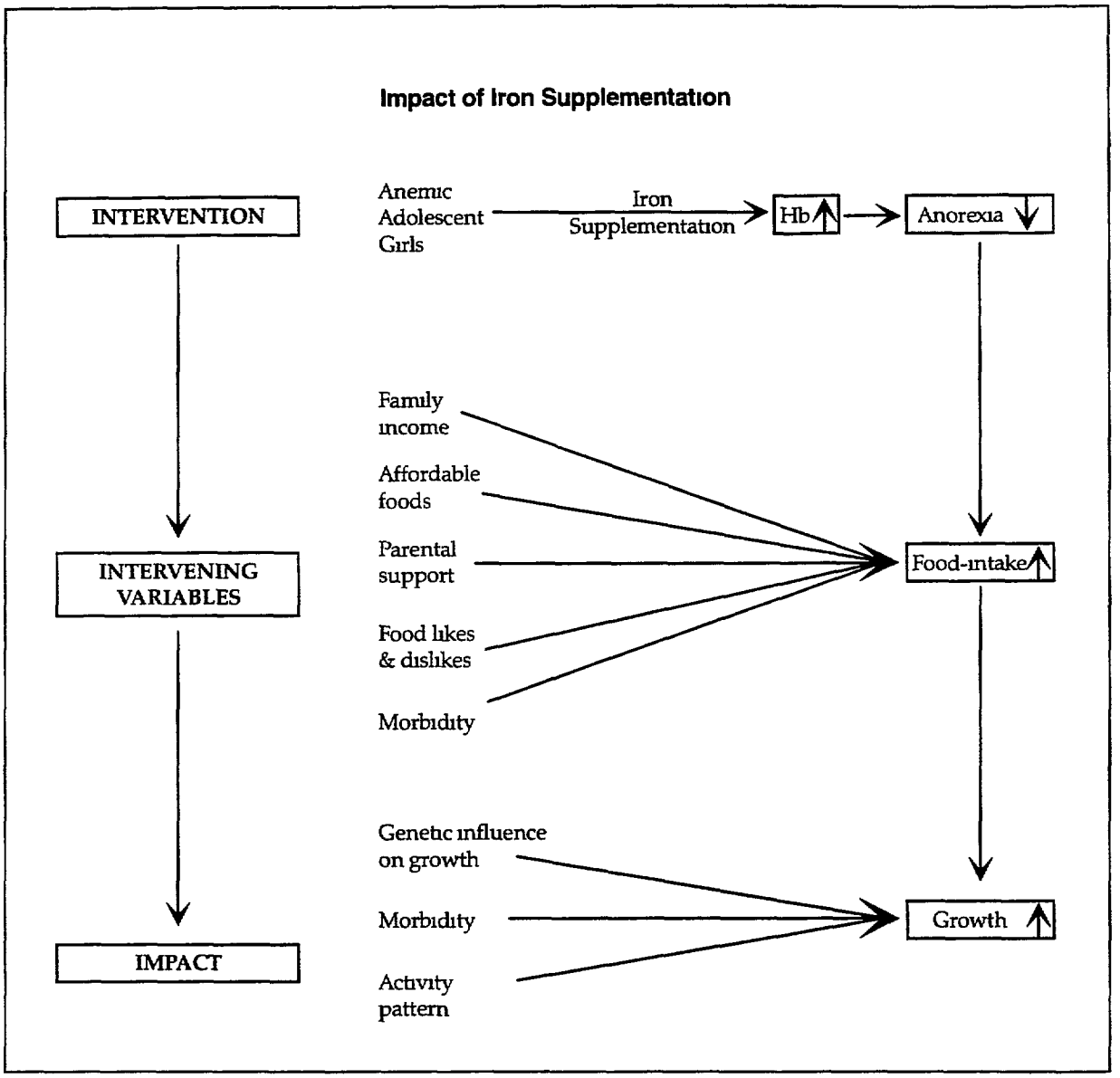
Supplementation with medicinal iron - folic acid (IFA) tablets can be a primary short-term strategy to combat IDA in adolescent girls as it is likely to improve hematinic status especially hemoglobin levels and to build iron stores and reduce morbidity (Bhatia and Seshadri 1992, Srikantia 1976)

As shown in Figure 2, it is hypothesized that iron supplementation to anemic adolescent girls will show an improvement in hemoglobin levels and a reduction in anorexia, leading to an increase in food intake But the food intake change will also be affected by several intervening variables such as income of family, available and affordable foods, parental support, and food likes and dislikes Increased food intake is likely to lead to better growth in girls However, again, impact of food intake on growth will also be influenced by other intervening variables such as genetic influence on growth, morbidity and energy expenditure as determined by activity patterns of girls

Most research studies have determined the impact of iron or IFA supplementation on hematinic status in children and some in addition to have also assessed impact on physical work capacity and cognitive functions (Bhatia and Seshadri 1992, Chwang et al 1988) However, there is little research evidence of the impact of IFA supplementation on adolescent growth In a few research studies on primary and pre-school children, the provision of iron supplements to iron deficient children has been shown to improve growth

A randomized double blind placebo control iron supplementation trial on 87 Kenyan primary school children (6 to 11 years) receiving 150 mg sustainable release ferrous sulphate daily at school for 14 weeks, showed an improvement in growth and appetite (in terms of both energy intake of the child and child report of appetite) as compared with children receiving the placebo In this study, appetite test was conducted for each child by quantitatively measuring the ad libitum consumption of a mid-morning snack In addition, each subject was asked for a subjective assessment of his or her appetite Responses were coded as an appetite score ranging from 1 to 5 The volume and the mean energy content of the maize porridge consumed at one sitting by the iron treated group was significantly greater as compared with the placebo group The authors concluded that it is plausible

Figure 2



and likely that provision of iron tablets to anemic children results in improved appetite which in turn results in improved growth (Lawless et al 1994)

In another study in Vadodara on anemic children of ages 3 to 5 years, growth performance of the children supplemented with iron was found to be superior to that of anemic placebo treated children, as indicated by a better weight gain and a significantly higher weight-for-height (Bhatia and Seshadri 1992)

In a double blind study on the effect of oral iron supplementation on blood iron levels and physical growth in 119 rural Indonesian school children 8 2 to 13 5 years age, Chwang et al (1988) indicated that treatment with 10 mg ferrous sulphate/kg/day for 12 weeks resulted in a significant improvement in anemic subjects' hematological status, growth velocity and level of morbidity

In view of this, it is worthwhile to explore if iron supplementation can lead to improved growth in adolescent girls, especially in the pubertal phase of 10 to 15 years Further, is the impact different in anemic and non-anemic girls?

Weekly versus Daily IFA Supplementation

Poor compliance because of the related gastrointestinal side effects of medicinal iron is commonly cited as an important constraint limiting the success of iron supplementation By giving iron supplements less often as compared to once daily, any decrease in absorbed iron resulting from a lower total dose will be offset by eliminating the inhibition in absorption from iron given on the previous day In addition, compliance might be improved by reducing the side effects of iron with less frequent administration (Cook and Reddy 1995)

In a study by Berger et al (1997), the efficiency of a weekly and 5 day per week iron supplementation regimen was assessed against a placebo control through a double blind trial in anemic school children (3 to 8 years old) living at high altitude in Bolivia A dose of 3 to 4 mg of elemental iron per kg body weight, one day per week or 5 days per week, was supplemented for 16 weeks Increase in hemoglobin was not found to be significantly different between the two supplemented groups (weekly group 1 52±0 69 g/dl and 5 days/week group 1 86±1 11 g/dl) but was higher than in the placebo group (0 05±0 71 g/dl) Thus, in this study weekly iron supplementation was found to be as efficacious in improving iron status and correcting moderate IDA as daily iron supplementation

Iron Supplementation to Girls through the School System

There has been a steady increase in the school enrolment rates of girls in India (UNICEF 1994) According to Gopalan (1989), reaching adolescent girls in their childhood has not been completely successful However girls can be reached in the school during their pre-adolescence and adolescence period The school system may be cost effective and feasible for implementing interventions for adolescent girls as it offers a captive group' for school health programs which are meant for improving the health of the school children The support of parents, school teachers and girls themselves can be enlisted to deliver iron supplements

In view of the fact that about 80% of the adolescent growth in terms of weight and height gain takes place during the pubertal growth spurt at 10 to 15 years (Srikantia 1989), and also that primary schools cater to this age group of the younger adolescents, it is worthwhile to explore impact of iron on growth among school going girls In urban areas, a significant number of girls would also be accessible through secondary schools If iron supplementation through the school system succeeds in improving growth, it is likely to be more cost effective than community based interventions

This report describes two studies which sequentially followed one another The first reported in Section 1 was a slum based study on adolescent girls in which IFA supplementation trial was given for 3 months and the second, Section 2, was a school based study wherein weekly IFA supplements were given to adolescent girls for 6 months These two studies had different experimental designs and were not planned as a daily versus weekly IFA trials Nevertheless, both have yielded interesting comparative data in terms of response of girls to daily or weekly supplements, and in terms of logistical differences of community based versus school based studies

In both studies, the Masters and Doctoral Program students of the Department of Foods and Nutrition, M S University of Baroda, who were working under Dr Kanani's guidance, were active participants throughout, from data collection to data management and writing up This team work enriched the research experience of all involved

SECTION I

IMPACT OF IFA SUPPLEMENTATION ON ADOLESCENT GROWTH OF URBAN POOR GIRLS IN VADODARA

Methodology

Does Daily IFA Supplementation Improve Growth Of Adolescent Girls In Urban Slums?

Site of the Study and Sample Selection

This study was carried out in three slums of Vadodara, where community development programs are implemented by the Baroda Citizens Council (BCC) All girls falling within the age range of 10 to 18 years, who were willing and available during the study period were enrolled, giving a sample of 203 girls

Socio-Economic Profile of the Subjects

The questionnaire used to collect this information is given in Appendix 1A As Table 2 indicates, more than half of the subjects were Hindus Almost half of the girls' families had a per capita income between Rs 201/- to 400/-[1] per month, reflecting their poor economic status

Table 2

Socio-Economic Characteristics Of The Subjects (N= 203)	
Characteristics	**%**
Religion	
✦ Hindu	56
✦ Muslim	44
School status	
✦ School going	83
✦ Dropouts	17
Average family size	
✦ 4 - 6 members	67
✦ > 6 members	33
Per capita income/month (Rs)	
✦ ≤ 200	24
✦ 201 - 400	55
✦ 401 - 600	18
✦ >600	3
Father's education	
✦ Illiterate	13
✦ Primary schooling	62
✦ Above primary schooling	25
Mother's education	
✦ Illiterate	43
✦ Primary schooling	52
✦ Above primary schooling	5
Father's occupation	
✦ Service	40
✦ Self employed	51
✦ Labourer (on daily wages)	9
✦ Professional or businessman	—
✦ Others (expired retired agriculture)	—
Mother's occupation	
✦ Housewife	70
✦ Others (maid cook small scale business etc)	30

[1] 1$ = Rs 42 00 (August 1998)

A majority of the subjects (83%) were school going, while 17% were dropouts, mostly because they were not interested in further studies, while a few had to work to supplement the family income (e g as maid servants), as stated by them

A familiar picture of poor schooling and lack of economic productivity among mothers in contrast to the better education among fathers was seen in this study About half of the mothers were illiterate (43%) whereas two-thirds of the fathers (62%) had undergone primary schooling

A majority of the fathers were self employed (91%) as labourers, lorry owners, *rickshaw* drivers and petty shop owners, while a majority of the mothers (70%) were housewives

The poor socio-economic background of the subjects was also reflected through their household characteristics Majority of the houses (66%) were of the semi-*pucca* type i e brick/cement walls with tin roof and tile flooring More than half of the families (62%) had toilet facilities within the house while open air defecation was reported by 28% of the subjects and remaining 10% using common toilets in the community Majority of the families depended on external source of water like community taps and hand pumps and had open drainage

Experimental Design

The three slums included in the study were very similar with regard to housing conditions, water supply and sanitation and socio-economic characteristics of families To ensure that sample size of experimental and control groups is similar, it was decided to include girls of the larger slum (Slum A) as one group (N=101) and those in Slum B and Slum C as the other group (N=102) Through random allocation, Slum A was in the experimental group and Slum B fell in the control group Table 3 shows that there were no significant differences between the groups with regard to mean body mass index (BMI) and hemoglobin (Hb) levels

Table 3

Mean Hemoglobin And Body Mass Index Of Experimental And Control Groups

Indicator	Experimental Group			Control Group		
	n	Mean	± SE	n	Mean	± SE
10 -14 Years						
Hemoglobin (g/dl)	75	10 80	0 117	78	10 93^{NS}	0 135
Body Mass Index	81	14 10	0 202	89	14 08^{NS}	0 217
15 18 Years						
Hemoglobin (g/dl)	16	11 16	0 289	11	10 75^{NS}	0 336
Body Mass Index	20	17 09	0 507	13	17 48^{NS}	0 909

^{NS} Non Significant

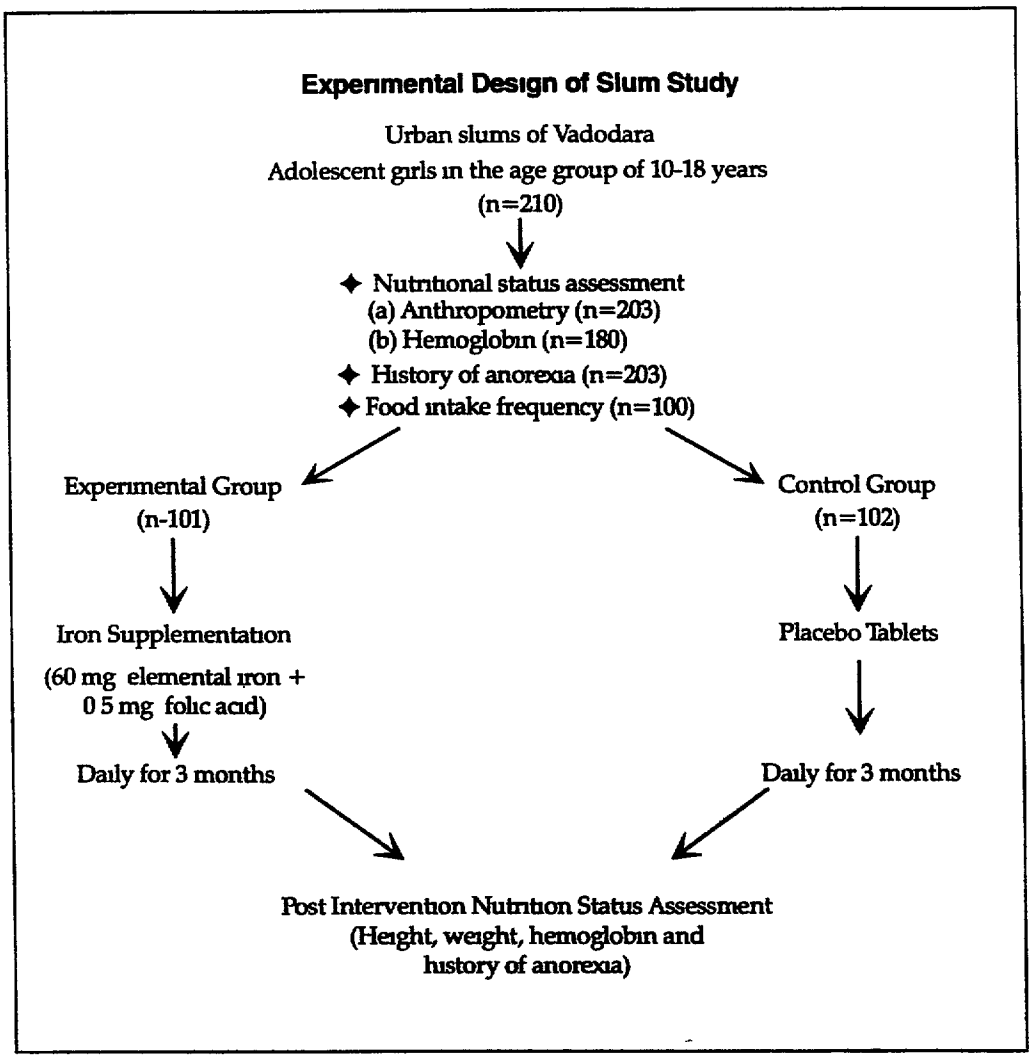
For ethical reasons it was decided to exclude all severely anemic girls (Hb < 7 g/dl) from the study after giving them iron tablets However, none of the girls was severely anemic in this study

The experimental design is given in Figure 3 In the pre-intervention phase, assessment of nutritional status socio-economic status, dietary intake and anemia related perceptions of adolescent girls were studied History of anorexia was taken, using a checklist of questions, as described later in this section

In the intervention phase, the experimental group was supplemented one tablet, daily for 3 months, each tablet containing 60 mg elemental iron and 0 5 mg folic acid (Beryl Labs, Mumbai) The control group was given dicalcium phosphate placebo tablets produced by Locost Pharmaceuticals, Vadodara, in the same regime i e 1 tablet per day for 3 months

Post-intervention nutritional status assessment was carried out on both groups using the same methodology as at baseline Weight, height and hemoglobin were measured and history of anorexia was taken

Figure 3



Description of Methods Used for Data Collection

Table 4 summarizes the indicators and methods of data collection employed in this study

Table 4

Indicators And Tools For Data Collection	
Indicators and Methods	**Sample Size**
1 Socio-economic status using structured questionnaire	203
2 Anthropometry	
✦ Weight-for-age	
✦ Height-for-age	
✦ Body Mass Index	203
3 Blood hemoglobin by cyanmethemoglobin method	203
4 Dietary intake by food frequency method	100
5 History of anorexia	
✦ Checklist	203
✦ Rating scale	203
6 Perceptions of girls using a semi-structured questionnaire	30

Assessment of nutritional status

Anthropometric measurements of height and weight of all subjects were based on standard techniques and compared to NCHS standards Body mass index (BMI), which indicates current nutrition status was then calculated and was compared to reference standards given by Must et al (1991)

Hemoglobin level in blood which is a biochemical index for detection of anemia was carried using the Cyanmethemoglobin method

Food and nutrient intake

Frequency of consumption of protective foods was obtained using the food frequency method The subjects were asked to report their usual frequency of consumption of each food item (e g daily, weekly, monthly consumption and so on) from a list of foods The focus was on usual intake of iron and vitamin C rich foods

History of anorexia

Anorexia is a symptom associated with iron deficiency anemia If anemic girls tend to have a poor appetite, it is likely that their food intake will diminish, leading to a deleterious effect on their growth

In this study, self report of appetite using a 'checklist' of questions to help girls correctly report if they had a poor appetite or not was used The responses were scored and later added to arrive at a composite score which reflected a poor or a good appetite (Appendix 2A) Further, a 'rating scale' which is a ten point scale, was used to assess the degree of anorexia as perceived by the subject The girls assigned a score on a rating scale ranging from 1 to 10 which represented their feeling of hunger According to them, lower the score, poorer was the appetite

5 Perceptions regarding health, nutrition and anemia

A semi-structured interview schedule was used to elicit perceptions of girls through individual interviews (Appendix 3A)

Data Management and Analysis

Most of the textual data were entered in MS Word For qualitative analysis data retreival was done using DT Search Data collected were categorized and summarized For quantitative analysis, numeric data were entered in Visual FoxPro (Version 3 0) and analysis was done by EPI Info (Version 6 0)

History of Anorexia

The mean anorexia scores from the checklist were calculated for all the subjects and for anemic and non-anemic girls A similar calculation was done for the scores obtained from the rating scale

To assess the impact of iron supplementation on anorexia, the mean scores of appetite were compared between the experimental and the control groups (overall anemics versus non-anemics) before and after the intervention Percentage girls anorexic in the experimental and control groups were compared, using cut off values as given on next page

Method	Anorexic	Non-Anorexic
Checklist	4, 5, 6	7, 8
Rating Scale	1 to 4	5 to 10

The students 't' test and chi-square test were applied to test the significance of difference as regards appetite scores between the anemics and non-anemics

Results

BASELINE NUTRITIONAL STATUS OF THE SUBJECTS

1 Anthropometric Measurements

Height-for-age

Table 5 indicates that overall, as many as 52% of the subjects were stunted (height-for-age below 90% of the norms) The prevalence of stunting varied from 11% to 64% In particular, girls in the age group of 10 to 13 years, showed a higher prevalence of stunting than the older girls Figure 4 presents the distance curve of height-for-age in which it is evident that the present subjects are consistently well below the growth curve of the affluent Bombay girls (NFI 1989) and the NCHS standards

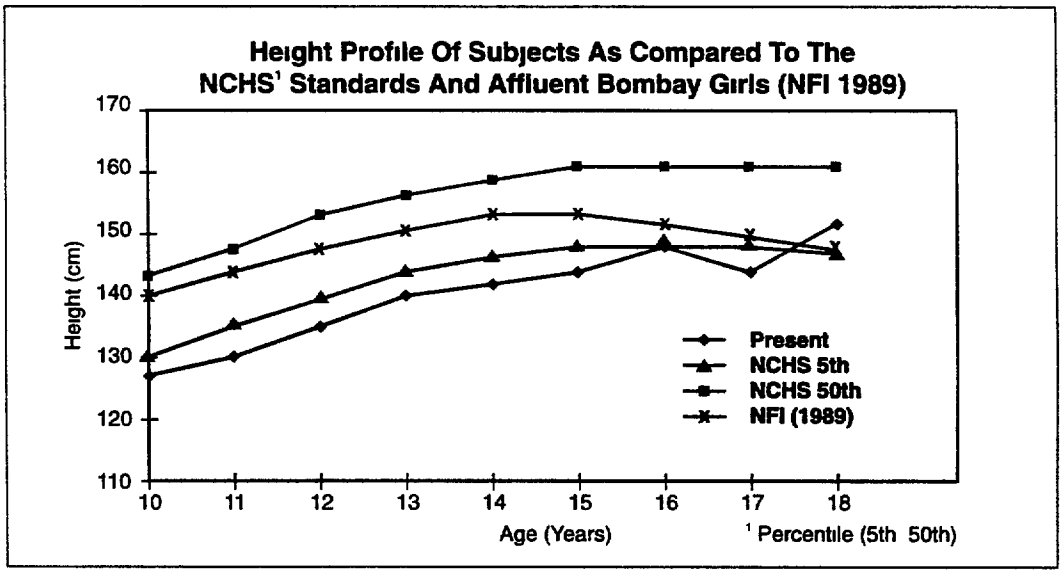
Table 5

Height-for-Age Data Of Present Subjects Compared With NCHS[1] Standards (N=203)

Age (Years)	n	Height (cms)		% NCHS Standard		%Girls With Height Below 90% Standard
		Mean	±SE	Mean	±SE	
10	50	125 73	0 89	89	0 63	60
11	43	131 23	1 30	88	0 81	60
12	33	137 53	1 00	89	0 65	64
13	27	141 47	1 57	89	0 99	48
14	17	147 24	1.22	91	0 60	35
15	17	148 34	1 53	91	0 94	41
16	9	151 85	2 03	93	1.24	11
17	5	149 94	1 46	92	0 89	20
18	2	156 15	1 45	95	0 88	0

[1] National Center for Health Statistics (1983)

Figure 4



Weight-for-age

As seen in Table 6 weight deficits were seen in all age groups Overall, a high proportion of the subjects (85%) had below normal weight-for-age The mean weight of the girls ranged from 60% to 76% of the NCHS standards As in the case of height, the weight profile shows that undernutrition was more pronounced in 10 to 13 year old girls Figure 5 represents the distance curve of weight-for-age data of the present subjects where it is clear that, the weight curve of present disadvantaged girls was far below the NCHS curve and that of affluent Bombay girls (NFI 1989)

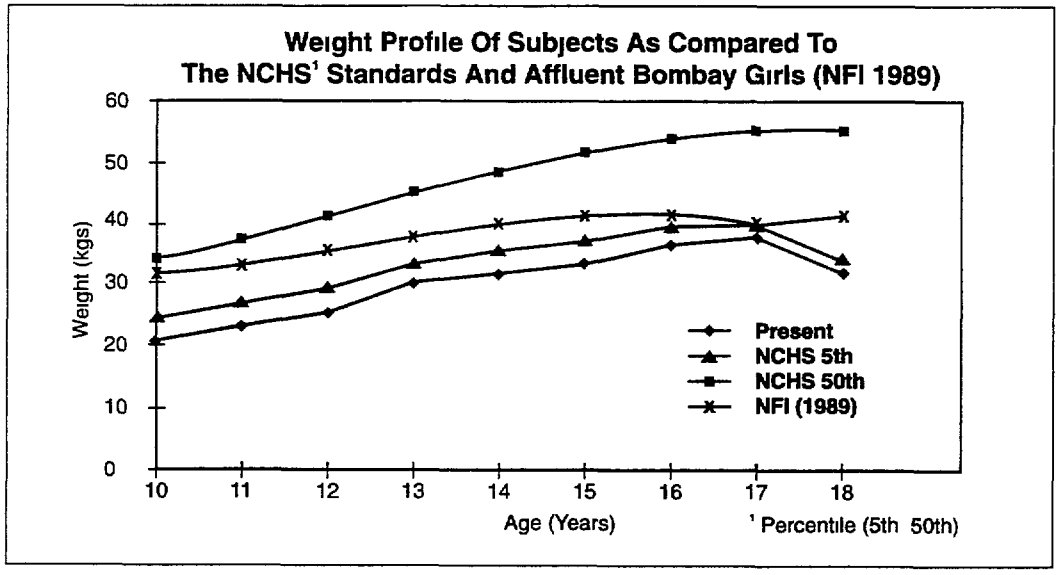
Table 6

Weight-for-Age Data Of Present Subjects Compared With NCHS[1] Standards (N-203)

Age (Years)	n	Weight (Kgs)		% NCHS Standard		% Girls Under-Nourished[2]	% Girls Severely Under-Nourished[3]
		Mean	±SE	Mean	±SE		
10	50	20 78	0 40	60	1 16	96	58
11	43	23 39	0 70	60	1 78	91	60
12	33	26 84	0 68	61	1 55	100	45
13	27	31 15	1 45	65	3 00	82	44
14	17	35 58	1 22	68	2 33	88	18
15	17	36 97	1 80	67	3 27	82	29
16	9	39 44	1 39	70	2 45	89	11
17	5	42 90	2 91	76	5 14	40	—
18	2	40 25	1 94	74	7 26	100	—

[1] National Center for Health Statistics (1983)
[2] Weight below 80% of standard
[3] Weight below 60% of standard

Figure 5



Peak Height Velocity (PHV)

The maximum increment in height took place at 11 5 years, which is a year later as compared to affluent Bombay girls (NFI 1989) and NCHS standard The average increment in height was 6 3 cm Maximum increment in weight took place at 12 5 years, 2 years later than that seen in affluent Bombay girls

The mean age at menarche in the present subjects was 13 years, which was a year later than the age at which PHV took place By the age of 14 years, above 90% of the subjects had attained menarche

Body Mass Index (BMI)

Little is known regarding specific BMI values in adolescence and their relation with concurrent or future risk, or response to interventions (Onis and Habicht 1996) The recommended cut-off values for BMI-for-age in adolescence, have been published by Must et al (1991) and are used in this study

According to BMI, more than half of the girls (59%) were undernourished (BMI below 80% of the standard) As evident in Table 7, grade III chronic energy deficiency was present in as many as 87% of 10 to 13 year old girls

The BMI profile (Figure 6) shows that the BMI values were below the reference standards

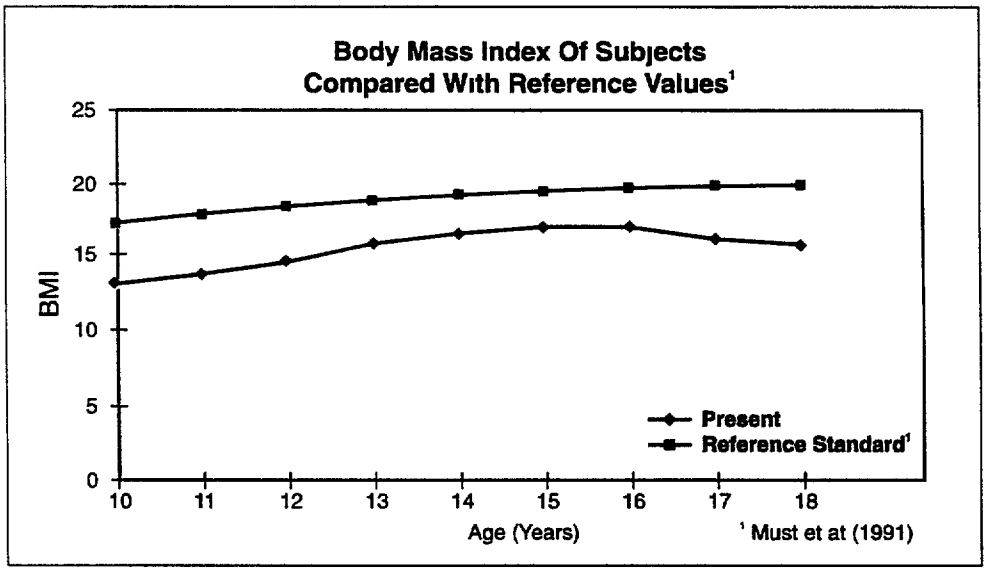
Table 7

Body Mass Index (BMI) Data of Present Subjects (N=203)

Age (Years)	Chronic Energy Deficiency						% Girls Below Normal[4] BMI
	Grade I[1]		Grade II[2]		Grade III[3]		
	n	%	n	%	n	%	
10	0	0	1	2	49	98	74
11	0	0	2	5	41	95	77
12	0	0	3	9	30	91	52
13	1	4	3	11	17	63	56
14	3	18	2	12	10	60	35
15	4	23	4	23	6	35	41
16	3	33	2	22	2	22	22
17	2	40	1	20	1	20	20
18	0	0	0	0	0	0	0

[1]BMI 17 18 5 [2] BMI 16- 17 [3] BMI < 16
[4]Below 80% of reference standard (Must et al 1991)

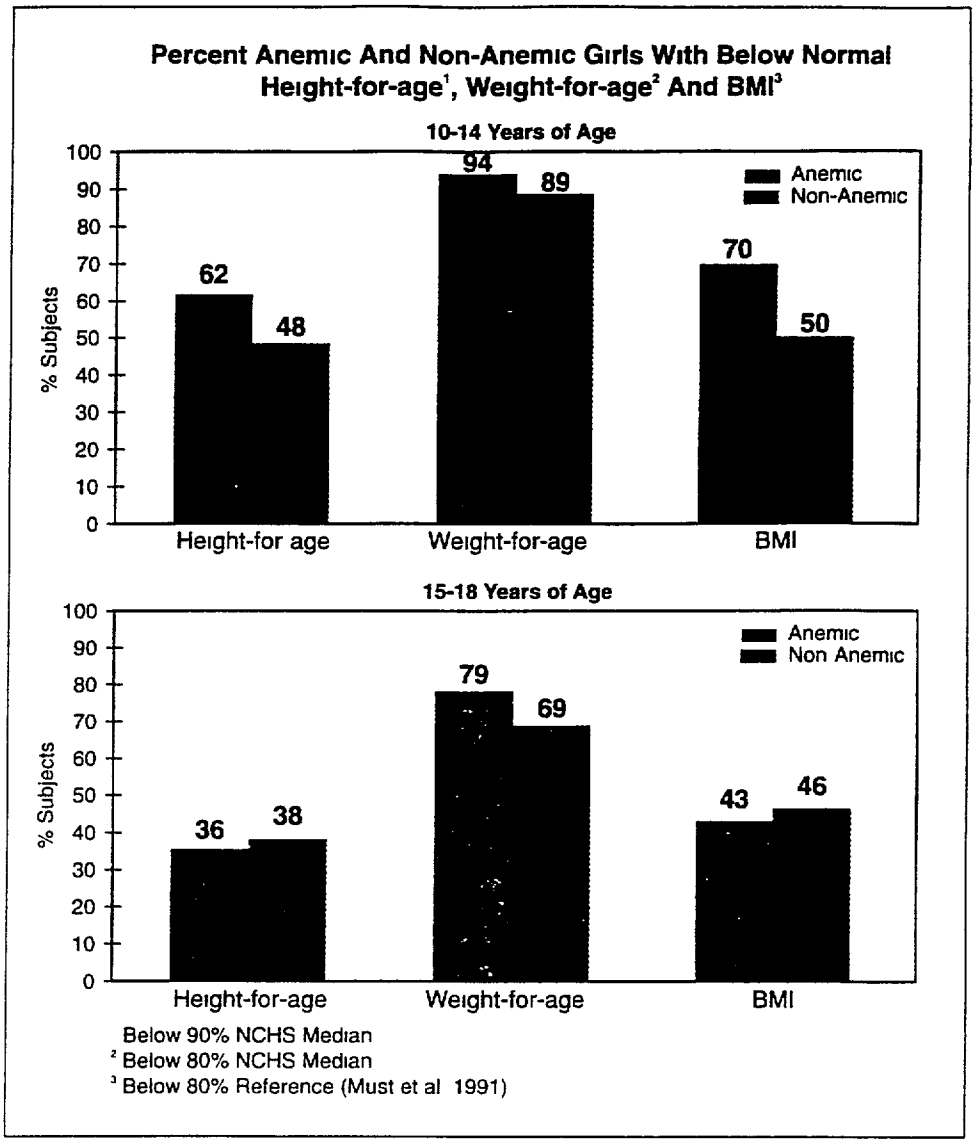
Figure 6



Summing up, about half of the girls were stunted and above 40% of the girls were currently undernourished as evident from BMI values It is disconcerting that severe undernutrition (weight-for-age <60% standard) was seen in about a third and grade III chronic energy deficiency in about 80% of the girls studied There appears to be a close association between undernutrition and anemia, as the present

anemic subjects tended to have a higher prevalence of undernutrition as compared to their non-anemic counterparts (Figure 7)

Figure 7



2 Hemoglobin Status

The mean hemoglobin level of 10 to 18 year old girls was low, 10 8 g/dl Overall 81% of the girls were anemic (Hb<12 g/dl) Severe anemia (Hb<7 g/dl) was not seen (Tables 8 and 9)

Table 8

Prevalence Of Anemia Amongst The Present Subjects (N=180)

Age Group (Years)	Hemoglobin (g/dl)		Anemic Subjects			
	Mean	±SE	n[1]	%	n*	%
10 14	10 9	0 09	89	58	125	82
15-18	10 9	0 22	14	52	21	78
10 18	10 9	0 08	103	57	146	81

[1] Hb < 11 g/dl
Hb < 12 g/dl

Table 9

Severity of Anemia Amongst the Present Subjects								
Age Group (Years)	Severe[1]		Moderate[2]		Mild[3]		Normal[4]	
	n	%	n	%	n	%	n	%
10-14	0	0	75	49	50	33	28	18
15-18	0	0	11	41	10	37	6	22
10-18	0	0	86	48	60	33	34	19

[1] Hb < 7 0 g/dl
[2] Hb 7-10 9 g/dl
[3] Hb 11 11 9 g/dl
[4] Hb□12 0 g/dl

3 Frequency of Intake of Selected Foods

The staple cereals of the subjects were rice and wheat Bajra and maize were also consumed on a weekly or fortnightly basis by 11% and 25% of the subjects respectively

Greengram (whole) and redgram *dhal* (split pulse or legume) were the most frequently consumed pulses More than one-third of the subjects (40%) consumed *dhal* only once in 15 days

The frequency of consumption of selected iron and vitamin C rich foods as elicited by the subjects is shown in Table 10 About half of the subjects consumed rice flakes[1] daily usually in the form of *'Chivda'* or *'Batata Poha'* (a salted breakfast snack made of rice flakes) Although green leafy vegetables and fruits were reported to be health promoting foods by the girls, the frequency of consumption of these foods was less Fenugreek leaves were most frequently consumed among the green leafy vegetables

Among the vitamin C rich fruits, tomatoes were most frequently consumed, usually as salads, in vegetables or *dhal* Potatoes formed a staple part of the diet, being consumed daily by almost 80% of the subjects Unfortunately, the traditional method of cooking these foods at high temperature is likely to destroy in large measure the vitamin C present in them

Fruits were usually consumed on days when the girls fasted[2], which was usually a weekly fast Milk was taken mainly in tea Milk products like *ghee* (clarified butter) and butter were consumed rarely by most of the subjects Curd, however in small amounts, was consumed on a weekly basis

About one-fifth of the girls consumed beef, egg and mutton weekly while one-third of the girls consumed these foods once in a fortnight

4 History of Anorexia

One symptom associated with iron deficiency is loss of appetite or anorexia There was a statistically significant difference between the mean anorexia scores of the anemic and the non-anemic girls, that is the anemic girls obtained lower scores (more anorexic) (Table 11) Thus, 72% (mean of checklist and rating scale) of the anemic girls perceived themselves to be anorexic as against 30% of the non-anemic girls (Table 12)

[1] The processing of rice to rice flakes in iron vessels adds iron to the flakes which is contaminant iron and may not be entirely bioavailable

Fasting is usually done for religious reasons and means having one meal in a day and having fruits, milk or other special foods (e g sago, potato etc) for the other meal

Table 10

Habitual Intakes Of Selected Iron And Vitamin C Rich Foods — Food Frequency Data (N=100)

Name Of Foodstuff	Frequency Of Consumption Of Selected Foods (% Response)					
	Daily	3-4 Times a week	1-2 Times a week	Once In 15 Days	Once In A Month	Rarely
Cereals						
Rice Flakes	51		18	16	2	13
Green Leafy Vegetables						
Amaranth	-	1	6	38	10	42
Bathua	-	-	3	12	4	81
Fenugreek		2	12	49	14	23
Mint		1	2	22	7	68
Spinach	-	-	5	45	12	38
Raddish leaves		-	4	42	11	43
Other Vegetables and Fruits						
Carrots	-		2	27	32	50
Cauliflower			3	30	46	11
Parwar	-	-	-	29	20	51
Coconut (Fresh)	-	1	18	19	5	57
Groundnut	6	10	29	28	1	26
Gauva	-		4	7	38	51
Tomato	20	43	33	2	1	1
Wood apple	4	2	5	7	17	62
Zizyphus		3	5	8	17	65
Animal Foods						
Beef	1	2	13	9	3	72
Egg	2	1	19	23	8	47
Mutton		2	19	20	6	53
Others						
Sago		2	23	24	7	44

Table 11

Appetite Scores of Anemic Versus Non-Anemic Subjects (N= 180)

	Indicators Of Anorexia	Anemic Subjects[1]			Non-Anemic Subjects		
		n	Mean	±SE	n	Mean	±SE
1	Mean score from Checklist	103	5 57	0 111	77	6 65 *	0 113
2	Mean score from Rating Scale	103	4 39	0.209	77	5 97 *	0 265

[1] Hb cut off 11 g/dl
By Student t test
Significant p< 001

Table 12

Percent Anemic And Non-Anemic Subjects Who Perceived Themselves To Be Anorexic (N= 180)

Indicators Of Anorexia	Anemic Subjects				Non-Anemic Subjects			
	Anorexic		Non-Anorexic		Anorexic		Non-Anorexic	
	n	%	n	%	n	%	n	%
Checklist[2]	86	83	17	17	29	38	48	62*
Rating Scale[3]	63	61	40	39	16	21	61	79*

[1] Hb cut off 11 g/dl
[2] Anorexic 4 5 6 Non-Anorexic 7, 8
[3] Anorexic 1 to 4 Non-Anorexic 5 to 10

By Chi-Square test
* Significant at p< 001

5 Prevalence of Morbidity

When asked to elaborate regarding the health problems experienced, the girls mentioned morbidities such as fever, cold, cough, headaches, vomiting and diarrhoea The treatment sought for minor illnesses stated above included self medication such as taking 'Crocin' and 'Stopache' tablets (local brand names of pain killer tablets) or a visit to the doctor Lime juice was considered to be an effective home remedy for vomiting

When asked to recall if they had suffered from any morbidity episode during the past 15 days, about one-third reported cold and fever, and a few mentioned malaria or headache A majority (60%) resorted to self medication like 'Crocin', while 40% visited the doctor

6 Perceptions of the Subjects Regarding Health, Nutrition and Anemia

The perceptions of the girls regarding nutrition, health and anemia as obtained from the semi-structured individual interviews are presented in Table 13

6 1 Responses of the subjects on health and diet

A majority of the girls (70%) believed that their health was satisfactory, while about one-third felt otherwise because they felt weak or fell sick frequently As one girl mentioned,

"Main aksar bimaar rahti hoon "
(I frequently remain sick)

The girls considered themselves to be healthy if they did not fall sick often (62%), did household or other work without tiring (48%) and consumed a good diet Fruits and green leafy vegetables, were stated as health promoting foods by almost half of the subjects, while about one-third felt that milk and *ghee* or wheat and dhal make one healthy A few reported meat, fish and poultry as foods giving health To quote a girl,

"Phal aur bhaji hame rog se bachate hain "
(Fruits and green leafy vegetables protect us from diseases)

These foods were believed to maintain health by half of the subjects (43%) as they gave energy and by protecting from disease according to a few subjects (13%) In order to explore if girls perceived health promoting foods as different from 'a nutritious diet' they were asked to also explain what they understood from the term 'nutritious diet'

A majority of the girls again stated vegetables, fruits, energy giving foods and non-vegetarian foods as nutritious (similar to health giving foods) Interestingly, a nutritious diet was also believed to be one that includes only home cooked foods, or one that has a variety of foods As one girl said,

"Ghar ka banaya khana hi paushtik hota hain "
(Only home cooked food is nutritious)

The suggestion given by the subjects to improve the health of a 'weak girl' included, take large quantities of food, vegetables and fruits and non-vegetarian foods One-fifth of the girls stated that a visit to the doctor and taking medicines will improve the health of a 'weak girl'

6 2 Responses of the subjects on menstruation and health

About half (47%) of the subjects had attained menarche From amongst these, a majority (49%) reported 14 years as their age of menarche, while 29% reported 13 years

As Table 13 further shows, only one-fourth of the girls associated menstruation with health Of these three-fourth felt that menstruation improves health, while one-fourth felt that menstruation worsens health To mention what two girls said,

"Kharab khoon nikal jata hain to accha lagta hain "
(After the bad blood is discarded we feel nice)
"Poore shareer main bahut dard hota hain "
(My whole body pains a lot)

About half of the girls were not aware as to why menstruation occurs One-third felt it is a natural event, one-fifth felt that it helps to remove 'bad blood' from the body and a few believed that it helps to conceive a child The girls could not elaborate further

Stomachache and bodyache were the most common problems faced due to menstruation When asked about the physical changes which took place in their body after menarche, a majority of the girls reported an increase in height and weight Breast development was reported by 36% of the girls

6 3 Perceptions of the girls regarding anemia

The communities where the study was conducted have been periodically receiving nutrition health education from the voluntary agency Baroda Citizens Council Adolescent girls also have received health messages including anemia in the past

As evident from Table 13, 60% of the girls had heard about anemia or *"Pandurog"* (the Gujarati term) One-fifth of the girls reported pallor of eyes and nails as a symptom of anemia *"Kamshakti'* or *Kamjori"* (weakness), loss of appetite, pale thin blood and occurrence of frequent illnesses were the other ways in which anemia was described To mention what one girl said,

"Lohi paani paani thai jaaye "
(Blood becomes like water)

The causes of anemia were stated to be inadequate food intake, frequent illnesses and poor intake of vitamins As one girl said,

"Kam khana khate hain to pandurog hota hain "
(Eating less food causes anemia)

When asked if they were anemic, about half believed that they were not, while 43% felt that they were anemic Most of the girls reported that it is necessary to treat anemia or *"Kamjori"* (weakness) One girl mentioned,

"Mujhe bahot kamjori lagti hain aur iske liye dava khaani chahiye"
(I feel very weak and for this I should take medicine)

About half of the subjects (43%) stated that anemia can be cured by increasing the quantity of food consumed The remaining felt that anemia can be treated by a visit to the doctor and taking medicines

A few who had consumed *"Shakti ni goli"* (IFA tablets) in the past reported that the tablet made them feel more energetic, improved their appetite and reduced the frequency of illness These tablets were probably prescribed to them by physicians or given by Baroda Citizens Council working in that area

Fruits and green leafy vegetables were stated to be iron rich foods by almost half (43%) of the subjects One-fifth of the subjects reported non-vegetarian foods and dairy foods to be iron rich

Table 13

Perceptions Of Girls Regarding Health, Nutrition And Anemia (N= 30)

Perceptions	% Response
Health and Nutrition	
✦ **Health of self**	
Satisfactory	70
Unsatisfactory	30
✦ **Reasons given for being healthy**	
Does not fall sick often	62
Is able to work without feeling tired	48
✦ **Reasons given for not being healthy**	
Feels weak	67
Falls sick often	33
✦ **As compared to girls in good health, girls in poor health -**	
Fall sick often	50
Feel tired most of the time	27
Eat less	13
Are inactive	10
✦ **Treatment sought during illness in general**	
No treatment usually sought	33
Self medication (e g tablets-painkillers)	23
Home treatment (e g lime juice for nausea and vomiting)	23
Visit to doctor	23
✦ **Health giving foods**	
Fruits and green leafy vegetables	43
Milk and *ghee* (clarified butter)	30
Wheat and *dhal* (split legumes and pulses)	30
Meat, fish and eggs	27
Does not know	13
✦ **Above foods maintain health by**	
Giving energy to do work	43
Protecting against diseases	13
Does not know	46
✦ **A balanced nutritious diet is**	
A diet that gives energy	13
Fruits and green leafy vegetables	10
Non-vegetarian foods	10
Variety of foods	17
Plenty of foods	13
Home cooked food	13
Does not know	23
✦ **To improve the health of a weak girl**	
Give fruits and green leafy vegetables	17
Give non-vegetarian foods	13
Encourage her to eat lots of food	13
Take her to doctor and give tonics	20
Does not know	27

Table 13

Perceptions	% Response
Menstruation	
✦ **Age of onset of menarche** (those who had attained menarche)	
11 years	7
12 years	7
13 years	29
14 years	49
15 years	7
✦ **Whether any relationship exists between health and menstruation**	
Yes	29
No	57
Does not know	14
✦ **If yes, how ?**	
Menstruation improves health	75
Menstruation worsens health	25
✦ **Reasons why menstruation occurs**	
It removes 'bad blood from the body	21
It is a natural event	29
It helps to conceive	14
Does not know	43
✦ **Problems experienced during menstruation**	
Stomachache	43
Body ache	29
No problem	57
✦ **Changes noticed in self after menarche**	
Increase in height and weight	71
Physical development (breast development)	36
No change	29
Anemia	
✦ **Aware of the term Anemia or "*Pandurog*"**	
Yes	60
No	40
✦ **Symptoms of anemia**	
Eyes and nails are pale	23
Weakness	20
One does not feel hungry	13
Pale thin blood	10
Frequent illness	17
Does not know	27
✦ **Causes of anemia**	
Inadequate food intake	40
Illness	13
Low intake of vitamins	13
Does not know	27
✦ **Are you anemic ?**	
Yes	40
No	53
Not sure	7
✦ **Is it necessary to treat anemia ?**	
Yes	90
No	3
Does not know	7
✦ **Treatment for anemia**	
Visit doctor	20
Take medicine	27
Eat more food	43
Does not know	10
✦ **Aware of *Shakti ni goli*' (IFA tablets)**	
Yes	80
No	17
Does not know	3

Perceptions	% Response
✦ **Perceived benefits of " *Shakti ni goli*"**	
Gives energy	29
Improves appetite	14
Reduces illness	14
Does not know	43
✦ **Iron rich foods are**	
Fruits and green leafy vegetables	43
Meat, fish and eggs	20
Dairy foods	20
Does not know	17

Note Due to multiple responses, per cent values may add up to more than 100

Feasibility of the Intervention and Subject Co-operation

Iron tablet supplementation is a feasible intervention from the point of view of its low cost (Rs 4 50 per 100 tablets) and relative ease of administration In the present study, the girls were given sachets containing 15 tablets and were asked to consume one tablet daily The sachet was replenished every fortnight The girls reported a very high level of compliance- 90% of the girls consumed an average of more than 85 tablets and in fact made several requests that the tablets be continued after the intervention was over, primarily because they felt an improved sense of well being, felt more hungry and energetic As one girl said,

"Aap abhi goli dene kyon nahi atte ?"
(Why don't you come to give us tablets now?)

However, to make such an intervention sustainable and ongoing, various distribution strategies, such as enlisting the co-operation of adolescent girls' groups or through ongoing health programs need to be explored

Impact Evaluation of The Iron Supplementation Intervention

Hemoglobin Levels

As Table 14 reveals, there was a statistically significant increase in the hemoglobin level of the experimental group (1 7 g/dl) as compared to the control group, which showed a slight decrease in hemoglobin level In both younger and older age groups, the experimental group subjects had significantly higher hemoglobin increments than control group subjects Within the experimental group, the younger subjects had higher increments, perhaps because their initial hemoglobin level was lower

Table 14

Mean Change In Hemoglobin Levels (g/dl) In The Experimental And Control Groups After Intervention

Indicator	Experimental Group				Control Group			
	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE
10 14 Years	75	10 80 ±0 117	12 65 ±0 087	1 840 ±0 111	78	10 93 ±0 135	10 86 ±0 122	-0 075* ±0 034
15 18 Years	16	11 16 ±0 289	12.29 ±0 203	1.230 ±0 049	11	10 75 ±0 336	10 60 ±0 282	-0 149* ±0 109
10 18 Years	91	10 87 ±0 111	12 61 ±0 081	1 734 ±0 111	89	10 91 ±0 125	10 82 ±0 113	-0 084* ±0 033

* By students t test (Experimental vs Control) Significant p< 001

In the experimental group, the hemoglobin increment was more pronounced in the anemic subjects (2 22 g/dl) after iron supplementation as compared to the non-anemic subjects (1 08 g/dl) as evident from Table 15 The anemic and non-anemic girls in the control group showed little change in hemoglobin level after intervention

Table 15

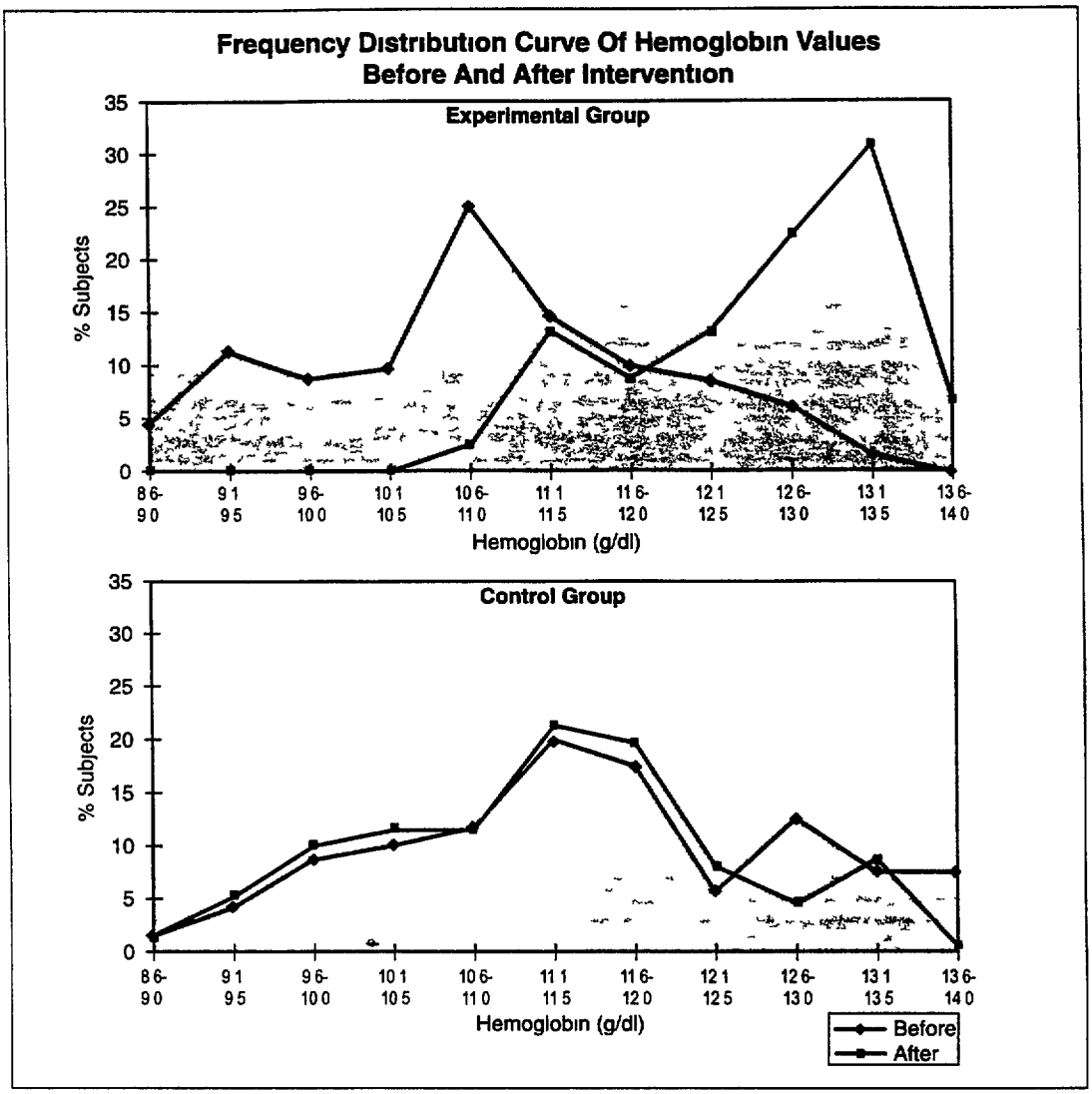
Mean Change In Hemoglobin Levels (g/dl) Among Anemics[1] and Non-Anemics In The Experimental And Control Groups After Intervention

Indicator	Experimental Group				Control Group			
	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE
Anemics[1]	53	10 13 ±0 093	12 35 ±0 105	2 22 ±0 122	50	10 04 ±0 097	10 09 ±0 101	±0 038* ±0 031
Non-Anemics	38	11 87 ±0 075	12 98 ±0 102	1 08 ±0 094	39	12 03 ±0 094	11 79 ±0 86	-0.210* ±0 055
Overall	91	10 87 ±0 111	12 61 ±0 081	1 734 ±0 111	89	10 91 ±0 125	10 82 ±0 113	-0 084* ±0 033

[1] Hb cut off 11 g/dl
* By students t test (Experimental vs Control) Significant p< 001

Figure 8 shows that there is a marked shift to the right in the frequency distribution curve of the experimental group after intervention which is not evident in the control group This indicates that the hemoglobin values of most of the experimental group subjects improved after intervention while those of control group did not

Figure 8



Anorexia

The iron supplementation intervention significantly improved appetite as evident from Table 16 The appetite scores were obtained from both the checklist and the rating scale methods (as explained in the earlier section and in Appendix 2A) These scores significantly improved in the experimental group as compared to the control group among the 10 to 18 year old girls Comparing the age groups, while the younger girls in the experimental group showed a statistically significant improvement in appetite scores as compared to the control group both in the checklist as well as the rating scale methods, the older girls (experimental group) were significantly better than the corresponding control group girls according to the rating scale scores but not according to the scores obtained from the checklist This may be because of a greater variation in the responses of the older girls

As evident in Figure 9 there was a marked decrease in the proportion of girls who reported that they were anorexic in the experimental group whereas this decrease was less pronounced in the control group This trend held true in both younger and older girls As some girls said,

"Bhookh bahu sari laage chhe "
(I feel quite hungry now)

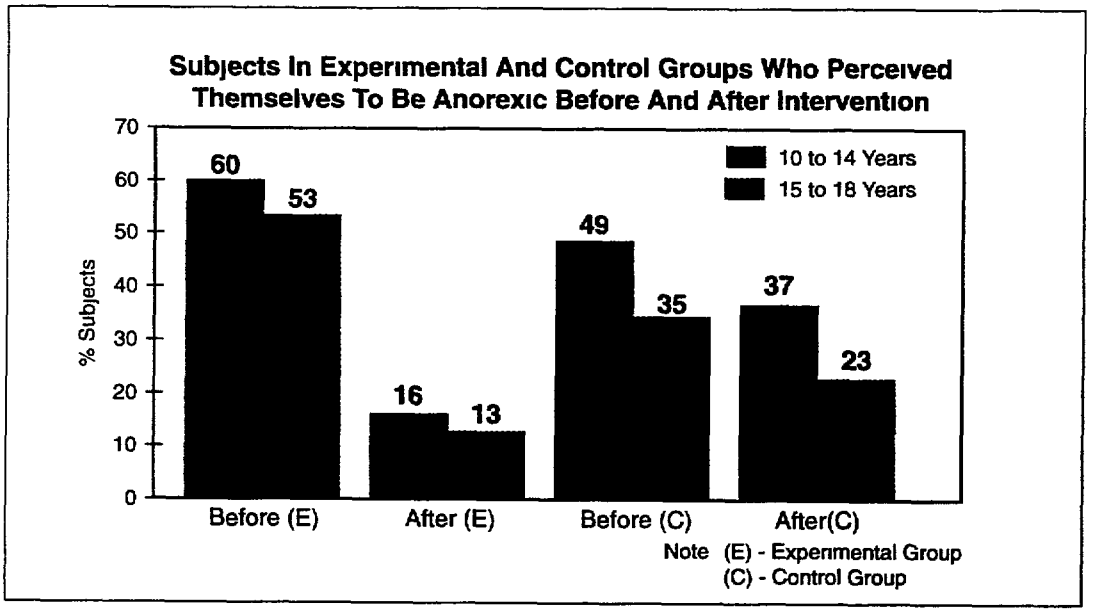
Table 16

Mean Change In Appetite Scores In The Experimental And Control Groups After Intervention

Indicator	Experimental Group N	Experimental Group Initial Mean ±SE	Experimental Group Final Mean ±SE	Experimental Group Mean Change ±SE	Control Group N	Control Group Inital Mean ±SE	Control Group Fianal Mean ±SE	Control Group Mean Change ±SE
Score from Checklist[1]								
10-14 Years	81	5 94 ±0 125	6 86 ±0 073	0 926 ±0 128	89	6 16 ±0 115	6.56 ±0 092	0.393* ±0 076
15-18 Years	20	6.30 ±0.256	7 05 ±0 132	0 750 ±0.244	13	6 15 ±0.263	6 38 ±0.232	0.230 ±0 193
10-18 Years	101	6 01 ±0 113	6 90 ±0 065	0 891 ±0 114	102	6 16 ±0 106	6 54 ±0 086	0.372* ±0 076
Score from Rating Scale[2]								
10-14 Years	81	4 47 ±0.208	6 00 ±0 017	1 56 ±0 125	89	5 68 ±0.254	6 14 ±0.212	0 483* ±0 089
15-18 Years	20	4 50 ±0 545	6 05 ±0.319	1 55 ±0 312	13	6.31 ±0.559	6 76 ±0 363	0.538* ±0.207
10 18 Years	101	4 47 ±0 198	6 03 ±0 137	1.55 ±0 117	102	5 76 ±0.235	6.23 ±0 193	0 490* ±0 082

*By students t test (Experimental vs Control) Significant p<0 001
[1] Maximum possible score 8 (Range of Scores 4-8)
[2] Maximum possible score 10 (Range of Scores 1 10)
Note Higher the score better the appetite

Figure 9



"Khoraak saaro levaye chhe "
(I am able to eat plenty of food)

Just as the younger girls tended to have lower hemoglobin levels than older girls as seen earlier, they also tended to have lower appetite scores (Table 16) This is a cause for concern because the pubertal growth spurt takes place in the age group of 10 to 14 years when the demand for nutrients increases This demand will not be satisfactorily met by these girls as they have a poor food intake due to anorexia

Table 17 compares the appetite score of anemics and non-anemics, in the experimental and control groups There was twice as much improvement in the appetite scores in anemics versus non-anemics in the experimental group, both by the checklist and the rating scale methods A similar improvement was not seen in the control group Thus, among both the anemics and non-anemics, experimental subjects showed significantly higher improvements in appetite scores as compared to the control group

Table 17

Mean Change In Appetite Scores Among Anemics[1] and Non-Anemics In The Experimental and Control Groups After Intervention

	Experimental Group				Control Group			
Indicator	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE
Score from Checklist								
Anemics[1]	53	5 69 ±0 150	6 78 ±0 098	1 130 ±0 169	50	5 64 ±0 116	6 12 ±0 122	0 480** ±0 110
Non-Anemics	38	6 45 ±0 156	7 30 ±0 079	0 526 ±0 157	39	6 82 ±0 153	6 92 ±0 110	0 077* ±0 98
Overall	101	6 01 ±0 113	6 90 ±0 065	0 891 ±0 114	102	6 16 ±0 106	6.54 ±0 086	0 372*** ±0 076
Score from Rating Scale								
Anemics[1]	53	3 92 ±0 262	6 02 ±0 188	2 090 ±0 134	50	5 02 ±0 319	5 62 ±0 253	0 660*** ±0 128
Non-Anemics	38	5.21 ±0 303	6 10 ±0.232	0 895 ±0 157	39	6 77 ±0 365	7 10 ±0.296	0 359** ±0 117
Overall	101	4 47 ±0 198	6 03 ±0 137	1.550 ±0 117	102	5 76 ±0 106	6 23 ±0 193	0 490*** ±0 082

By students t test (Experimental vs Control)
* Significant p< 05
** Significant p< 01
***Significant p< 001

Growth

Along with an improvement in hemoglobin levels and appetite, did the iron supplementation also significantly improve adolescent growth ?

Yes, the answer appear to be in the affirmative in the present study as the data below indicate

Considering the overall age range of 10 to 18 years, the experimental group girls gained about 1 kg weight in 3 months whereas the girls in the control group showed a negligible weight gain (Table 18) Comparing the age group, the weight gain was higher in the younger girls than in the older girls in the experimental group This was perhaps because weight deficits were more pronounced to begin with in the younger girls In the control group both the younger and older girls did not register any weight gain

With regard to BMI, there was a statistically significant improvement overall (10 to 18 years) and in

Table 18

Mean Change In Weight (kg) And Body Mass Index (BMI) In The Experimental And Control Groups After Intervention

	Experimental Group				Control Group			
Indicator	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE
Weight (kg)								
10-14 Years	81	26 30 ±0 723	27 05 ±0 722	0 901 ±0 096	89	25.24 ±0 731	25 31 ±0 722	0 045*** ±0 066
15-18 Years	20	37 60 ±1 215	38.35 ±1 137	0.525 ±0.208	13	40.50 ±2 127	40 35 ±2 127	-0.231* ±0.222
10-18 Years	101	28 54 ±0 774	29 39 ±0 770	0.827 ±0 089	102	27 19 ±0 859	27.22 ±0 847	0 039*** ±0 063
Body Mass Index (BMI)								
10-14 Years	81	14 10 ±0.202	14 07 ±0.204	-0 033 ±0 063	89	14 08 ±0.217	13 69 ±0.221	-0 396*** ±0 040
15-18 Years	20	17 09 ±0 507	17.23 ±0 474	0 138 ±0 109	13	17 48 ±0 909	17 40 ±0 899	- 0 079 ±0 088
10-18 Years	101	14 69 ±0 224	14 70 ±0.227	0 001 ±0 056	102	14 51 ±0.249	14 16 ±0.256	-0 353** ±0 038

By students t test (Experimental vs Control)
* Significant p< 05
** Significant p< 01
***Significant p< 001

the younger girls in the experimental group as compared to the control group The older 15 to 18 year olds in the experimental group maintained their BMI whereas their peers in the control group showed a slight deterioration in BMI

Comparing the response to growth among anemics versus non-anemics, Table 19 reveals that

Among the anemics as well as the non-anemics, the mean weight increment in the experimental group was significantly higher than that in the control group

Unexpectedly, despite better increments in hemoglobin and better appetite scores, the anemics gained as much weight as non-anemics (about 0 8 kg) in the experimental group This may be because the capacity to do work might have improved in the anemic girls leading to increase in energy expenditure which would have offset the benefit of an increase in the dietary caloric intake brought about by an improvement in the appetite As exemplified by the statements of a few girls in the experimental group,

"Kaam pahale se zyada hota hai '
(I can work more than before)
"Kaam karte thakan mehsus nahi hoti, kaam zyada hota hai"
(I do not feel tired while working, I can work more)

With regard to BMI, overall the iron supplementation appeared to maintain BMI in the experimental group whereas there was a slight deterioration in BMI in the control group Comparing the anemic and non-anemic subjects, the trend was similar - there was a negligible decrease in BMI in both the experimental and control groups, this was slightly more marked in the control group One reason why the BMI values did not markedly improve after iron supplementation could be because the relative gain in weight was less as compared to the gain in height Due to partial catch up growth, marked height increments are seen in underprivileged adolescents whereas weight gains, which are sensitive to daily food intake, are less marked during adolescent growth

Table 19

Mean Change in Weight (kg) And Body Mass Index (BMI) Among Anemics[1] And Non-Anemics In The Experimental And Control Group After Intervention

	Experimental Group				Control Group			
Indicator	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE	N	Initial Mean ±SE	Final Mean ±SE	Mean Change ±SE
Weight (kg)								
Anemics[1]	53	27 68 ±1 054	28 15 ±1 049	0 839 ±0 128	50	26 62 ±1 100	26 69 ±1 081	0 070*** ±0 099
Non-Anemics	38	29 14 ±1.268	30 19 ±1.259	0 816 ±0 152	39	27 43 ±1.367	27 45 ±1 342	0 013*** ±0 098
Overall	101	28.54 ±0 774	29 39 ±0 770	0 827 ±0 089	102	27 19 ±0 859	27.22 ±0 847	0 039*** ±0 063
Body Mass Index (BMI)								
Anemics[1]	53	14 45 ±0 304	14 39 ±0 301	-0 006 ±0 079	50	14.27 ±0 301	13 94 ±0 308	-0 328** ±0 059
Non-Anemics	38	14 94 ±0 386	14 93 ±0 395	-0 013 ±0 095	39	14.52 ±0 382	14 17 ±0 392	-0 359** ±0 056
Overall	101	14 69 ±0.224	14 70 ±0.227	-0 001 ±0 056	102	14 51 ±0.249	14 16 ±0.256	-0 353** ±0 038

[1]Hb cut off < 11g/dl
By students t test (Experimental vs Control)
Significant p< 05
** Significant p< 01
***Significant p< 001

Summing up, this study has revealed that daily IFA supplementation (60 mg elemental iron + 0 5 mg folate) over 3 months, not only improved hematinic status but also improved appetite and growth in adolescent girls

A question arises Is weekly IFA supplementation also effective as regards improvement in appetite and growth ? If yes, better feasibility and compliance and lower cost of weekly dosing may make it potentially a promising intervention for adolescent girls In view of this, a second study was executed, described in Section 2

SECTION II

IMPACT OF IRON SUPPLEMENTATION ON ADOLESCENT GROWTH OF SCHOOL GOING GIRLS IN VADODARA

Methodology

Does Weekly Iron Supplementation To School Girls Improve Appetite And Growth ?

Site of the Study and Sample Selection

This study was conducted in a school located in the inner city of Vadodara catering to students from low to middle income groups The school has both primary and secondary sections All girls between the age range of 10 to 19 years studying in classes 5th to 12th standards were selected for the study after taking prior permissions from their parents, yielding a sample of considerable size 2090 girls The sample sizes for the different indicators however varied depending on the availability and co-operation of the girls

Socio-Economic Profile of the Subjects

Information on socio-economic status was collected through structured questionnaires as in the previous study The data are presented in Table 20

Table 20

Socio-Economic Characteristics of the Subjects (N=1382)

Characteristics	%
Religion	
✦ Hindu	99
✦ Muslim	1
Average family size	
✦ 4 to 6 members	75
✦ >6 members	21
Per capita income/month (Rs)	
✦ ≤ 200	11
✦ 201 - 400	26
✦ 401 - 600	24
✦ > 600	39
Father's education	
✦ Illiterate	2
✦ Primary schooling	9
✦ Above primary schooling	89
Mother's education	
✦ Illiterate	6
✦ Primary schooling	18
✦ Above primary schooling	76
Father's occupation	
✦ Service	36
✦ Self employed	31
✦ Labourer (on daily wages)	13
✦ Professional or businessman	15
✦ Others (expired, retired, agriculture)	5
Mother's occupation	
✦ Housewife	90
✦ Others (maid, cook, small scale business etc)	10

Of the three age groups included in the study, about one-fourth of them belonged to the age group of 10 to 12 years and 16 to 19 years while the remaining half (52%) were from 13 to 15 years age group This was probably because there were more number of sections for the classes catering this group (8th to 10th standard)

Almost all the subjects from the study were Hindus (99%) and were vegetarian (95%) It was found that 70% of the girls belonged to nuclear families A majority of both parents had undergone secondary/ higher secondary schooling (89%-fathers, 76%-mothers) Majority of the fathers were either self-employed (31%) or were in service (36%) and around 90% of the mothers were housewives

Mean per capita income per month was found to be around Rs 627/-[1] About a tenth of the families had a per capita income of $\leq$ Rs 200/- per month, while 50% of them had a per capita of Rs 201/-to 600/-, revealing that majority had a poor economic status Total monthly income was also less, mean monthly income being Rs 3334/-

The household characteristic data shows that around three-fourths of the total subjects (78%) lived in *pucca* houses (roof and walls made of cement and tile flooring) while one-fifth of the subjects lived in semi-*pucca* houses (cement walls with tin roofs) Almost all the families had closed drainage (95%), independent toilet (87%) and an independent source of drinking water (86%) More than 70% of the families possessed electrical appliances like fan, TV, radio and iron and also had their own vehicle, mainly two-wheelers like cycles, scooters or mopeds About 40% also possessed refrigerators

The girls in the experimental and control groups had a similar background as regards their socio-economic profile

Experimental Design

This study was a double blind experimental placebo control trial as shown in Figure 10 Although 2090 girls were initially enrolled in the study, the figure depicts only those subjects on whom both pre and post intervention data were available and who participated in the intervention (i e consumed at least 80% of dose of tablets) As depicted in the figure, the study was divided into three phases

Phase A Pre-Intervention Data Collection

In this phase, baseline data on school going adolescent girls (10 to 19 years) were collected Assessment of socio-economic status, nutritional status, prevalence of anemia and anorexia, extent of fatigue as perceived by girls, and perceptions of girls regarding health, nutrition and anemia were determined Both qualitative and quantitative tools were used (described later)

Phase B Intervention

A double blind experimental and placebo control intervention trial was conducted to assess the feasibility and impact of weekly iron supplementation on hemoglobin level, appetite, food intake and growth of the school going adolescent girls (10 to 19 years) As depicted in the Figure 11, girls were stratified by age into three groups i e 10 to 12 years, 13 to 15 years and 16 to 19 years They were further divided into three groups according to hemoglobin levels

Group I

Girls having hemoglobin level $\geq$ 11 g/dl This group was randomly divided into experimental and control groups

Group II

Girls having hemoglobin level between 8 1 to 10 9 g/dl This group was again randomly divided into experimental and control groups

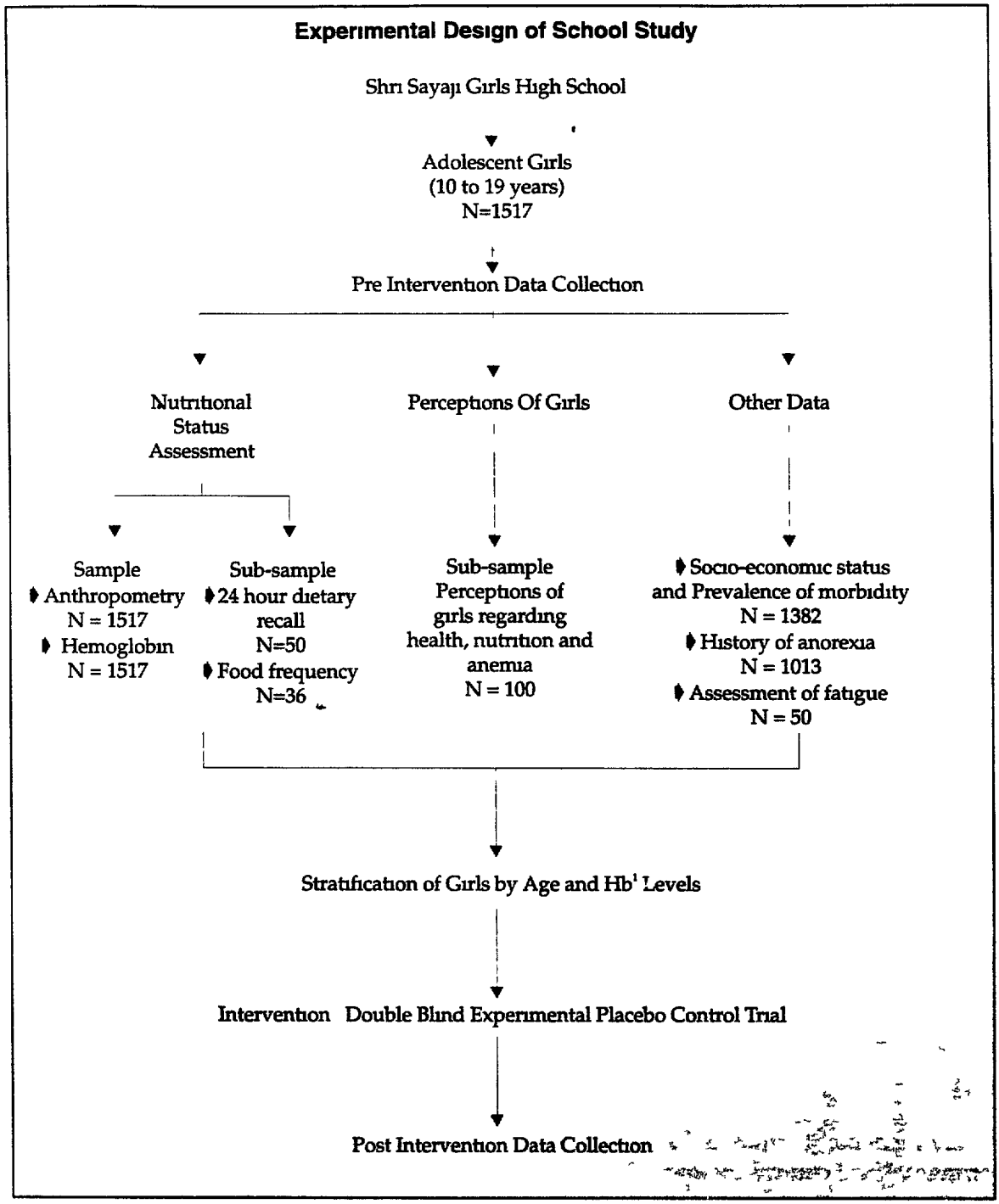
1 $ = Rs 42 00 (August 1998)

Group III

Girls having hemoglobin level ≤ 8 g/dl, were treated with iron and were excluded from the study

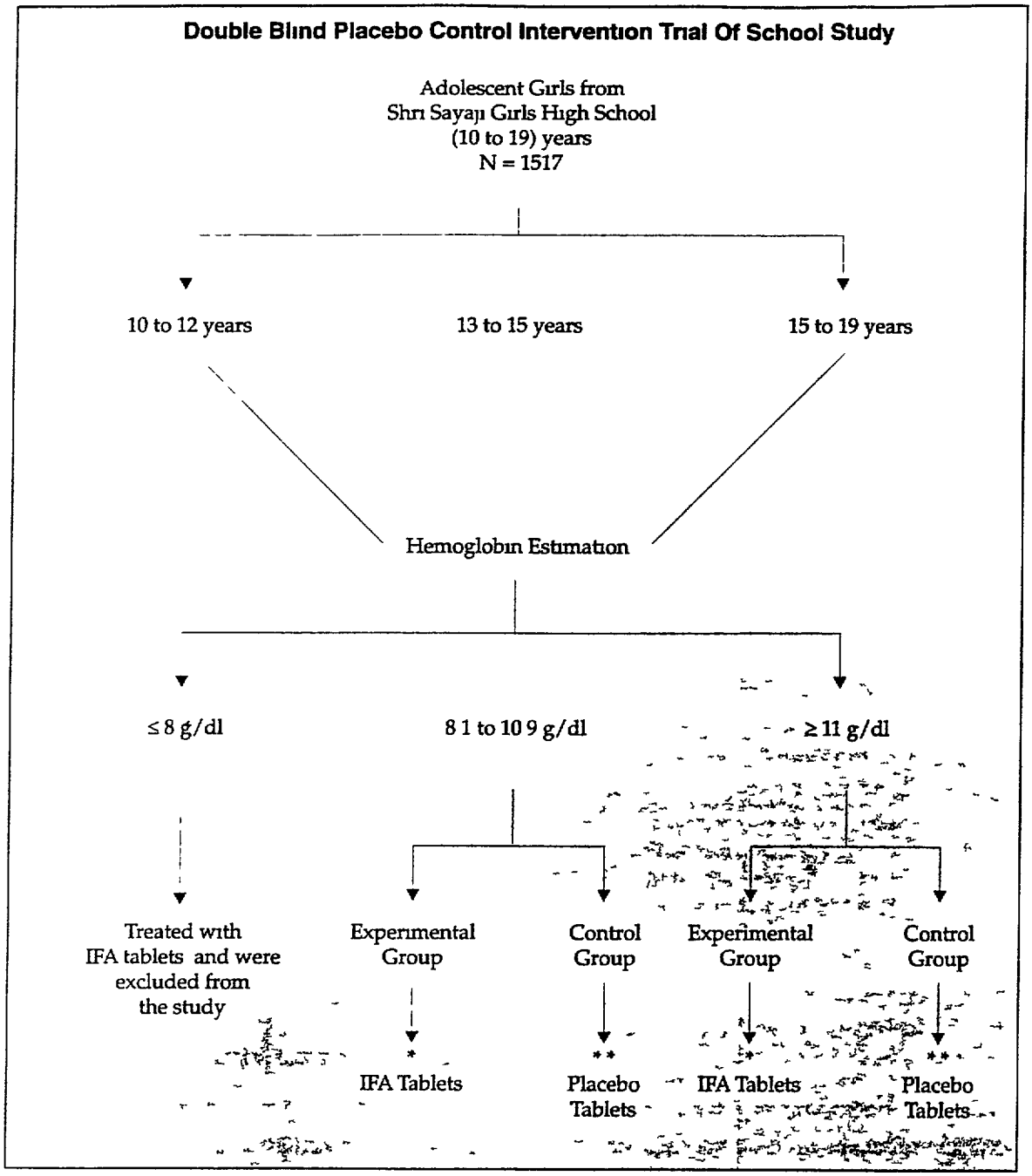
In both groups (I and II), the experimental group was given weekly IFA supplementation of 100 mg elemental iron and 0 5 mg of folic acid (Gracure Pharmaceuticals, New Delhi) The dosage was higher than in the previous study, firstly because it was a weekly supplementation trial and secondly, the government supply of adult IFA tablets also contains 100 mg elemental iron The control group was given dicalcium phosphate placebo tablets on a weekly basis (similar in shape, size and colour as the IFA tablets) produced by Locost Pharmaceuticals, Vadodara

Figure 10



[1]Hb - Hemoglobin

Figure II



Weekly IFA supplementation 100 mg elemental iron + 0 5 mg folic acid
Weekly supplementation with identical looking placebo tablets

Process of Double Blinding

Empty boxes labelled 'X', 'Y' and 'Z', as well as the IFA tablets and identical looking placebo tablets were given to a doctor in the Department of Preventive and Social Medicine, Medical College, Vadodara, wherein, without the investigator's knowledge, boxes 'X' and 'Y' were filled one with IFA and one with placebo tablets Boxes labelled 'Z' were meant for severely anemic girls and contained IFA tablets Thus the investigators did not know the content of the boxes labelled 'X' and 'Y' At the end of data analysis the experimental and control groups were decoded

Supervized weekly IFA and placebo supplementation was given for six months Girls swallowed the tablets in class in front of the class teacher usually in the first period The class monitors got drinking water from the school taps in bottles and gave the water to girls in plastic glasses supplied by the project staff The investigator assisted the teachers as and when necessary Teachers were instructed in detail in a meeting regarding the intervention procedure, their role in facilitating and supervizing the girls for swallowing the tablets in front of them and the importance of recording the compliance for each girl in ready-to-use compliance registers given to them Additional monitoring of the intake of tablets and maintenance of the records for the compliance of tablets was also done by the investigator

Phase C Post-Intervention Data Collection

In this phase, post-intervention data were collected Assessment of nutritional status, prevalence of anemia and anorexia and fatigue perceived were determined by the same methods as at baseline

Description Of Methods Used For Data Collection

Table 21 summarizes the indicators and methods of data collection used in the school study

Table 21

Indicators and Methods of Data Collection	
Indicators And Method	**Sample Size**
Socio-economic status and prevalence of morbidity using structured questionnaire	1382
Anthropometry	
✦ Weight-for-age	
✦ Height-for-age	1517
✦ Body Mass Index	
Blood hemoglobin by cyanmethemoglobin method	1517
Dietary intake	
✦ Food frequency questionnaire	36
✦ 24 hour dietary recall method	50
History of anorexia	
✦ Rating scale	1013
Activity pattern using a rating scale	50
Perceptions of girls using a semi-structured questionnaire	100

1 Structured Questionnaire on Socio-Economic Status

Due to the large sample size, this questionnaire was administered to the class as a whole and the girls were asked to fill them in presence of the investigator who explained each question to them They were also allowed to take home the questionnaire to fill in information related to family composition and parents' education, occupation and income (Appendix 1B) The last section of the questionnaire included questions pertaining to prevalence of morbidity in the past 15 days and commonly suffered diseases prevalent amongst adolescent girls as perceived by the students

2 **Assessment of Nutritional Status**

Anthropometry and hemoglobin indicators were used as described in Section 1 earlier

3 **Food and Nutrient Intake**

Using the food frequency method (described in Section 1), subjects were asked to report their usual frequency of consumption of each food item from a list of foods The focus was on usual intake of iron and vitamin C rich foods (Appendix 2B) In addition, the girls were also asked to mention the quantity generally consumed per serving

Diet intake was measured using the 24-hour dietary recall method (Appendix 3B) The houses and families of selected subjects were visited to record their food intake on the previous day The food intake of the whole family was noted, amount of raw ingredients used in the preparation of food for the whole family, total cooked quantity prepared and the amount eaten by the subjects was recorded Food eaten by the subjects outside the home was also recorded Subjects' diet consumed were converted into raw foods in grams and the nutrient values were calculated using the standard food composition table (NIN 1991)

4 **History of Anorexia**

As in the previous study, a 'rating scale' which is a ten point scale was used to assess the degree of anorexia as perceived by the subject The rating ranged from 1 to 10 Lower the score, poorer was the appetite according to the subject Due to the large sample size in the school study, instead of individual interviews, the students were given the forms (Appendix 4B) in their class, explained by the investigator and were asked to fill under the investigator's supervision

5 Activity Pattern

In the first study (Section 1), indicator of fatigue was not developed One deleterious effect of nutritional anemia is fatigue and inability to work on routine tasks without getting tired So it was thought worthwhile to develop an activity pattern of common activities carried out by girls and see how easily they could carry out each activity This list was subjected to a rating scale by the girls As in the appetite scale above, here also, a 10 point numerical rating scale was used to assess how easily and comfortably girls could perform their various routine activities as perceived by them without experiencing fatigue (Appendix 5B) Lower the score, less easily they were able to perform the individual activities

6 **Perceptions of Girls on Health, Nutrition and Anemia**

A semi-structured schedule was given to each class and filled in by the girls under the guidance of the investigator (Appendix 6B) In this schedule, girls wrote their views and perceptions of different aspects of adolescent nutrition and anemia

7 **Anemia Education**

To motivate girls to consume IFA tablets and to also increase their awareness regarding iron rich foods, the following educational materials were given to each girl

a) Labels - These were name and subject labels which girls could paste onto their school notebooks or textbooks Each label had a different slogan printed on it in Gujarati which is translated below

- *Those who eat Bajra, sprouted legumes, jaggery, their health improves, blood becomes red*
- *Eat red strength giving tablets once a week and make your blood red*
- *If you take iron tablets for 6 months regularly, then your body will get strength*
- *Green leafy vegetables, sour fruits, these reduce anemia, you get strength*

b) Compliance card cum school time table - This was primarily meant to facilitate girls to record their compliance to IFA tablets wherein they were asked to cross the red circles on the card every time they took an IFA tablet A perforated second section of the card carried a time table which the girls could remove and use in the school This card also had a slogan on IFA tablet in Gujarati which is translated below

- *Eat red strength giving tablets once a week and make your blood red*

c) Brochure - This was prepared in an earlier project by the Department of Foods and Nutrition, M S University of Baroda, Vadodara, and reprinted with permission to be distributed to students and parents regarding anemia, its prevention and control

Data Management and Analysis

Data management and analysis procedures were similar to those described in the earlier study (Section 1)

Results

BASELINE NUTRITIONAL STATUS OF THE SUBJECTS

1 Anthropometric Measurements

Height-for-age

Table 22 indicates that overall, 18% of the girls were stunted The prevalence of stunting varied from 7% to 28% The younger girls in the age group of 10 to 12 years showed a higher prevalence of stunting than the girls in the age group of 13 to 19 years Figure 12 presents the distance curve of height-for-age in which it is evident that the height curve of the present girls is parallel to 5th percentile of NCHS standards It was consistently well below the 50th percentile of NCHS standard as well as the growth curve of the affluent Bombay girls (NFI 1989) This again indicated a high prevalence of stunting

Weight-for-age

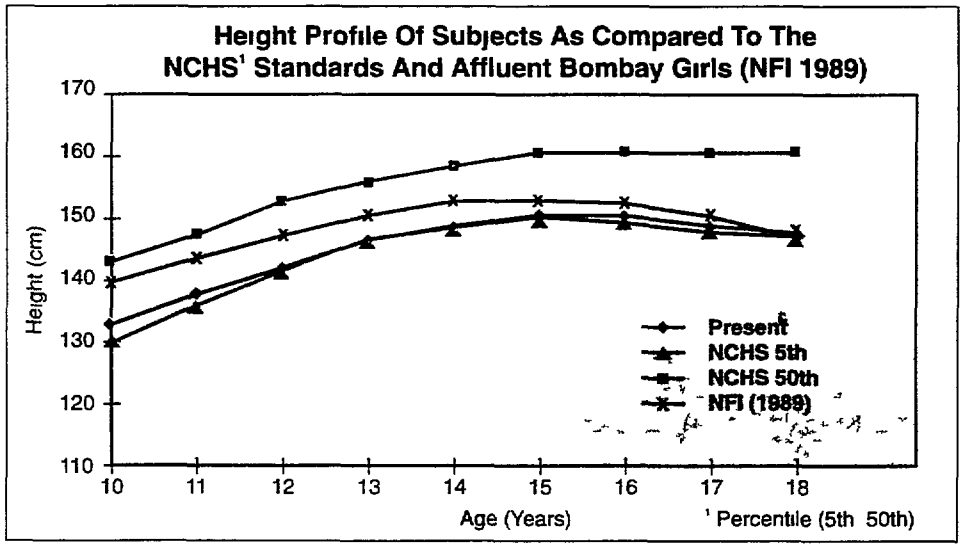
Table 22

Height-For-Age Data Of Present Subjects Compared With NCHS[1] Standard (N=1517)

Age (Years)	N	Height (cm)		% NCHS Standard		% Girls Stunted[2]
		Mean ± SE	Median	Mean ± SE	Median	
10	123	132 8 ± 0 66	132 9	93 8 ± 0 46	93 5	22
11	175	138 4 ± 0 56	138 5	93 4 ± 0 37	93 1	28
12	252	145 0 ± 0 46	144 1	93 8 ± 0.29	93 3	19
13	275	147 4 ± 0 42	148 2	92 8 ± 0.26	93.2	23
14	236	150 6 ± 0 40	150 7	93 5 ± 0.25	93 5	17
15	181	151 7 ± 0 43	151 2	93 6 ± 0.26	93 3	13
16	161	152 9 ± 0 41	153 0	94 0 ± 0.25	93 9	9
17	86	152 4 ± 0 64	152 3	93 3 ± 0 39	93 2	13
18-19	28	154 9 ± 1 04	154 8	94 6 ± 0 63	93 6	7
Overall	1517	146 9 ± 0 23	148 2	93 5 ± 0 11	93 0	18

National Center for Health Statistics (1983)
Height below 90% standard

Figure 12



As seen in Table 23 weight deficits were seen in all the age groups Overall, as many as 66% of the subjects had below normal weight-for-age (weight below 80% standard) The mean weight of the girls ranged from 74% to 78% of the NCHS standards Proportion of severely undernourished girls tended to be higher in 10 to 12 years age group Figure 13 represents the distance curve of weight-for-age data of present subjects As in case of height, the curve of the subjects was parallel to 5th percentile NCHS standards and well below the 50th percentile NCHS standards as well as the affluent Bombay girls (NFI 1989)

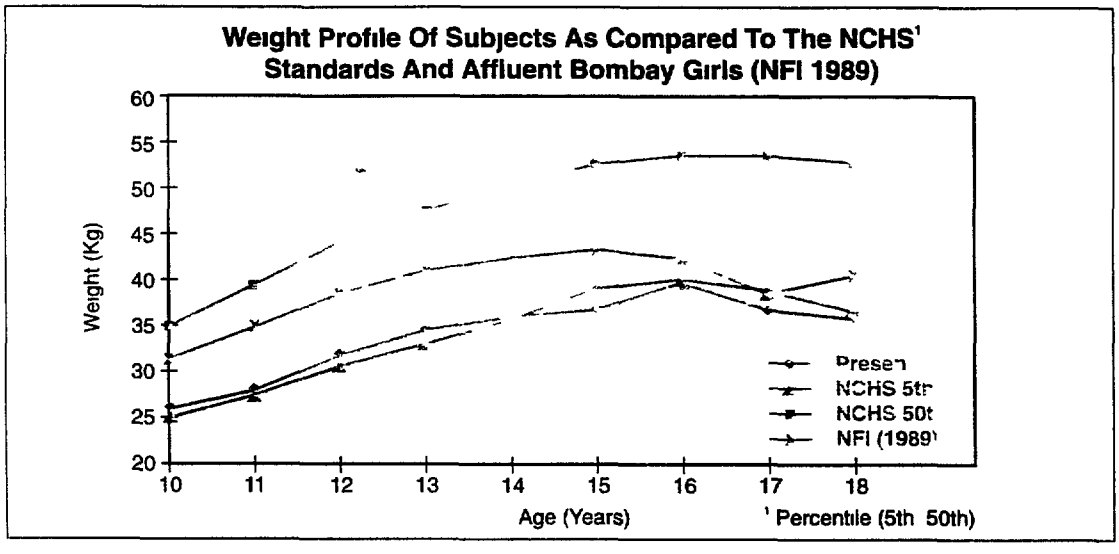
Table 23

Weight-For-Age Data Of Present Subjects Compared With NCHS[1] Standard (N=1517)

Age (Years)	N	Weight (kg)		% NCHS Standard		% Girls Below Normal	
		Mean ± SE	Median	Mean ± SE	Median	A[2]	B[3]
10	123	26 7 ± 0 51	26	76 8 ± 1.51	73 8	69	11
11	175	29 8 ± 0 49	28	75 6 ± 1.22	73 0	70	13
12	252	34 1 ± 0 47	33	77 7 ± 1 05	74 7	63	14
13	275	36 9 ± 0 40	37	76 8 ± 0 83	75 9	59	10
14	236	39 9 ± 0 45	39	76 8 ± 0 85	75 9	68	7
15	181	41.3 ± 0 51	40	75 5 ± 0 93	72 6	71	8
16	161	43 9 ± 0 54	43	77 8 ± 0 95	76 0	63	3
17	86	42 9 ± 0 77	42	75 8 ± 1 36	74 1	69	7
18-19	28	42 1 ± 1 08	41	74 4 ± 1 92	72 9	71	11
Overall	1517	36 9 ± 0.22	37	76 7 ± 0.37	74 8	66	8

[1] National Center for Health Statistics (1983)
Weight below 80% standard
[3] Weight below 60% standard

Figure 13



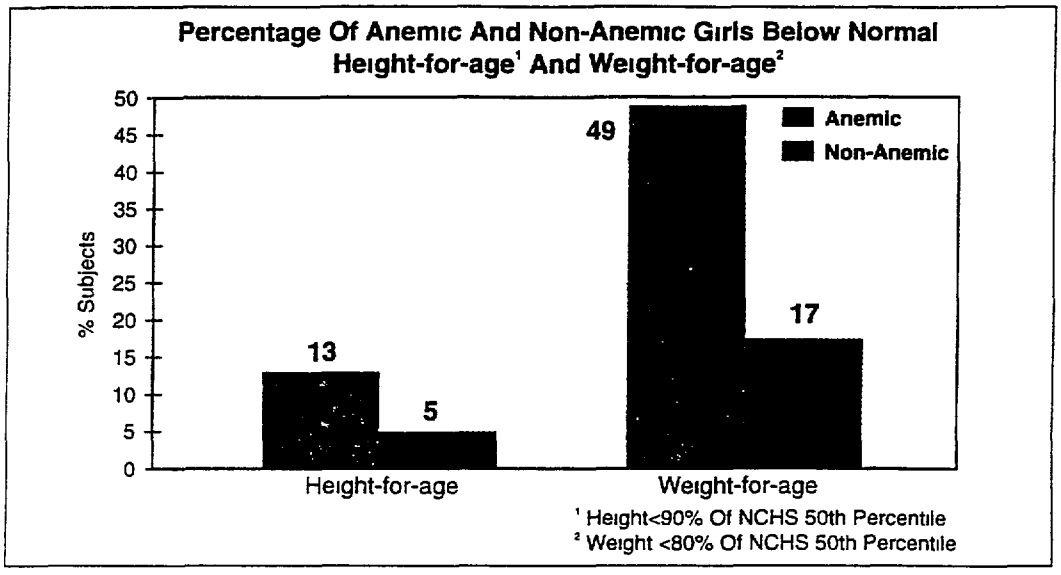
Peak height velocity (PHV)

The maximum increment in height took place at 11 years, which is a year later as compared to that of affluent Bombay girls (NFI 1989) The increment in height during age of PHV was 5 6 cm Peak in weight gain spurt took place at 12 years, two years later than seen in affluent Bombay girls (NFI 1989)

Anemia and Growth Retardation

Anemia and growth retardation coexist as seen in Figure 14 A higher proportion of anemic girls were growth retarded in terms of weight and height deficits as compared to non-anemic girls This difference was more marked as regards weight deficits than height deficits

Figure 14



Body mass index (BMI)

The BMI data of the present subjects is shown in Table 24 According to BMI, as many as 25% of the girls were undernourished (BMI below 80% of the standards given by Must et al 1991) As evident in Table 25 40% of the present subjects suffered from grade III chronic energy deficiency, which was more prevalent in 10 to 12 year old girls (65%) as compared to 13 to 15 year old girls (29%) and 16 to 19 vear old girls (19%) Highlighting further the unsatisfactory BMI values of the girls is the BMI curve of the present subjects is shown in Figure 15

Table 24

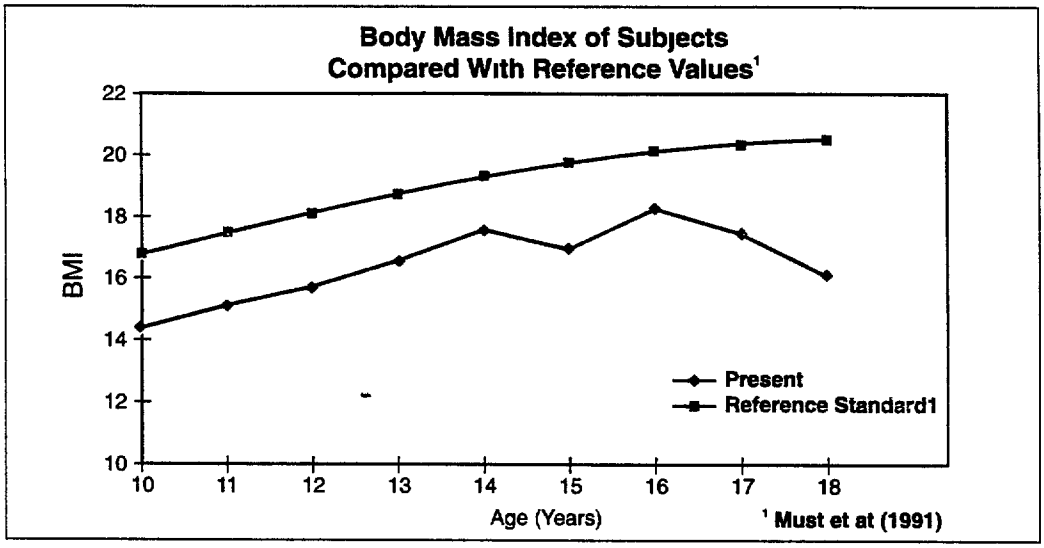
Body Mass Index (BMI) Data Of Present Subjects (N=1517)			
Age (Years)	N	Body Mass Index	
		Mean ± SE	Median
10	123	15 04 ± 0 21	14 34
11	175	15 38 ± 0 17	14 89
12	252	16 07 ± 0 15	15 56
13	275	16 95 ± 0 14	16 54
14	236	17 56 ± 0 17	17 27
15	181	17 94 ± 0 21	17 43
16	161	18 74 ± 0 22	18 28
17	86	18 48 ± 0 29	17 91
18 19	28	17 57 ± 0 48	17 10
Overall	1517	16 97 ± 0 07	16 56

Table 25

Chronic Energy Deficiency Grades Of Present Subjects (N=1517)									
Age (Years)	N	Chronic Energy Deficiency Grade						Girls Below Normal[4] BMI[5]	
		I[1]		II[2]		III[3]			
		N	%	N	%	N	%	N	%
10	123	13	11	9	7	89	72	39	32
11	175	21	12	20	11	118	67	57	33
12	252	39	16	33	13	142	56	76	30
13	275	54	20	48	18	108	39	66	24
14	236	57	24	50	21	62	26	46	20
15	181	42	23	38	21	41	23	36	20
16	161	44	27	26	16	22	14	22	14
17	86	23	27	13	15	15	17	19	22
18-19	28	5	18	7	25	7	25	10	36
Overall	1517	298	20	244	16	604	40	371	25

[1] BMI 17 0 - 18 5
[2] BMI 16 0 - 16 9
[3] BMI <16 0
[4] Below 80% of reference standard (Must et al 1991)
BMI Body Mass Index

Figure 15



Summing up the nutritional status data, overall, 18% of the girls were stunted and the prevalence of current undernutrition was about 66% as judged by below normal weight-for-age, while about one-fourth of them (25%) had below normal BMI Although the present subjects were socio-economically better off than the urban poor girls of city slums, research evidence shows that the prevalence of undernutrition was high in both groups

Menarche

As indicated in Table 26, 80% of the girls had attained menarche by 14 years Compared to girls of middle income group (MIG) and high income group (HIG) in other studies, the present girls had a delayed onset of menarche (Table 27) One reason why menarche is delayed could be the high prevalence of undernutrition in girls It is known that there is a linear relationship between weight deficits and menarche, underweight girls tend to attain menarche later than their well nourished counterparts

Table 26

Menstrual Status Of The Present Subjects (N=993)		
Characteristics	N	%
Girls menstruating at present		
a) Yes	481	48
b) No	512	52
Standards in which studying at menarche		
a) Std 5th to 7th	69	14
b) Std 8th to 12th	412	86
Age at onset of menarche (years)		
a) 10	1	0
b) 11	9	2
c) 12	38	8
d) 13	149	31
e) 14	186	39
f) 15	83	17
g) 16	12	2
h) 17	3	1

Table 27

Mean Age At Menarche Of Present Subjects Compared To Other Studies On Adolescent Girls				
Reference	Year	Place	SES[1]	Mean Age at Menarche (Years)
Present	1997	Vadodara	MIG[2]	14 0
Kanani and Bhargava	1992	Vadodara	HIG[3]	12 0
Kanani and Kak	1990	Vadodara	HIG	12 4
NFI[4]	1989	Bombay	HIG	12 4
Rana et al	1986	Vadodara	MIG	12 4

1 Socio-economic status
2 Middle income group
3 High income group
4 Nutrition Foundation of India

2 Hemoglobin Status

Tables 28 and 29 reveal that the mean hemoglobin (Hb) level of 10 to 19 year old girls was low 10 76g/dl and showed a decreasing trend with an increase in age Overall, 75% girls were anemic using the cut off level of Hb <12g/dl Around 42% of the girls were moderately anemic and severe anemia was seen in 7% of the present subjects with a higher prevalence being observed in post menarcheal age of 13 to 19 years

Table 28

Prevalence Of Anemia Amongst The Present Subjects (N=1517)							
Age (Years)	N	Hemoglobin (g/dl)		Anemic Subjects			
		Mean ± SE	Median	N[1]	%	N[2]	%
10	123	11 7±0 09	11.8	23	19	72	59
11	175	11.2±0.09	11 4	61	35	133	76
12	252	11 0±0 11	11 4	103	41	164	65
13	275	10.8±0.09	11 0	133	48	207	75
14	236	10 9±0.09	11 0	116	49	167	71
15	181	10.2±0 11	10 4	122	67	156	86
16	161	10 1±0 15	10.2	107	67	138	86
17	86	9 6 ±0.24	10 1	63	73	73	85
18-19	28	9.36±0.53	10 0	18	64	24	86
Overall	1517	10 76±0 45	11 0	746	49	1134	75

[1] Hb cut off 11g/dl
[2] Hb cut off 12g/dl

Table 29

Severity Of Anemia Amongst The Present Subjects (N=1517)									
Age (Years)	N	Mild[1]		Moderate[2]		Severe[3]		Normal[4]	
		N	%	N	%	N	%	N	%
10	123	49	40	22	18	1	1	51	42
11	175	72	41	59	34	2	1	42	24
12	252	61	24	85	34	18	7	88	35
13	275	74	31	113	41	20	7	68	25
14	236	51	22	108	46	8	3	69	29
15	181	34	19	112	62	10	6	25	14
16	161	31	19	83	52	24	15	23	14
17	86	10	12	41	48	22	26	13	15
18-19	28	6	21	10	36	8	29	4	14
Overall	1517	388	26	633	42	113	7	383	25

[1] Mild Hb 11 0 - 11 9 g /dl
[2] Moderate Hb 8 0 10 9 g /dl
[3] Severe Hb < 8 0 g /dl
[4] Normal Hb ≥ 12 0 g /dl

3 Food And Nutrient Intake

As regards dietary habits, only 5% of the present subjects were non-vegetarian, consuming animal foods like meat and fish or eggs, while 16% of the subjects believed themselves to be vegetarians but ate eggs

Table 30 lists several iron and vitamin C rich foods which were liked and disliked by the girls Most girls (82%) liked vitamin C rich foods such as gooseberry (*"amla"*), guava, ripe tomato and oranges Amongst the iron rich foods, only rice flakes (*"poha"*) was liked the most Dislike for iron rich foods rather than poor affordability may be an etiological factor explaining the high prevalence of anemia in these girls Their families were able to purchase foods but the girls did not eat them

Table 30

Iron And Vitamin C Rich Foods Liked And Disliked By The Present Subjects (N=293)		
Food Items		
Like A Lot [1]	Like Less [2]	Dislike [3]
Gooseberry *(Amla)*	Bajra *(Bajro)*	Jowar *(Juwar)*
Ripe tomato *(Tamatar)*	Brinjal *(Ringan)*	Mint *(Pudina)*
Pineapple *(Pineapple)*	Moth Beans *(Chola)*	Green tomato *(Kacha tamatar)*
Guava *(Jamphal)*	Sprouts *(Phangawela kathod)*	Shepu *(Suva)*
Custard Apple *(Seethaphal)*	Jaggery *(Gol)*	Soyabean *(Soya)*
Orange *(Santro)*	Dry peas *(Vatana)*	Lentil *(Masoor)*
Rice Flakes *(Poha)*	Lemon *(Limbu)*	

1 62% - 82% subjects
2 31% - 34% subjects
3 34% - 50% subjects

Frequency of intake of selected food items

Most girls (80%) usually consumed tea without breakfast and went to school School tiffin usually contained '*poha*[1]", "*mamara*[2]", "*samosa*[3]", "*fryums*[4]" and "*namkeen*[5]" which were poor sources of micronutrients

The staple cereal consumd by the present subjects was wheat in the form of "*bhakari*[6] ", "*roti*[6]" and rice Redgram dhal was the most commonly consumed pulse, with occasional intake of other pulses such as green gram or blackgram dhal

Table 31, presents information regarding frequency and approximate quantities of intake of protective foods Pulses which give appreciable amounts of iron were consumed daily by about half of the subjects Usual quantity consumed was about one "*vatki*", equivalent to a standard half cup (i e 100 ml) Sprouts were consumed weekly by only one-fourth of the girls and half did not consume them at all

Green leafy vegetables (GLVs) were consumed weekly or less often Among GLVs, intake of cabbage was common, followed by fenugreek leaves in season Other GLVs such as coriander, mint (used for seasoning) and shepu were rarely consumed This shows that in spite of knowing about the benefits of GLVs (as described in the next section on perceptions of girls), the adolescent girls consumed them infrequently

Fruits were usually consumed only on the days of fast once weekly As 13 to 19 year old girls fasted more often, they consumed more fruits than 10 to 12 year old girls Salads and chutneys were rarely consumed and eaten in small amounts by most subjects A salad known as "*kuchumber*" (mix of cucumber, ripe tomato and onion) was often taken with meals

1 Rice flakes
2 Puffed rice
3 Fried item made up of refined flour with potato filling
4 Fried item made up of rice flour and purchased from market
5 Deep fried snack
6 Unleavened bread

Other vegetables chiefly consumed by the subjects were parwar, tinda, ladies finger and ridge gourd, but in very inadequate amounts (less than half of standard cup)

Mean food intake

Quantitative estimation of intake of various food groups from the 24-hour dietary recall is shown in Figure 16

In both age groups, 10 to 12 and 13 to 15 years, no consumption of GLVs was reported, while in the age group of 16 to 19 years, only one girl reported to have consumed GLVs However, in the food frequency questionnaire some of the subjects reported a once a week consumption of GLVs Most iron and vitamin C rich foods such as GLVs and fruits were consumed in varying amounts Fruit intake was better than that of GLVs but as the food frequency data showed, fruits also were consumed weekly by most girls

No particular age wise trend was found with regard to intake of various other foods, and there was considerable variation in reported mean intakes of food groups, especially for fats and oils, sugar and jaggery

Mean nutrient intake

These data are presented in Tables 32 and 33 Among the macronutrients, protein intake was the lowest (<60% RDA) and interestingly, fat intake was high at above 200% of RDA, perhaps because as income levels improve, fats and oils in seasoning foods are used in larger quantities, especially in Gujarat However, due to the overall unsatisfactory intake as regards the quantity of diet consumed, calorie intake met only about 70%-76% RDA

Among the micronutrients, mean intake of ß-carotene was found to be lowest amongst the adolescent girls of this study- overall only 18% of RDA Mean intake of iron as % RDA was low amongst the older age groups as compared to the younger ones Further, the type of iron, reported was primarily non heme iron from plant sources with poor bioavailability which may explain the high prevalence of anemia (75%, Hb<12g/dl) in the subjects Overall, as age increased, intake of micronutrients decreased

Table 31

Protective Food Intake By The Present Subjects Frequency Of Consumption With The Approximate Amounts (N=36)

Food Item (Years)	Age Group	N	Frequency of Consumption (% Subjects)						Amount Consumed (% Subjects)		
			Daily	2 - 4 Times a Week	Once a Week	Fort nightly	Once a Month	Never	< 1/2 Cup	1/2 Cup	> 1/2 Cup
Pulses	10-12	18	61	11	22	0	6	0	39	55	6
	13-15	18	55	27	6	6	0	6	39	44	11
Sprouts	10-12	18	0	0	28	22	6	44	22	17	17
	13-15	18	0	0	22	6	17	55	22	17	6
GLVs[1]	10-12	18	11	22	28	11	22	6	72	17	6
	13-15	18	0	11	67	17	6	0	61	39	0
Fruits	10-12	18	27	17	28	11	17	0	61	39	0
	13-15	18	17	11	66	0	6	0	39	39	22
Salads & Chutney	10-12	18	11	0	11	6	22	50	44	6	0
	13-15	18	6	6	27	6	16	39	50	11	0

1/2 Cup = 100 ml
Green leafy vegetables

Figure 16

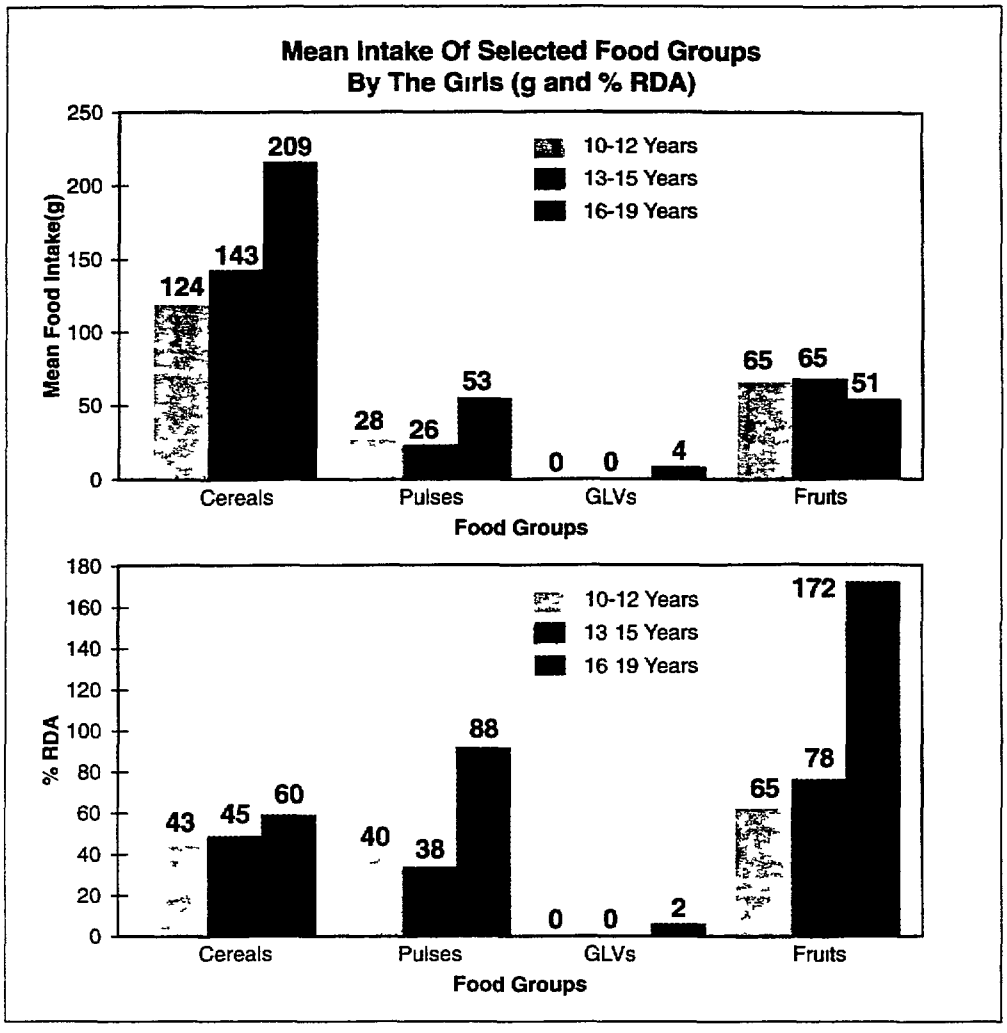


Table 32

Mean Nutrient Intake Of The Subjects (N=52)				
Nutrient (Unit)	Age (Years) N =	10 to12 20	13 to15 20	16 to 19 12
Calories (kcal)	Mean ± SE Median	1446±72 2 1412	1430±61 7 1406	1706±140 4 1515
Proteins (g)	Mean ± SE Median	35±2 1 33 6	39±2 9 35 7	39±2 7 36 3
Fat (g)	Mean ± SE Median	51±3 2 51	51±3 8 48	61±6 7 61
Iron (mg)	Mean ± SE Median	13 7±1 8 13 4	12 4±1 4 10 9	10 5±1 2 9 1
Calcium (mg)	Mean ± SE Median	411±43 2 411	354±25 6 350	361±27 9 323
Vitamin C (mg)	Mean ± SE Median	34±4 2 34	20±2 8 19	22±6 4 13
ß-Carotene (µg)	Mean ± SE Median	469±63 2 455	455±47 9 454	341±24 6 328

Table 33

Mean Nutrient Intake Of The Subjects As % RDA (N=52)				
Nutrient	Age (Years) N	10 to12 20	13 to15 20	16 to 19 12
Calories	Mean ± SE	74±3 7	70±3 0	77±7 9
	Median	72	68	72
Proteins	Mean ± SE	61±3 6	60±4 4	61±5 5
	Median	59	55	59
Fat	Mean ± SE	229±14 3	231±17 4	245±26 4
	Median	229	220	243
Iron	Mean ± SE	72±9 3	46±5 1	35±3 9
	Median	70	39	30
Calcium	Mean ± SE	69±7 2	59±4 3	54±6 8
	Median	69	58	52
Vitamin C	Mean ± SE	86±10 5	50±7 0	75±32 9
	Median	86	47	25
ß Carotene	Mean ± SE	20±2 6	19±2 0	16±2 2
	Median	19	19	15

4 Activity Pattern

As stated in the earlier chapter, a rating scale was developed to assess the ease and comfort with which habitual activities were performed as perceived by the anemic versus non-anemic girls Mean scores were similar in both groups However, girls with Hb<10g/dl often spontaneously complained to the investigator about fatigue experienced during work, such as breathlessness on climbing stairs (*"Dadar chade ne haanfe jaye chhe"*), getting tired on running errands, mopping the floor or playing in school They also said that they had difficulty in concentrating on studies

Thus, though in reality there could be appreciable differences in the abilities of anemic and non-anemic girls to perform various tasks and also in the duration of tasks performed with ease, the present methodology of scoring the perceived ease of doing a task was perhaps not appropriate, and needs to be improved

5 Prevalence Of Morbidity

Morbidity data were collected from 1382 girls regarding the major illnesses suffered by the girls during last 15 days It was seen that only 13% of the total subjects had suffered from some form of illness as seen in Table 34 on the following page

Major illnesses found amongst the subjects were fever, cold, cough, malaria or a combination of these illnesses Of these, around 88% of the subjects had taken the treatment mainly allopathic treatment (77%), while a tenth had taken home remedies

Majority of the girls went with their mothers (43%) while some of them (16%) had gone with their fathers for the treatment and 10% of the girls did not take any kind of treatment

About a third of the girls did not know the cause of their illness (35 3%) A fifth however thought that it was caused due to "cold", i e either cold climate or having a cold bath or drinking cold water or eating ice-creams Other mentioned reasons were- change in climate, eating outside foods, mosquito bites and unhygienic living conditions

Table 34

Morbidity Profile of the Present Subjects (N=1382)		
Characteristics	Total N	%
Morbidity		
a) Yes	173	13
b) No	1209	88
Major illnesses		
a) Fever	32	19
b) Cold	28	16
c) Cough	2	1
d) Malaria	15	26
e) Combination of above	45	9
Duration of illness		
a) 1 7 days	147	85
b) >7 days	26	15
Treatment taken		
a) Yes	155	88
b) No	18	11
Who treated		
a) Home	17	10
b) Allopathy	133	77
c) Ayurvedic	4	2
d) Combination	1	1
Cause of illness		
a) Don t know	61	35
b) Due to cold (climate drink ice-cream bath)	34	20
c) Due to change in climate	14	8
d) Eating outside	8	5
e) Mosquito bite	7	4
f) Unhygienic living conditions	6	4

6 History Of Anorexia

The earlier section has described that the subjective feeling of anorexia was quantified by means of a rating scale of 0 to 10 lower the score assigned by a girl, more was the extent of poor appetite perceived by her

As indicated in Table 35, no difference in mean appetite scores was found between the anemic and non-anemic subjects In view of the marked variations in appetite scores, it was decided to compare

Table 35

Percent Responses Of The Girls Regarding Appetite And Fatigue (N = 1013)			
Characteristics	Normal[1]	Mild - Moderate[2] Anemia	Severe[3] Anemia
Feel hungry at meal time			
✦ Yes	27	67	6
✦ No	33	61	6
Family members say you eat less			
✦ Yes	28	65	7
✦ No	27	67	6
Appetite level			
✦ Anorexic (score of 0 - 4)	28	66	6
✦ Non anorexic (score of 8 - 10)	31	62	7
Fatigue level			
✦ Less tired (score of 0 - 4)	30	63	7
✦ More tired (score of 8 - 10)	30	64	6

[1] Hb ≥ 12 g/dl Hb 8 1 11 9 g/dl [3] Hb ≤ 8 g/dl

girls giving the 'lowest' scores of 0 to 4 (anorexic) with those giving the 'highest' scores of 8 to 10 (non-anorexic) in the anemic and non-anemic groups, which again showed no trend In contrast, in the earlier study described in Section 1, the same method showed a relationship between anorexia and anemia This is perhaps because in the earlier study, each girl was individually explained the rating scale and it was filled by the investigator based on the subject's response, whereas in this study, the large sample necessitated filling in the scale by the whole class, by the girls themselves with guidance from the investigators It appears that a simpler scale, administered individually on smaller samples if necessary, may be more useful

7 Perceptions Of Girls Regarding Health, Nutrition, Anemia And Gender Bias

7 1 Perceptions regarding Health and Nutrition

Tables 36 to 39 summarizes and compare the perceptions of 10 to 15 year old girls vs 16 to 19 year old girls regarding health and nutrition

7 1 1 Perceptions regarding health of self

Majority of the girls believed themselves to be healthy with a higher percentage of 10 to 15 years girls believing so (94% vs 64%) The main reasons for this were that they ate well, did not feel tired, did not suffer from illness and could work efficiently (Table 36)

Those who believed they were unhealthy gave reasons such as feeling weak or tired easily, did not feel like working, fell sick often and suffered from giddiness and breathlessness While the younger group (10 to 15 years) mentioned lack of stamina to walk or run, the older group (16 to 19 years) mentioned their lack of interest in work, physical problems (e g low weight, less height, pain in chest), mental problems (e g less concentration, 'wrong' thoughts) and diet related problems (e g deficiency of proteins, vitamins)

7 1 2 Perceptions regarding healthy and unhealthy/weak girl

Both groups believed that a healthy girl is one who can do all types of work, has more height and weight, is intelligent, good natured and does not fall ill However, a higher percentage (62%) of older girls mentioned that a healthy girl is active, energetic and has more strength which was not mentioned by the younger group Half of the younger girls said a healthy girl is one who is good and clean which was not perceived by the older group

An unhealthy girl was described by 10 to15 year old girls as one who can not work, looks thin and who is not clean, good looking, intelligent and smart The older girls described an unhealthy girl as one who always remains sick, gets tired soon, is weak, looks thin and who remains unhappy, irritated and apathetic Both groups mentioned eating on time, eating a nutritious diet (especially GLVs), doing exercise and taking strength giving tablets as ways to improve the health of a weak girl Box 1 shows that the concept of health in adolescence, according to the girls, covered various dimensions including the environment and mental health

7 1 3 Perceptions regarding nutritious diet

GLVs, fruits, cereals, milk, vegetables and pulses were mentioned as foods that lead to good health by both groups, as seen in the Table

Around 34% of the younger girls were unable to describe a nutritious diet A fifth mentioned foods with 'vitamins', 'energy' and 'proteins' as a nutritious diet The older groups, though aware, were unable to correctly describe a nutritious diet Majority (76%) mentioned a diet containing a combination of various nutrients like carbohydrates, fat, energy, vitamins, proteins, iron and calcium Around a fifth (26%) did describe it correctly as foods which provide all nutrients in required amounts As Box 2 reveals, varied concepts about diet and health were expressed by girls and most were not aware of specific benefits of a nutritious diet

Table 36

Perceptions Of Girls Regarding Health And Nutrition

Description	10 to 15 Years		16 to 19 Years	
	N	%	N	%
Health of self				
✦ Healthy	47	94	32	64
✦ Unhealthy	3	6	18	36
Reasons for good health of self				
✦ Is happy and enthusiastic in doing work	—	—	7	22
✦ Eats well (i e feels hungry eats good diet, eats on time)	23	49	17	53
✦ Does exercise regularly	11	23	—	—
✦ Does not feel tired	30	64	14	44
✦ Does not fall ill/ suffer from illness	12	25	14	44
✦ Her blood is pure	5	11	7	22
✦ Can work efficiently	5	11	7	22
✦ Can take care of health	5	11	—	—
✦ Can run/ walk fast	—	—	5	17
✦ Has no tension	17	36	—	—
✦ Has a good memory/ is clever/ is interested in studies	6	13	—	—
Reasons for poor health of self				
✦ Feels weak/ tires easily	16	34	—	—
✦ Cannot walk/ run fast	2	67	10	55
✦ Does not feel like working/ unable to do work	3	100	10	55
✦ Falls sick often/ does not recover soon	1	33	4	22
✦ Has physique related problems (less weight less height physically imbalanced)	—	—	5	28
✦ Others				
Physical problems (Breathlessness, pain in chest hair does not grow watery eyes feels suffocated)	1	33	6	33
Mental problems (Less concentration has wrong thoughts, feels scared cannot tolerate noise)	—	—	35	28
Diet related problems (Deficiency of blood proteins vitamins)	—	—	35	28

Box 1

Who is a Healthy and Weak Girl? Voices of Adolescent Girls

Healthy Girl

- *A girl whose physical and mental state is balanced is called a healthy girl*
- *Healthy girl is neat, good and strong*
- *Girl who do not get tired while doing work and does not feel breathless*
- *Her body's blood is pure*
- *Healthy girls do not suffer from any type of diseases*

Weak Girl

- *Girls who get tired while doing work, feel breathlessness, cannot climb steps, fall sick oftenly*
- *She loses temper on small things*
- *She remains apathetic, disinterested*
- *A girl who falls sick always and who has fever in her bones*
- *A girl who is confused, not enthusiastic and has no interest in anything*

Improving Health of a Weak Girl

- *Her surrounding environment should be such that she should get mental peace*
- *She should be given balanced diet, should do exercise daily, should also take GLVs*
- *Weak girl should be given good diet, energy tablets, she should take treatment to increase blood*
- *She should take treatment in order to increase blood*
- *She should be given health and nutrition education*
- *Should take milk, buttermilk, curd, ghee, vegetables, various fruits, pulses to keep her healthy*

Although both groups mentioned that a nutritious diet helps to keep the body healthy, helps to prevent illness and makes the body energetic or active, the percentage was higher among older girls (16 to 19 year olds) About one-fifth (28%) of younger girls did not know the relation between health and a nutritious diet while only one-tenth of older girls could not correlate the two

7 1 4 Perceptions regarding common illnesses seen in adolescent girls

When asked about common illnesses suffered by girls (10 to 19 years) as perceived by them, about a fifth mentioned vomiting, diarrhoea, and dysentry, while around half of them mentioned headache, jaundice and other aches and pains Around 60-70% mentioned cough, cold, fever, typhoid and malaria

Box 2

What is the Relationship Between Health and Nutritious Diet? Voices of Girls

- *A balanced diet increases fat in the body and if we take this type of diet then our health remains good*
- *By having balanced diet health remains good, body keeps fit and it also keeps a good amount of blood in body*
- *By having balanced diet body remains healthy, body get all the required nutrients and physical development takes place and also working capacity increases*
- *Mental tension is not there You feel happy*
- *By eating nutritious diet we get strength and can also maintain good health Blood increases, other body parts get energy to do work and also the life span increases*
- *By eating balanced diet the growth of body takes place adequately and also balanced diet prevents body from attack of microorganisms*

7 2 Perceptions regarding Anemia and Iron Tablets

A majority of the older girls (94%) were aware about 'paleness of blood' while less than half of the younger group (44%) were aware about it While 62% of the younger girls did not know the other term for paleness of blood, 86% of older girls mentioned *'pandurog'* as the other term which is the Gujarati equivalent for 'anemia' A higher percentage of younger girls mentioned 'anemia' and *kamjori'* or weakness as the other terms for 'paleness of blood' compared to the older girls

The correct cause of anemia was not known by majority of the girls in both groups (>90%) As seen in Table 37 a majority of the girls believed that they did not suffer from 'paleness of blood mainly because they said they were hungry, had energy to do work and did not have pale blood

Regarding problems faced due to anemia about half the younger group and a fourth of the older group could not elaborate In the older group the symptoms of anemia mentioned were - felt weak or tired easily, could not work and looked weak About a third of the older girls and most of the younger girls were not aware of ways to combat anemia (See Box 3)

7 2 1 Diet and anemia

Both groups mentioned tomatoes, carrots, GLVs, fruits, other vegetables and beetroot as foods that 'make blood red'

Amongst the older group, a majority felt that their diet contains iron (70%) and vitamin C (94%) while only about half the younger girls felt that their diet contains iron and vitamin C, though both groups did not know much about foods rich in iron, and mentioned GLVs tomatoes and carrots as iron rich foods The older group was better informed about food rich in vitamin C and mentioned lemon, oranges, gooseberry and other sour fruits while less than a fifth of the younger group was able to mention this

Table 37

Perceptions Of Girls Regarding Anemia And Iron Tablets				
Description	10 to 15 Years (N = 50)		16 to 19 Years (N = 50)	
	n	%	n	%
Aware about paleness of blood?				
✦ Yes	22	44	47	94
✦ No	28	56	3	6
Subject feels she suffers from paleness of blood				
✦ Yes	6	12	3	6
✦ No	31	62	47	94
✦ Does not know	13	26	—	—
If yes, why? Because -				
✦ Do not feel hungry and have thin body structure	—	—	1	33
✦ Body is weak and looks pale	—	—	1	63
✦ Have black circles around eyes	—	—	1	33
✦ Face is pale and whitish	2	33	—	—
✦ Fall sick frequently	2	33	—	—
✦ Get tired soon	2	33	—	—
If no, why? Because -				
✦ I feel healthy	6	20	17	36
✦ I am not weak / I have energy to do work and body does not look yellow	4	13	14	30
✦ I do not have pale blood / blood is red / am not anemic	3	10	6	13
✦ I eat more / have good diet / eat foods which increase blood	3	—	6	17
✦ I do not know	—	—	8	17
✦ My body does not look yellow and is not weak	2	6	—	—
Subject feels her diet contains iron				
✦ Yes	23	46	35	70
✦ No	27	54	15	30
Subject feels her diet contains vitamin C				
✦ Yes	27	54	47	94
✦ No	23	46	3	6
Subject has seen iron tablets earlier				
✦ Yes	48	96	40	80
✦ No	2	4	10	20
If yes, where?				
✦ In hospital / health center / doctor	35	73	32	80
✦ Do not know	—	—	11	27
✦ In medical store	12	25	8	20
✦ At home - family member consuming it	11	26	11	27
✦ School	3	8	—	—
✦ Faith healer	2	4	—	—
Subject has consumed iron tablets				
✦ Yes	33	66	8	16
✦ No	17	34	42	84
If yes, advise given by				
✦ Doctor	27	81	7	87
✦ Parents	2	6	1	12
✦ Faith healer	2	6	—	—
✦ Others (class teacher grand-parents, neighbor)	2	6	1	12
✦ Not reported	2	6	—	—

Table 37 (Cont)

Perceptions Of Girls Regarding Anemia And Iron Tablets				
Description	10 to 15 Years (N = 50)		16 to 19 Years (N = 50)	
	n	%	n	%
If yes, period of consumption				
✦ Weeks	23	70	2	25
✦ Months	9	27	4	50
✦ Ongoing since 2 years	—	—	1	12
✦ Do not know	1	3	1	12
If yes, beneficial effects of tablets				
✦ Became more energetic / got strength (weakness removed / tiredness reduced)	25	78	6	75
✦ Memory increased	2	6	3	37
✦ Blood formed in body	4	12	2	25
✦ Blood became pure	5	15	1	12
✦ Body became healthy	14	42	2	25
✦ Put on weight and got iron in body	—	—	1	12
✦ Did not fall ill	3	9	—	—
Subjects willingness for consuming tablets once a week				
✦ Yes	45	90	46	92
✦ No	5	10	4	8

7 2 2 Iron tablets

Majority of the subjects had seen the iron tablets earlier (80% to 96%) Amongst those who had seen it earlier, most had seen it in the hospital or health center while around one-fourth had seen it either at the medical store or at home where either they or a family member was consuming it

Sixty-six percent of the younger girls mentioned that they had consumed iron tablets earlier on doctor's advice while only 16% amongst the older group mentioned having consumed it earlier The major benefits mentioned after consuming the tablets was that they became more energetic or their strength increased or weakness/tiredness reduced A third of the older group mentioned that their memory had also improved

7 3 Perceptions regarding Health and Menstruation

With regard to menstruation (Table 38), majority of the girls started menstruating between the ages 13 to 15 years and most were unaware about it before it started Interestingly, more younger than older girls stated that they had prior knowledge regarding menarche indicating perhaps a trend of preparing girls for this event

Most were not clear about the reasons for menstruation While majority (96%) of the older group felt there was some relation between menstruation and health, most (81%) could not specify Amongst the younger group, majority (88%) did not feel there was any relation between menstruation and health

In both groups, about 60% of the menstruating girls reported that they suffered from problems of stomachache, backache and pain in hands and legs, reduced appetite and tiredness due to menstruation

Box 4 reveals that most girls had negative feelings and emotions associated with onset of menarche, pointing to a need to prepare them adequately for this event in their development

Box 3

Views on Anemia ("Pale Blood") - What the Girls said

Causes and Symptoms of Anemia

- *By eating stale food blood becomes pale*
- *By eating more of salt, due to mental tension and by not taking balanced diet, we get anemia*
- *The blood becomes pale because the girl eats clay and chalk which makes the blood watery and also because of lack of nutritious food*
- *Reason for suffering from anemia is weak body, not taking balanced diet, protein and vitamin deficiency other than this, low level of hemoglobin in blood*
- *If body is not healthy then the circulation of blood stops As the circulation of blood reduces, blood becomes pale*
- *Due to increase in white blood cells in blood blood gets pale*

Appearance of an Anemic Girl

- *She looks like a skeleton*
- *The girl s face has no enthusiasm while talking to other people she gets angry*
- *Girl whose blood is pale and one who looks weak her body is pale and also she suffers from general weakness*
- *Her appetite gets reduced*
- *Her face looks withered and wrinkled*

Problems due to Anemia

- *The girl whose blood is pale she has less strength she cannot see properly and she feels giddy*
- *Girl who has pale blood has low appetite, she feels giddiness and she needs rest*
- *The girl who has pale blood looks pale (yellowish) and she has difficulty or problem during menstruation*

Ways to Improve Pale Blood

- *The girl should take vitamin rich diet as well as the diet which provides hemoglobin*
- *By increasing the digestibility of food, by having more jaggery blood increases in your body, should have vegetables should take iron tablets*
- *Lungs play important part in purification of blood hence it is necessary to keep lungs healthy Balanced diet is also necessary*
- *The girl who has pale blood should eat protein rich food in sufficient quantity and should eat fruits*
- *She should be given fat rich food like milk ghee daily in the morning should do exercise in the morning and should be made to run*
- *For the treatment of anemia blood transfusion should be done*
- *For the treatment of blood to increase hemoglobin medicine should be given*

Benefits of Iron Tablets

- *By eating Shakti ni laal goli one gets energy By eating this tablet one is able to get vitamin which is deficient*
- *By taking the red tablets we get energy interest towards work increases and circulation of blood increases*
- *Body keeps fit and we do not have giddiness after taking these tablets*
- *By taking these tablets blood is increased health increases and intelligence increases*
- *It increases energy and thinking abilities if we do not have energy to do work then after consuming these tablets the work can be done faster we take interest in studying and body remains healthy*
- *By having these red colored iron tablets we feel hungry and can take diet in more amount It gives iron and energy to the body*
- *Blood forms, it remains pure memory power increases, body remains healthy and we get vitamin and iron*
- *By consuming these tablets weakness is diminished and energy develops in the body*

Table 38

Perceptions Of Girls Regarding Menstruation				
Description	10 to 15 Years (N = 50)		16 to 19 Years (N = 50)	
	n	%	n	%
Attained menarche				
✦ Yes	8	16	50	100
✦ No	42	84	0	0
Age at menarche (years)				
✦ 13	3	37	9	18
✦ 14	3	37	21	42
✦ 15	1	12	15	30
✦ 16	—	—	5	10
Class in which menstruation started				
✦ 8th Std	4	50	14	28
✦ 9th Std	2	25	20	40
✦ 10th Std	—	—	16	32
✦ 7th Std	2	25	—	—
Prior awareness about menstruation before it started				
✦ Yes	3	38	4	8
✦ No	5	63	46	92
If yes, who informed				
✦ Mother	2	67	2	50
✦ Friend	—	—	1	25
✦ Sister in-law	—	—	1	25
✦ Elder sister	1	33	—	—
Relation between menstruation and health				
✦ Yes	6	12	48	96
✦ No	44	88	2	4
If yes, elaborate				
✦ Do not know	4	67	39	81
✦ Blood remains pure	1	17	3	6
✦ Changes in body take place	1	17	3	6
✦ For good health onset of menarche is must	—	—	3	6
✦ Waste of body goes out	—	—	4	8
✦ If menses does not start you get pimples	1	17	7	14
Suffer from any problem due to menstruation				
✦ Yes	5	62	33	66
✦ No	3	37	17	34
If yes what problems?				
✦ Stomachache	3	60	24	73
✦ Backache	3	60	14	42
✦ Pain in legs	2	40	13	39
✦ Do not feel like working	1	20	7	21
✦ Pain in hands	—	—	3	9
✦ Problem in sleeping and sitting	—	—	3	9
✦ Feel tired/weak	—	—	2	6
✦ Headache	1	20	—	—
Suffer from following problems after menarche				
✦ Tiredness	4	50	21	42
✦ Breathlessness	1	125	4	8
✦ Reduced appetite	5	625	25	50
✦ Footache	4	50	26	52
✦ Backache	6	75	27	54
✦ Giddiness	1	125	5	10
✦ Others				
Stomachache	—	—	3	6
No problem	—	—	8	16

Box 4

Attaining Menarche

First Feelings and Experiences

- *Freedom is taken away and cannot play like before*
- *When period came for the first time at that time I had stomachache I felt restless for the whole day I did not feel like working, I felt bad I could not play because I felt it was dirty, I did not like it*
- *I felt bad when periods started for the first time After this when I came to know that now I have to follow all the rituals of home, I felt like crying*
- *I did not know how to use sanitary napkin and I also felt bad, I felt inconvenient walking and sitting*
- *When periods came for the first time I felt bad but afterwards I felt good because girls look like an adult only after menstruation starts*
- *It felt strange when it happened the first time but when the elderly people explained about it I came to know about it and felt that I am free as I was before*
- *After entering into adolescence I stopped playing I felt bad about all these things*

Reasons for Menstruation

- *According to me period come to the girls so that all the waste material of the body can come out*
- *Because after 12 years of age sexual changes take place in the body testicles develop blood needs to be removed from the body and so some get periods*
- *When the girl gets her periods it is good - whatever dirt/waste material there is in her body that comes out*

Relation between Menstruation and Health

- *Impure blood is discarded due to menstruation Hence health is improved*
- *For good health onset of menarche is must in girls*
- *Because in some people if they do not get periods they get pimples*
- *All heat of the body comes out through this and body remains healthy*
- *According to science books it is good and has many benefits*

Problems due to Menstruation

- *Because of periods I have headache giddiness backache and I do not like doing anything*
- *Due to menstruation in one part of the stomach there is continuous pain Also I do not like to do any work*
- *I have pain in stomach, cramps in hands and legs, pain in whole body, backache and problem while sleeping and sitting I have to eat tablets to get rid of the pain*
- *Due to menstruation there is pain in the lower abdomen and stomach*

Physical Changes after Menstruation

- *Once menstruation started there was no increase in height*
- *After the onset of menarche height does not increase much, pimples come on the face and surface area of the stomach reduces*
- *Breast development took place and it seems I have grown up*
- *Slowly my body became good after the periods started, the blood of my body became good*

7 4 Perceptions regarding Household Responsibilities and Gender Bias

As seen in Table 39, most girls had household responsibilities such as sweeping and mopping the floor, washing clothes and utensils, helping mother in house work and cooking Their brothers mostly took care of outside work like bringing items from the market (32% to 46%) and also occasionally did house work like arranging bed, keeping utensils, filling water, folding clothes (37% to 48%) About 25% to 32% of girls mentioned that their brothers did not work at all at home, while many mentioned studies as 'work', which their brothers did at home Amongst the

older group, 12% of the girls mentioned that their brothers would carry out only their own work at home like keeping their plates away, ironing their clothes etc

When asked about how they felt about their brothers not working at home, only 18% amongst the younger group and 37% amongst the older group felt bad or did not like it Several girls believed that house work is a girl's responsibility and that their brothers are not expected to do it or help (Box 5)

Table 39

Perceptions Of Girls On Gender Based Household Roles and Responsibilities

Description	10 to 15 Years (N = 50)		16 to 19 Years (N = 50)	
	n	%	n	%
Household responsibilities of girls				
✦ Sweeping and mopping floor	48	96	49	98
✦ Washing clothes	35	70	30	60
✦ Washing utensils	42	84	38	76
✦ Cooking lunch	8	16	15	30
✦ Cooking both meals	8	16	13	26
✦ Helping mother in house work	48	96	42	84
✦ Helping mother in cooking	40	80	40	80
✦ Looking after younger siblings	27	54	10	20
✦ Bringing vegetables or outside work	34	68	21	42
✦ Teaching young siblings	37	74	24	48
✦ Helping in family business	33	66	18	36
✦ Do not do work at home	1	2	1	2
Gender preference in next birth				
✦ Girl	20	40	30	60
✦ Boy	23	46	17	34
✦ Do not know	6	12	3	6
Reasons to become a girl				
✦ Girls have higher status	—	—	11	37
✦ Girls can do lots of work	2	10	7	23
✦ Girls feel for parents	9	45	5	17
✦ Girls can do fashion	4	20	4	13
✦ Girls are good natured	2	10	5	17
✦ Girls can progress in any field	—	—	3	10
✦ No difference between boys and girls	—	—	2	7
✦ Girls are beautiful	—	—	2	7
✦ Girls have honor of becoming mother	2	10	2	7
Reasons to become a boy				
✦ They have more freedom (roam/take up job)	12	52	15	88
✦ They are free from tensions	2	7	4	23
✦ They do not have to work	7	30	4	23
✦ They get more respect	1	4	4	6
✦ They can struggle hard with society	—	—	1	6
✦ No response	3	13	1	6

Box 5

What the Girls Said About Gender Based Roles and Responsibilities

- *I feel good about it Younger brothers are supposed to do household chores but elder brothers are supposed to earn money for the family*
- *I feel good when my brother does not work at home as only girls should do work at home*
- *I like doing work Even though my brother does not work, I like it*
- *I am a girl, that is why I have to do all the work, brother does not do any work*
- *We feel good, now they do not do anything but eventually when they grow up they will have to earn*
- *I get angry*

When asked about whether they would like to be a boy or a girl in the next birth, majority (60%) of the older girls wanted to become a girl again mainly because they believed that girls have a higher status (are given more respect), girls can do lots of work, they are good natured, they 'feel more' for their parents and girls can dress up in various ways ('fashion') Only 40% of the younger group wanted to be a girl again mainly because they felt that girls can serve the parents better and can do fashion

Those who wanted to become a boy in the next birth said that they felt that boys have more freedom and independence, they can roam about at any time, are free from tensions and do not have to work Box 6 elaborates on their responses

Box 6

Do I Want to be a Girl or a Boy in my Next Birth?

I want to be a boy in my next birth because

- *I do not like to work, and I like to have fun*
- *A boy does not have to do any work He can roam about with freedom and nobody stops him from doing anything*
- *He can move about according to his desire Also girls do not get too much respect, boys get more respect*
- *They are free from tensions and can easily go where they please*

I want to be a girl in my next birth because

- *Now a days there is no difference between girls and boys I like to remain serious I love to do all the work which girls are supposed to do*
- *She can do fashionable and her status is higher*
- *Her status is high and she is treated as Lakshmi'(Goddes of wealth) in the house*
- *They look fair and beautiful*

To sum up the perceptions of the adolescent girls, a majority believed that they were healthy and did not give much importance to minor health problems including symptoms of anemia Their perception of good health was related primarily to their life experiences such as ability to do housework, not feeling tired or not falling ill often, having a good appetite, having a good appearance and nature and a few added aspects of mental health such as freedom from 'tension' Awareness about anemia and its treatment was poor The relationship between a nutritious diet and health or anemia prevention was very general, with inadequate knowledge about specific iron or vitamin C rich foods to 'increase blood' Most girls had negative feelings about menarche and did not see its association with anemia Gender based roles and responsibilities were by and large accepted unquestioningly by the girls and the relationship between women s work' (especially if excessive) and 'poor health and nutrition' was largely unknown

Impact Evaluation Of The Weekly IFA Supplementation Interventions

In all Tables presented in this section only those girls were included in the analysis who had consumed at least 80% of the total dose of tablets (i e 21 tablets and above)

Hemoglobin Levels

There was a significant decrease in the prevalence of anemia in the experimental group from 71% to 29% as well as the control group from 71% to 41% The extent of decrease in percent prevalence of anemia was similar in both the groups (Table 40)

Table 40

Proportion Of Anemic[1] Subjects Before And After The Intervention In Experimental And Control Groups

Age Group (Years)	% Anemic in Experimental Group			% Anemic in Control Group		
	Pre	Post	% Decrease	Pre	Post	% Decrease
10 12	37	12	25	36	19	17
13 - 19	34	17	17	35	22	13
Overall	71	29	42	71	41	30

[1] HB ≥ 12 g/dl

Table 41, indicates that in both the experimental and the control group girls, mean hemoglobin rose from 11g/dl to 12g/dl after the intervention (0 9 to 1 0 g/dl increment) The pattern of increase was similar in most age groups Comparing the hemoglobin increments (Table 42), it was seen that the increment tended to be somewhat higher in most age groups in experimental subjects than controls, but this difference was non-significant Figure 17 shows that there was a similar shift to the right in the frequency distribution curve of both the experimental and control groups indicating that the IFA supplementation had no significant impact in improving hemoglobin values

Table 41

Mean Change In Hemoglobin In The Study Groups After Intervention (N=729)

Age (Years)	Experimental Group				Control Group			
	N	Initial Mean ± SE	Final Mean ± SE	Mean Change	N	Initial Mean ± SE	Final Mean ± SE	Mean Change
10	37	11 68 ±0 17	12 98 ±0 16	1 30 ±0 23	49	11 71 ±0 15	13 14 ±0 12	1 42 ±0 18
11	64	11 02 ±0 17	12 73 ±0 15	1 70 ±0 18	72	11 47 ±0 15	12 63 ±0 13	1 15 ±0 18
12	84	11 51 ±0 15	12 53 ±0 12	1 02 ±0 17	92	11 04 ±0 16	11 90 ±0 12	0 86 ±0 17
13	89	11.24 ±0 13	12 17 ±0 15	0 93 ±0 17	92	11 18 ±0 14	11 99 ±0 16	0 82 ±0 17
14	37	11.28 ±0 23	12 60 ±0 21	1 31 ±0 25	30	11 07 ±0 25	11 90 ±0 27	0 83 ±0 28
15	23	10 15 ±0 28	12 39 ±0 28	1 24 ±0 38	36	10 54 ±0 24	11 78 ±0 27	1 24 ±0 31
16-19	10	11 02 ±0 49	12 75 ±0 45	1 73 ±0 11	12	10 22 ±0 35	11 75 ±0 30	1 53 ±0 44
Overall	344	11 23 ±0 07	12 46 ±0 07	1 22 ±0 08	385	11 16 ±0 07	12 20 ±0 07	1 04 ±0 08

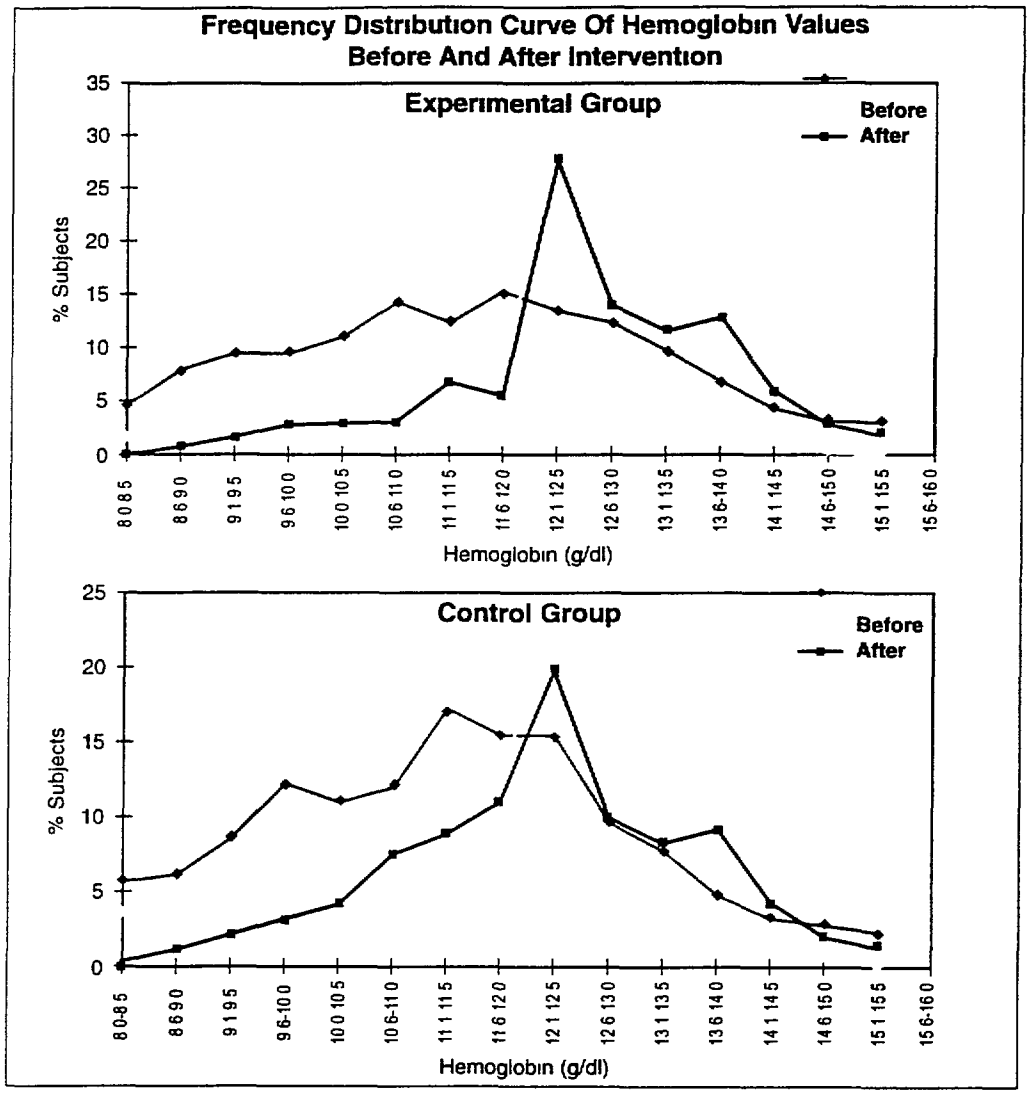
Table 42

Comparison Of Mean Hemoglobin Increments In Experimental And Control Groups

Age (Years)	Mean Change (E^1)	Mean Change (C^2)	Mean Difference (E-C)	't' Value	'p' Value
10	1.297	1 421	-0 124	0 4315	0 6671
11	1 702	1 151	0.551	2 1134	0 0364
12	1 018	0 858	0 160	0 6531	0.5145
13	0 926	0 816	0 110	0 4544	0 6500
14	1 314	0 833	0 480	1.2634	0.2109
15	1.239	1.244	0 011	0 1011	0 9913
16-19	1 730	1 533	0 197	0.3001	0 7671
Overall	1 217	1 038	0 179	1 5179	0 1294

[1] Experimental Group (N=344)
[2] Control Group (N=385)

Figure 17



The anemic subjects showed a higher mean increment in hemoglobin levels than the non-anemics subjects in both the experimental and control groups

Thus the hematological data of the present study has demonstrated that the hemoglobin improvements in both the groups are more a function of adolescent growth rather than the impact of weekly IFA supplementation given in a dose of 100 mg elemental iron + 0 5 mg folic acid

Appetite Score

Table 43 reveals that there is no consistent difference between experimental and control groups with regard to change in the appetite scores between anemics and non-anemics Perhaps the girls could not understand the rating scale adequately suggesting that methodological improvement is required in the administration of the scale Also, administration of such scales in school situation and slum situation seem to elicit different responses For example, in the previous study the girls in slums could comprehend the rating scale and fill it up, whereas in the present school study, the girls as a whole could fill up the rating scale only after considerable guidance from the investigators In Table 44, however, a trend towards better appetite in experimental group as compared to control group is seen and is significantly better However, more investigation is required in this area for a better understanding of the relationship between IFA supplementation and appetite

Table 43

Comparison Of Scores Indicating Appetite And Fatigue In Experimental And Control Groups (% Subjects)

Criteria	Experimental Group (N=285)		Control Group (N=300)	
	Pre	Post	Pre	Post
Appetite Scores				
Anemics				
✦ 0 3	2	8	3	8
✦ 4 7	11	7	17	13
✦ 8 10	2	1	2	1
Non Anemics				
✦ 0 3	8	32	14	31
✦ 4 7	66	43	57	38
✦ 8 - 10	10	9	7	9
Fatigue Scores				
Anemics				
✦ 0 3	3	9	4	11
✦ 4 7	10	6	14	9
✦ 8 10	2	1	4	2
Non-Anemics				
✦ 0 3	13	43	14	40
✦ 4 7	53	36	44	33
✦ 8 10	17	5	20	5

Table 44

Post Intervention Appetite Data Of Experimental And Control Groups (% Subjects)

Criteria	Experimental Group (N=285)	Control Group (N=300)	Values
Feel hungry at meal time			
✦ Yes	96	92	4 505*
✦ No	4	8	
Family members say you eat more than before			
✦ Yes	41	39	3 512*
✦ No	58	61	
You feel more hungry than before			
✦ Yes	66	68	0 190
✦ No	2	32	
You feel less tired than before			
✦ Yes	74	75	0 071
✦ No	26	25	

* Significant according to chi-square test

Dietary Intake

Mean nutrient intake

Tables 45 to 47 show that nutrient intakes of the experimental and control groups in all age groups - 10 to 12 years, 13 to 15 years and 16 to 19 years - were essentially similar after the intervention There were wide variations in the nutrient intakes amongst the girls due to which it is not possible to arrive at any definitive conclusions One reason for these wide variations could be that the present subjects belong to the middle income group where a greater variety of foods are available and the adolescents are likely to have varied choices in the amount and type of foods they eat It should be noted in both experimental and control groups, intake of Vitamin C and β - carotene markedly increased after intervention (Figures 18 to 20), indicating that the informal and indirect nutrition education that took place due to the interaction of girls with the investigators and the materials given to them (e g labels and compliance cards), might have had a positive impact on the intake of protective foods like fruits

Table 45

Mean Change In The Nutrient Intakes Of 10 to 12 Year Old Girls Pre And Post Intervention Data

Nutrient (Unit)	Mean ± SE Median	Experimental Group (N=7)			Control Group (N=8)		
		Initial	Final	t	Initial	Final	t
Calories (kcal)	Mean ± SE Median	1520 ±101 4 1520	1484 ±160 6 1484	0 1911	1532 ±117 2 1532	1623 ±98 7 1779	0 5952
Proteins (g)	Mean ± SE Median	31 1 ±2 5 31 1	45 6 ±4 5 46 9	2 8160	36 1 ±3 2 36 1	32 8 ±2 5 32 8	0 8128
Fat (g)	Mean ± SE Median	48 2 ±4 0 50 1	48 0 ±7 8 43 9	0 0228	62 6 ±6 5 62 1	55 7 ±6 8 55 7	0 7335
Iron (mg)	Mean ± SE Median	9 6 ±1 5 9 1	10 5 ±1 5 11 3	0 4242	17 7 ±3 3 16 3	16 1 ±3 5 15 7	0 3326
Calcium (mg)	Mean ± SE Median	326 ±43 1 326	428 ±50 5 424	1 5330	404 ±65 3 380	516 ±99 1 516	0 9504
Vitamin C (mg) Median	Mean ± SE 25	25 ±2 1 64	73 ±24 5	1 9723 43	43 ±4 5 5	55 ±7 8	1 3215
β Carotene (μg)	Mean ± SE Median	311 ±44 5 311	465 ±51 8 465	2 2580	378 ±46 0 378	751 ±131 2 751	2 6864

Table 46

Mean Change In The Nutrient Intakes Of 13 to 15 Year Old Girls Pre And Post Intervention Data

Nutrient (Unit)	Mean ± SE Median	Experimental Group (N=8)			Control Group (N=6)		
		Initial	Final	't'	Initial	Final	't'
Calories (kcal)	Mean ± SE Median	1440 ±86 2 1411	1450 ±155 8 1312	0 0540	1219 ±18 6 1216	1617 ±193 1 1719	2 052
Proteins (g)	Mean ± SE Median	34 9 ±2 4 34 6	40 3 ±5.2 37.2	0 943	38 6 ±4 9 34 9	41 9 ±7 8 44 7	0 358
Fat (g)	Mean ± SE Median	42 6 ±3.2 42 6	48 7 ±3 7 48 7	1.247	49 0 ±4 8 45 3	43 2 ±6 8 37 3	0 696
Iron (mg)	Mean ± SE Median	14 6 ±1 3 13 3	8 2 ±1 0 8 3	3 902	9 4 ±1 8 8.2	11 0 ±1 7 10 5	0 646
Calcium (mg)	Mean ± SE Median	344 ±43 1 336	394 ±54 3 394	0 724	355 ±59 3 339	313 ±50 6 277	0 549
Vitamin C (mg)	Mean ± SE Median	29 5 ±5 6 26	47 ±70 0 47	1 963	11 ±0 4 11	34 ±4 9 34	1 3215
ß Carotene (µg)	Mean ± SE Median	560 ±81 0 543	577 ±120 9 577	0 116	300 ±32 5 294	362 ±47 9 362	1 064

Table 47

Mean Change In The Nutrient Intakes Of 16 to 19 Year Old Girls Pre And Post Intervention Data

Nutrient (Unit)	Mean ± SE Median	Experimental Group (N=4)			Control Group (N=5)		
		Initial	Final	't'	Initial	Final	't'
Calories (kcal)	Mean ± SE Median	1467 ±258 4 1300	1525 ±205 0 1357	0 191	1698 ±276 2 1483	1294 ±115 8 1287	1 346
Proteins (g)	Mean ± SE Median	37 7 ±4 1 34 7	44 3 ±9 6 39 5	0 287	37 3 ±4 8 35 5	30 8 ±2 3 34 2	1 221
Fat (g)	Mean ± SE Median	67 3 ±9 5 68 8	73 4 ±19 0 56 9	0 287	54 4 ±9 9 43 5	56 9 ±11 1 55 0	0 168
Iron (mg)	Mean ± SE Median	11.2 ±1 7 11 8	13 1 ±2 2 11.5	0 909	9 8 ±1 8 8 6	8 2 ±1 7 7 6	0 646
Calcium (mg)	Mean ± SE Median	377 ±80 1 390	726 ±158 5 873	1 969	352 ±36 8 316	406 ±104 0 334	0 483
Vitamin C (mg) Median	Mean ± SE 12	19 ±7 9 89	79 ±13 5	3 829 10	25 ±13 7 70 5	79 ±28 4	1 706
ß Carotene (µg)	Mean ± SE Median	345 ±62 3 337	3724 ±575 1 3889	5 840	333 ±29 6 292	2323 ±585 4 1639	3 394

Figure 18

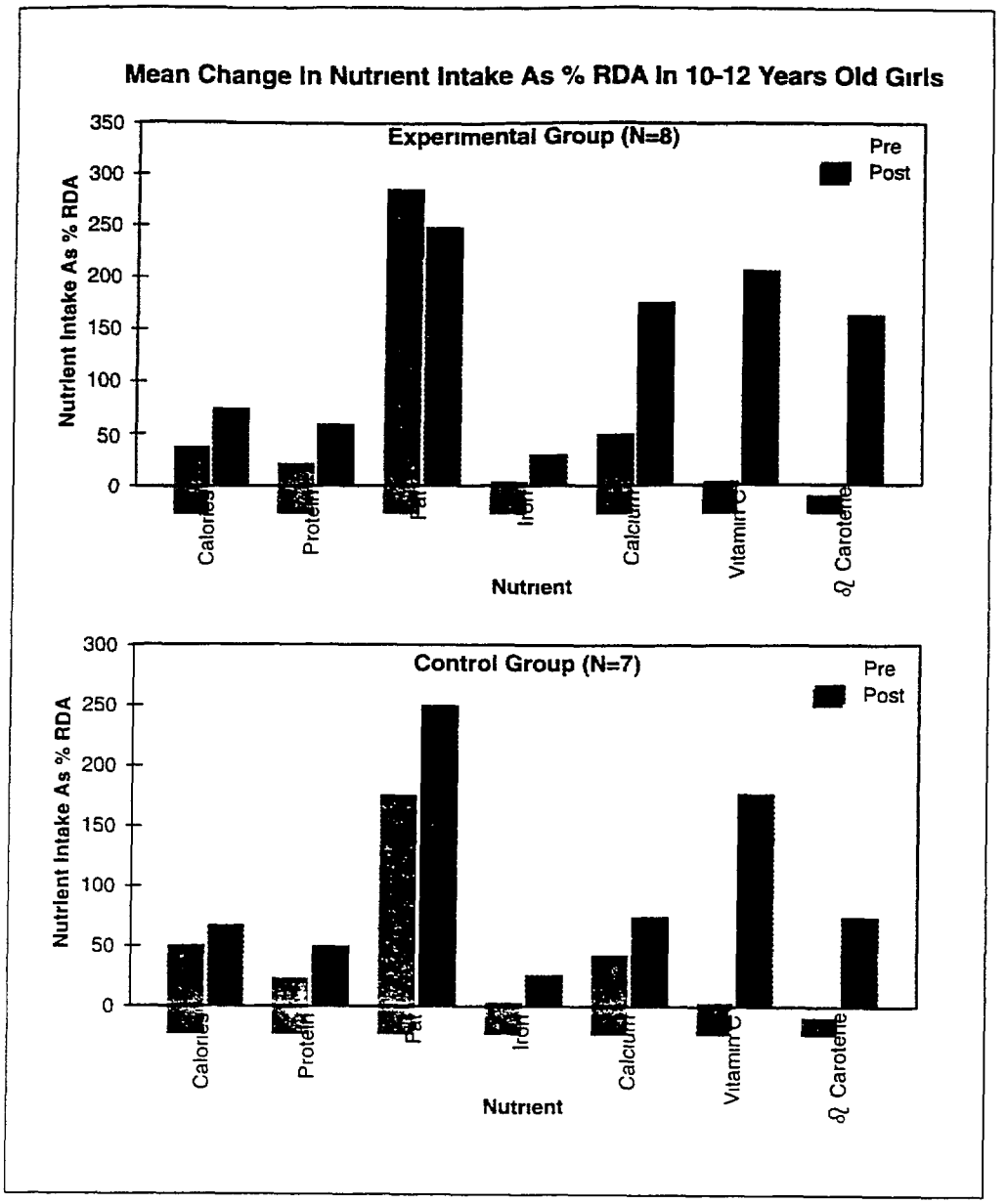

Mean Change In Nutrient Intake As % RDA In 10-12 Years Old Girls
Experimental Group (N=8)
Pre
Post
Nutrient Intake As % RDA
350
300
250
200
150
100
50
0
Calories
Protein
Fat
Iron
Calcium
Vitamin C
β Carotene
Nutrient
Control Group (N=7)
Pre
Post
Nutrient Intake As % RDA
300
250
200
150
100
50
0
Calories
Protein
Fat
Iron
Calcium
Vitamin C
β Carotene
Nutrient

Figure 19

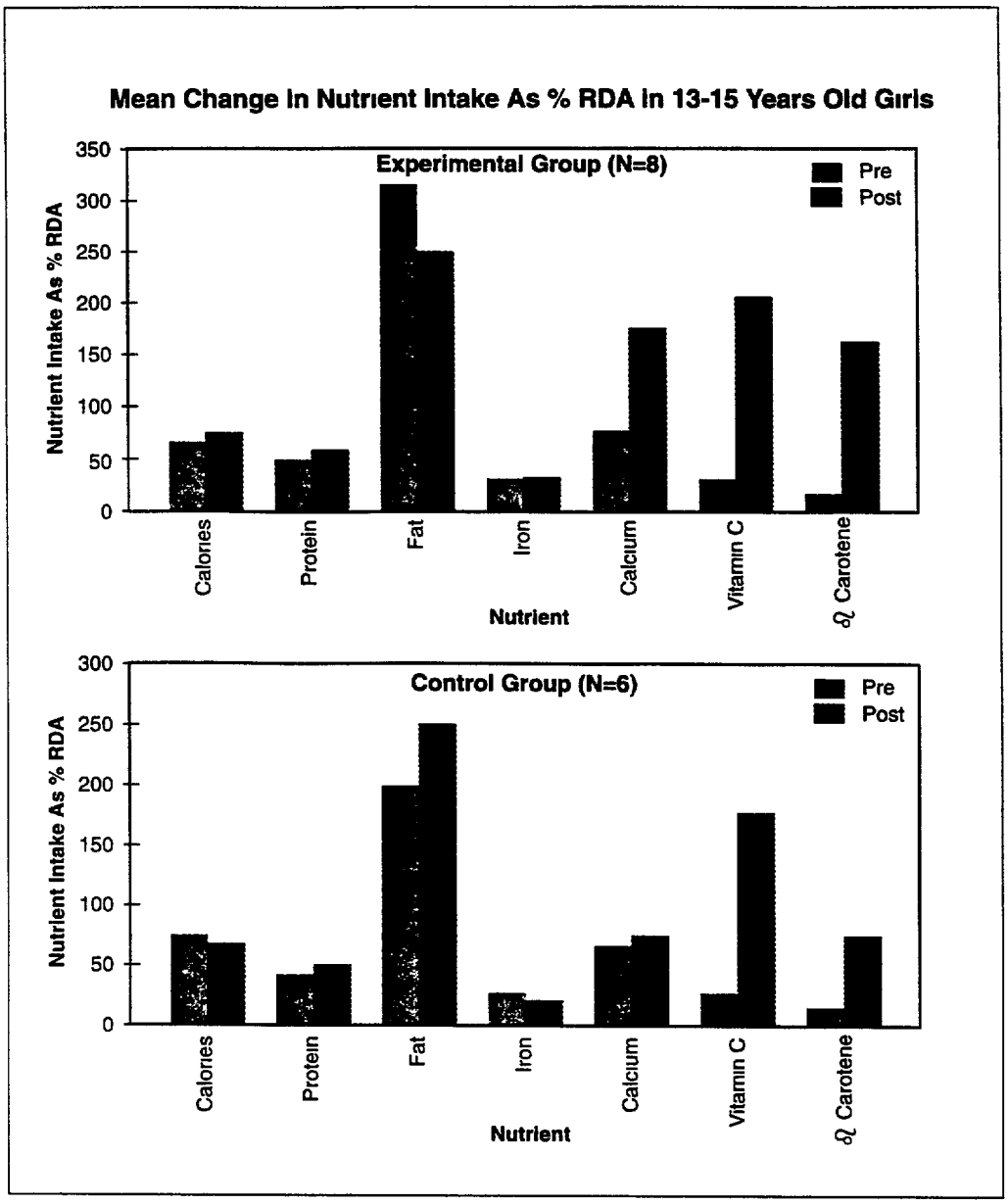
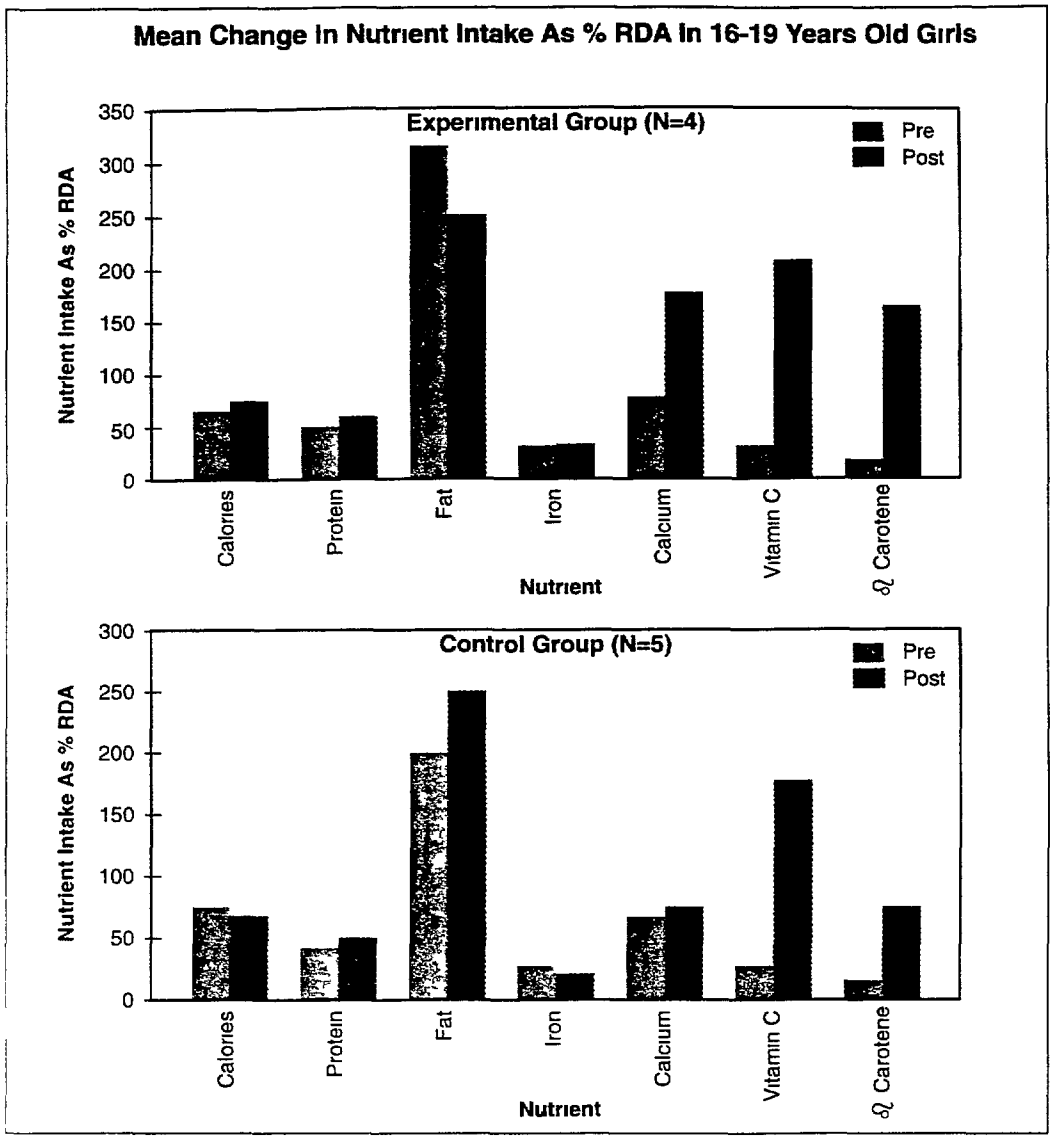

Mean Change In Nutrient Intake As % RDA In 13-15 Years Old Girls
Experimental Group (N=8)
Pre
Post
Nutrient Intake As % RDA
350
300
250
200
150
100
50
0
Calories
Protein
Fat
Iron
Calcium
Vitamin C
β Carotene
Nutrient
Control Group (N=6)
Pre
Post
Nutrient Intake As % RDA
300
250
200
150
100
50
0
Calories
Protein
Fat
Iron
Calcium
Vitamin C
β Carotene
Nutrient

Figure 20



Concept of body image and effect on food intake

The investigators observations during the study period are summarized below

For most girls, an ideal body image was that of a 'thin girl' whose ideal body weight is 40 kg They did not want to consume amounts of foods which were excessive according to them Most of the mothers during the diet survey expressed concern at the poor food intake of the girls About one-third of the mothers worried that if girls eat more food then they will become overweight Responses which were given by the girls about the parental support for their food intake were

Mummy mane kahe chhe ke tane pahela karata vadhare bhukh laage chhe Ane kahe chhe ke ketlu khayae chhe !"

(My mother says that you feel more hungry than before and she also says how much you eat!)

Bahu na kha nahee to vajan vadhi jase'

(Don't eat too much otherwise, your weight will increase)

'Mummy evu kahe chhe ke tu khavudhari chhe"

(My mother says that you eat too much food)

Growth

As Tables 48 to 50 indicate, there was a similar increase in weight, height and BMI of girls in both the experimental and the control groups on account of normal pubertal growth

Table 48

Mean Change In Height In The Study Group After Intervention (N=729)

Age (Years)	Experimental Group				Control Group			
	N	Initial Mean ± SE	Final Mean ± SE	Mean Change	N	Initial Mean ± SE	Final Mean ± SE	Mean Change
10	37	133 5 ±1 19	136 8 ±1.21	3 33 ±0 18	49	132 1 ±1 14	135.2 ±1 17	3 19 ±0 19
11	64	139 5 ±0 93	143 1 ±3 60	3 60 ±0 19	72	139 4 ±0 87	143 2 ±0 86	3 73 ±0 19
12	84	145 8 ±0 74	148 5 ±0 69	2 70 ±0 18	92	143 9 ±0 62	147 3 ±0 57	3 29 ±0 16
13	89	147 3 ±0 72	149 7 ±0 70	2 44 ±0 16	92	147 5 ±0 68	149 9 ±0 64	2 38 ±0 14
14	37	149 5 ±1 04	151 4 ±1 01	1 87 ±0.25	30	150 0 ±1 19	151 5 ±1 02	1 49 ±0.28
15	23	150 5 ±1 28	151 3 ±1 27	0 87 ±0 18	36	151 2 ±0 75	152 4 ±0 79	1 19 ±0 19
16 19	10	149 9 ±1 52	150 3 ±1 51	0 38 ±0 14	12	151 3 ±1.55	152 2 ±1 69	0 93 ±0 27
Overall	344	144 5 ±0 46	147 1 ±0 43	2 59 ±0 09	385	143 9 ±0 45	146 6 ±0 42	2 71 ±0 09

Table 49

Mean Change in Weight In The Study Group After Intervention (N=729)

Age (Years)	Experimental Group				Control Group			
	N	Initial Mean ± SE	Final Mean ± SE	Mean Change	N	Initial Mean ± SE	Final Mean ± SE	Mean Change
10	37	27 59 ±1 04	30 59 ±1 19	3 00 ±0 34	49	26 08 ±0 81	28 45 ±0 95	2 37 ±0 27
11	64	30 42 ±0 90	33 17 ±0 92	2 75 ±0 32	72	29 78 ±0 66	32 67 ±0 68	2 88 ±0 16
12	84	34 38 ±0 75	37 07 ±0 75	2 69 ±0 19	92	33 12 ±0 58	36 09 ±0 60	2 87 ±0 21
13	89	36 89 ±0 70	39 01 ±0 71	2 12 ±0 19	92	36 85 ±0 67	39 06 ±0 72	2 21 ±0 18
14	37	39 50 ±1 29	41 05 ±1 34	2 00 ±0.29	30	39 92 ±1 13	41 83 ±1 11	1 92 ±0 33
15	23	38 63 ±0 82	39 46 ±0 84	0 83 ±0 28	36	39 59 ±0 89	40 46 ±0 84	0 86 ±0 22
16-19	10	41 00 ±2 78	41 35 ±2 86	0 35 ±0 43	12	42 92 ±1 34	43 08 ±1 50	0 17 ±0 58
Overall	344	34 59 ±0 42	36 91 ±0 42	2 32 ±0 11	385	34 04 ±0.38	36 33 ±0.38	2 29 ±0 09

Table 50

Mean Change In BMI In The Study Group After Intervention (N-729)								
Age (Years)	Experimental Group				Control Group			
	N	Initial Mean ± SE	Final Mean ± SE	Mean Change	N	Initial Mean ± SE	Final Mean ± SE	Mean Change
10	37	15 34 ±0 42	16 21 ±0 45	0 87 ±0 17	49	14 87 ±0.34	15 33 ±0 34	0 46 ±0 18
11	64	15 45 ±0 31	16 03 ±0 31	0 58 ±0 16	72	15.24 ±0.23	15 88 ±0.24	0 64 ±0 07
12	84	16 06 ±0.26	16 73 ±0 03	0 67 ±0 08	92	15 96 ±0.21	16 58 ±0 21	0 63 ±0 09
13	89	17 01 ±0.28	17 35 ±0 26	0 35 ±0 12	92	16 86 ±0.24	17 32 ±0.26	0 46 ±0 08
14	37	17 61 ±0 49	18 07 ±0 53	0 46 ±0 12	30	17 69 ±0 42	18 22 ±0 45	0 53 ±0 14
15	23	17 07 ±0 34	17 25 ±0 35	0 17 ±0 13	36	17 32 ±0 37	17 43 ±0 36	0 11 ±0 11
16-19	10	18 16 ±1 05	18 23 ±1 09	0 07 ±0 18	12	18 82 ±0 69	18 71 ±0 77	0 11 ±0.24
Overall	344	16 14 ±0 14	16 93 ±1 14	0 68 ±0 07	385	16 27 ±0 12	16 76 ±0 12	0 49 ±0 44

Comparing the growth of anemic versus non-anemics Tables 51 t0 53 reveal that

- There was a similar increase in the weights and heights of anemic and non-anemic subjects of both the experimental and control groups
- BMI values were also essentially similar in both groups, experimental and control, overall as well as in anemic and non-anemic girls

In sum the weekly IFA supplementation did not significantly enhance growth over and above that seen in puberty

Table 51

Comparison Of Mean Height Increments In Experimental And Control Groups					
Age (Years)	Mean Change (E[1])	Mean Change (C[2])	Mean Difference (E-C)	't' Value	p' Value
10	3 327	3 188	0 139	0.5228	0 6025
11	3 600	3 726	-0 126	0 4606	0 6458
12	2 701	3 289	-0.588	2 4322	0 0160
13	2 437	2 377	0 060	0.2786	0 7808
14	1 868	1 497	0 371	0 9777	0 3318
15	0 870	1 186	-0 317	1 1553	0 2527
16-19	0 380	0 933	-0.553	1 6981	0 1049
Overall	2 588	2 714	-0 126	1 0167	0 3096

1 Experimental Group (N=344)
2 Control Group (N=385)

Table 52

Comparison Of Mean Weight Increments In Experimental And Control Groups					
Age (Years)	Mean Change (E^1)	Mean Change (C^2)	Mean Difference (E-C)	't' Value	'p' Value
10	3 000	2 367	0 633	1 4591	0 1482
11	2 750	2 882	-0 132	0 3759	0 7075
12	0 685	2 875	-0 190	0 6827	0 4956
13	2 115	2.205	-0 091	0 3382	0 7355
14	2 000	1 917	0 083	0 1889	0 8507
15	0 826	0 861	-0 035	0 0968	0 9231
16-19	0 350	0 167	0 183	0.2457	0 8083
Overall	2 317	2.295	0 023	0 1578	0 8746

[1] Experimental Group (N=344)
Control Group (N=385)

Table 53

Comparison of Mean BMI Increments In Experimental And Control Groups					
Age (Years)	Mean Change (E^1)	Mean Change (C^2)	Mean Difference (E-C)	't' Value	'p' Value
10	0 866	0 459	0 407	1 5510	0 1246
11	0 577	0 639	-0 062	0 3669	0 7142
12	0 674	0 625	0 049	0 3915	0 6958
13	0 345	0 456	-0 111	0 7708	0 4418
14	0 463	0 525	-0 062	0 3302	0 7422
15	0 175	0 114	0 061	0 3575	0 7219
16-19	0 069	-0 107	0 176	0 5651	0 5782
Overall	0 518	0 486	0 032	0 4570	0 6478

Experimental Group (N=344)
Control Group (N=385)

Feasibility Of The Intervention

The teachers were involved right from the beginning in the supervision of iron supplementation in each class As explained in the previous chapter they were explained about the procedure of giving iron tablets to the girls and helping them swallow the tablets with water They were also explained how to fill up the compliance registers each time they gave the tablets

Teachers in most classes were co-operative and followed the weekly regime except for one to two teachers who were reluctant to give the tablets because there were three boxes from which tablets were to be given and compliance was to be marked accordingly This took up sometime which a few teachers did not welcome However, in several classes the girls compensated for the lack of teacher's interest or absence by enthusiastically taking over the responsibility of distributing IFA tablets

The age group of girls greatly affected the compliance The younger girls were far more co-operative in swallowing the tablet than the older girls in secondary section It appears that if only one type of tablet is to be given to all girls, then it is likely to be a more feasible proposition to integrate it into the school routine

Benefits Of The Intervention

Benefits of consuming the tablets as expressed by the girls

- A majority of the girls from classes 6th to 9th as well as from higher classes said in informal conversations that they feel more hungry and less tired while working

  "Saru lage chhe have Khawaye chhe vadhare"

  (I feel good now I can eat more)

- During 24-hour dietary recall, some mothers said that their daughters tended to eat more after consuming the tablets One mother was very pleased with her daughter's health and she appreciated that such inputs were given in the school

- Some girls reported that their headache was cured after taking the tablets

  Pehla amne mathu dukhtu hatu, have nathi dukhtu "

  (Earlier my head used to ache, now it does not pain)

  Other benefits reported by a few girls were that their memory had improved and their weight gain was more In fact, one girl said,

  I have become fat after consuming the tablets Now you give me tablets to reduce my weight !"

- As regards one severely anemic girl (who had received IFA tablets), the class teacher reported that she had become more active mentally and physically and there was a great improvement in her weight gain The girl too corroborated this observation

Response of the Girls to the Anemia Education Material

Labels

This was effective in spreading awareness regarding dietary sources of iron and Vitamin C and IFA tablets The girls remembered the catchy slogans and liked the information given on the labels On an average, they remembered 3 slogans out of the 4 printed on the labels

Compliance cards cum time table

Most students did not realize that the card had a dual purpose of recording compliance with IFA as well as for the school time table The younger girls used the material more as a time table than as a compliance record, while many of the older girls could perceive it more for compliance recording

Brochure

The brochure was meant more for the parents and a few parents did give a feedback that they liked the brochure The students did not refer much to the brochure and could not recall its messages

The overall idea of giving the anemia educational material was to motivate girls to consume IFA tablets which most of them did under supervised conditions

Discussion and Conclusion

Given the immediate benefits of raising the iron status of adolescent girls for their own health and their long term reproductive health, recent research globally is focussing on efficacy and efficiency of IFA supplementation on hematological status and growth However, whether the supplementation should be weekly or daily is a debatable issue The rationale for recommending the weekly supplementation has been that the net absorption of iron from the gastrointestinal track over the week is essentially similar whether weekly or daily supplementation is given in view of the regulatory mechanism of iron absorption at the mucosal level Also, it is believed that the side effects are likely to be less with weekly supplementation

In India there have been several studies investigating the impact of IFA supplementation on prevalence of anemia in adolescent girls which have been recently reviewed (Kanani and Ghanekar, 1997) In India, UNICEF supported three multicentric studies to compare the effects of weekly dosing with daily dosing on prevalence of anemia Two studies showed that weekly dosing was effective while the third study did not perhaps because it was an unsupervised community based distribution trial, assuring compliance was a key issue for reducing anemia (Personal communication, UNICEF (Gujarat) Program Officer, 1998)

Research on impact of iron-folate on growth of adolescent girls is scarce There are a few studies where daily iron supplementation for varying periods of 12 to 14 weeks to school children led to significant improvements in children's hematological status and growth (Chwang et al 1988, Lawless et al 1994) Our earlier study reported in Section 1 also showed that in adolescent girls, daily iron supplementation for 12 weeks improved pubertal growth This study as well as the one by Lawless et al (1994) showed that improvement in growth could also be a function of improved appetite which resulted after supplementation Zavaleta et al (1997) compared the impact of daily, intermittent (2 days/week) iron supplementation and placebo for 16 weeks among 12 to 18 year old adolescent girls in Peru They reported that the daily supplementation was significantly better than the intermittent one in raising hemoglobin values

Our weekly supplementation study on adolescent girls did not show an impact as did the daily supplementation on hematinic status and growth Though a trend towards better improvement was seen in experimental subjects as compared to controls in the weekly supplementation, in rapidly growing anemic girls such as those in the present study the weekly supplementation was clearly not adequate to meet iron needs and significantly reduce anemia or improve appetite or growth The reasons for this could be several, but a primary reason is perhaps the inadequacy of the weekly iron dose to overcome the level of anemia seen in the girls, and to meet growth requirements This conclusion is strengthened by the fact that daily supplementation for a shorter period did improve appetite and growth, as highlighted in Section 1 Weekly trials for 12 to 24 months could show impact on hematinic status and growth and need not be studied in rural and urban settings

The efficacy of daily or weekly supplementation depends on several factors such as the target group s initial hemoglobin level, the hypothesized 'mucosal block effect' regulating iron absorption, the dosage of the IFA supplements, presence of infectious or parasitic infestations and above all, compliance with the supplementation regimen Compliance in large part is determined by the operational, field level effectiveness of the large scale IFA supplementation programs

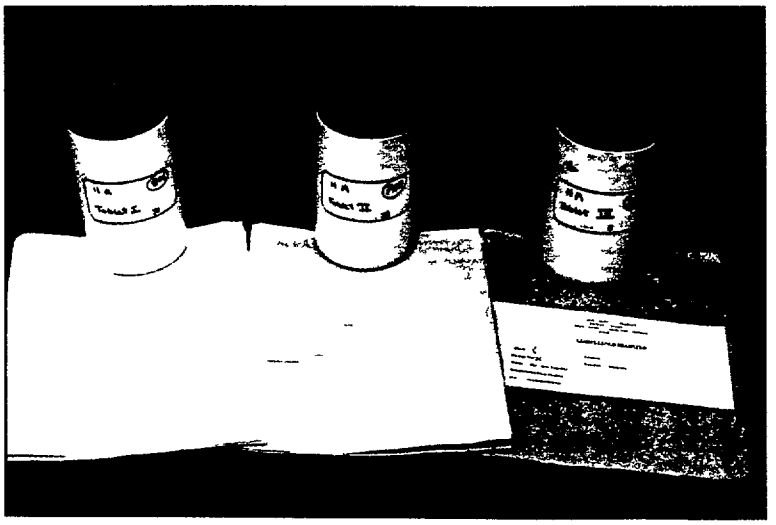
Our experience suggests that with well designed and implemented nutrition awareness activities and encouragement given through counselling, a majority of adolescent girls willingly comply with either daily or weekly IFA supplements Dropouts are few and relate partly to the reluctance of girls to take any medication on a long term basis Further, implementing interventions such as the daily or weekly iron supplementation through the school system could be a cost effective and feasible measure in terms of reaching a large number of girls during their pre-adolescent and adolescent period

However, as a recent Micronutrient Initiative and UNICEF document states (Gillespie 1998) Prevention of anemia, as an objective, need not be pursued through supplementation, but rather through other non-targetted approaches such as dietary modification and food fortification For adolescent girls particularly, nutrition communication and education approaches need to be seriously considered to improve not only their iron-folate status, but their nutritional status in terms of growth and prevention of other

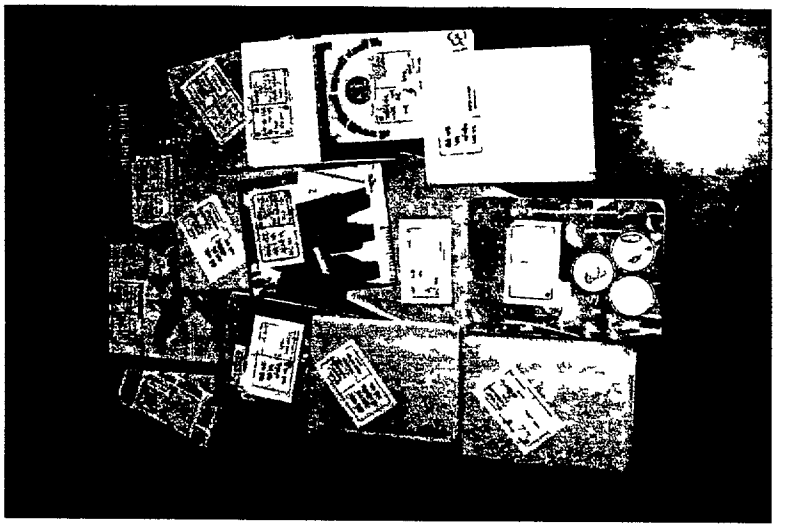
deficiencies such as vitamin A A recent study in Vadodara, India (Kanani and Agarwal, 1997) clearly showed that nutrition communication alone could significantly improve levels of awareness, specific dietary behaviours and nutritional status (weight and height gain, increased hemoglobin levels) of school going girls and young adolescents in the experimental school versus that of the control school

As a long term stretegy for reducing anemia in women, well designed intervention trials are required on adolescent girls not only in the low income group but even in girls of better socio-economic status who also suffer from anemia and growth retardation Adolescent boys also are known to be anemic especially in disadvantaged groups and should also be included in anemia control interventions

The Study In Pictures



The Iron Folate and Placebo tablets with the Compliance registers for teachers



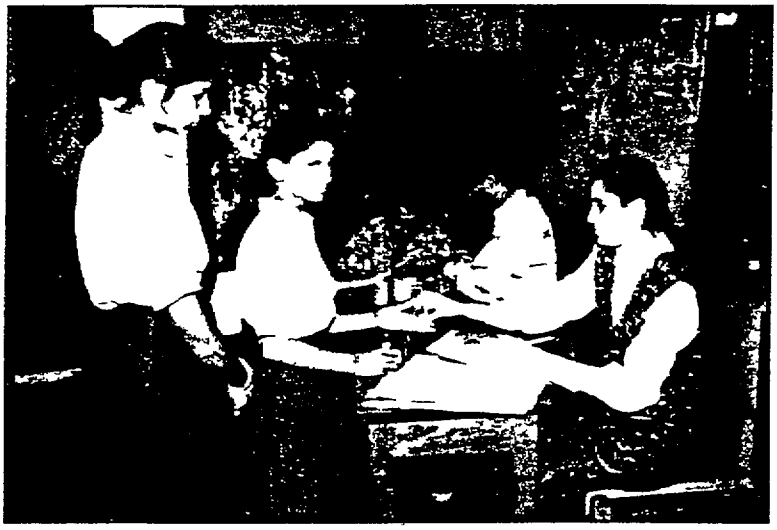
Catchy slogans on books Labels to educate girls on anemia

Girls in a class filling in compliance cards

The Study In Pictures

How much does an adolescent girl eat? 24 hour dietary recall survey in progress

Class monitors ensure that girls swallow the tablets



Gwung finger prick blood sample for hemoglobin estimation

APPENDICES

Appendix - 1A

Socio-Economic Background of the Subjects

Name

Age

School-going/Non-school going

Religion

Veg/Non-veg

Mother's education &

Father's education

- Illiterate
- Primary
- SSC /HSC
- Graduate

Father's occupation

- Service
- Self employed
- Daily wage labourer
- Skilled labourer

Mother's occupation

- Housewife
- Cook/maid servant
- Daily wage labourer
- Others

Type of house

- *Kuccha* (Brick walls and tin roof)
- Semi-*pucca* (Cemented walls and tin roof)
- *Pucca* (Cemented walls, roof and tile flooring)

Toilet facility

- Open
- Community toilets
- Own

Income per month (PCI)

General comments

Appendix - 2A

Check-list for History of Anorexia

1	Do you feel hungry at meal time?	Yes (2)	No (1)
2	Do you feel hungry at times other than meal time?	Yes (2)	No (1)
3	Do your family members (specify) feel that you eat less than you ought to?	Yes (1)	No (2)
4	Do you think that you eat less now than you did earlier? (specify Now and Earlier)	Yes (1)	No (2)

Total Score

Rating Scale

Please circle any one of the scores that you feel most closely matches your own appetite i e the extent of hunger according to you Lesser the score, less hungey you feel More the score, more hungry you feel

1	2	3	4	5	6	7	8	9	10

Appendix - 3A

Semi-Structured Interview Schedule

Name of the subject

Age of subject

Health and Nutrition

1 Do you think you are healthy? Give reasons

2 Do you know the difference between a healthy and an unhealthy person? If yes, what ?

3 (a) Which health problems do you face frequently?

(b) What were the treatments taken by you for these problems?

4 Have you suffered from any disease in last 15 days? If yes, what was the disease and what treatment was taken?

5 (a) Name the foods that are good for health?

(b) How do these foods help to maintain health?

6 What is a balanced and nutritious diet?

7 How do we improve the health of a weak girl?

Menstruation

1 Do you menstruate? Yes / No

2 When did you start menstruating?

(a) _____Years _____Months

(b) _____ Std

3 Why do you think menstruation occurs?

4 Do you think there is a relation between menstruation and health? If Yes, how?

5 Do you face any health problems during menstruation? If yes, what problems?

6 Mention the physical changes observed in you after menarche?

Anemia

1 Have you heard about anemia? Yes / No

2 Name the symptoms of anemia

3 What do you think are the causes of anemia?

4 Do you think you are suffering from anemia? Yes / No

5 Is it necessary to treat anemia? Yes / No

6 What is the treatment for anemia?

7 Where can anemia be treated?

8 Have you heard of iron tablets? Yes / No

9 What do you think are the perceived benefits of taking iron tablets?

10 Name dietary sources which are rich in iron?

Appendix - IB

Socio-Economic Background and Prevalence of Morbidity

I 1 1 Interview No

1.2 Full Name

1 3 Address

1 4 Religion

(1) Hindu

(2) Muslim

(3) Any other

1 5 Date of Birth

1 6 Age

1 7 School's Name

1 8 Class and Section

1 9 What type of diet do you take?

(1) Vegetarian

(2) Non-vegetarian

II **Family's Information**

2 1 Type of family

(1) Joint

(2) Nuclear

2 2 Total no of family members

III **Family Composition**

Sr	Name No	Relationship with the member	Age	Education	Occupation	Monthly Income

IV **Income**

Total monthly income

Per capita income

V **Living Conditions**

5 1 Type of house

(1) *Kaccha*

(2) Semi-*pucca*

(3) *Pucca*

(4) Any other

5 2 Total no of rooms along with the kitchen

5 3 Drainage system

(1) Open

(2) Closed

(3) Soak pits

(4) Any other

5 4 Toilet facilities

(1) Independent toilet facility at home

(2) General toilet facility

(3) In open

(4) Any other

5 5 From where do you get drinking water?

(1) Your own tap for drinking water

(2) General tap

(3) Handpump

(4) Any other

5 6 Do you have any facility which is given below

(1) Fan (5) Tape-recorder

(2) T V (6) Iron

(3) Radio (7) Vehicle

(4) Fridge (8) Any other

5 7 Cleanliness in the house and in the nearby areas of the house (Answer - Yes/No)

(1) Cleanliness inside the house

(2) Cleanliness outside the house

(3) Mosquitoes and flies (inside the house / outside the house)

(4) Stagnant water (near the house)

(5) Kids do toilet outside the house

VI Morbidity

(1) Did you fall sick within the last 15 days? Yes No

(2) If yes,

Name of the disease	For how many days you suffered from	Treatment Yes	Treatment No	If yes, from whom you took the	For how many days you took the treatment	Who took you for the treatment

(3) What do you think, why did you suffer from the particular disease?

(4) What are the common problems from which the girls in the age group of 10 to 18 years suffer from?

Appendix - 2B

Food Frequency Questionnaire

Name **Class**

Age **Section**

Address

Sr No	Name of the Food-Stuff	Frequency of Consumption		Quantity of Food Item Consumed	
		Frequency	Code	Quantity	Code\
1	Wheat flour				
2	Rice				
3	Rice-Flakes				
4	Bajra				
5	Jowar				
6	Maize				
7	Semolina				
8	Bengalgram Whole				
9	Bengalgram *Dhal*				
10	Soyabean				
11	Lentil				
12	Peas Dry				
13	Moth beans				
14	Sprouts				
15	Colocasia Leaves Green				
16	Fenugreek Leaves				
17	Mint				
18	Shepu				
19	Tomato Ripe				
20	Tomato Green				
21	Gooseberry				
22	Pineapple				
23	Oranges				
24	Guava				
25	Lemon				
26	Custard Apple				
27	Brinjal				
28	Spinach				
29	Jaggery				

Codes

Code	Frequency of Consumption	Code	Quantity of Food Consumed
1	Daily	1	< ¼ cup
2	Twice in a week	2	¼ to ½ cup
3	Once in a week	3	½ to 1cup
4	Once in 15 days	4	1 cup
5	Once in a month	5	> 1 cup
6	Rarely		
7	Never		

Appendix - 3B

24-Hour Dietary Recall Questionnaire

Name **Class**

Age **Section**

Address

Amount used by thefamily on previous day						Index child	
Meal Pattern	Time	Name of the Preparation	Ingredients Used	Raw Amount (g/ml)	Cooked Quantity (g/ml)	Cooked Quantity (g/ml)	Raw Equivalents (g/ml)

Appendix - 4B

Rating Scale for History of Anorexia

Name **Class** **Section** **Roll No**

TICK MARK (_/) THE APPROPRIATE ANSWER			
Q 1	Do you feel hungry during meal time?	Yes (2)	No (1)
Q 2	Do your family members feel that you eat more than before?	Yes (2)	No (1)
Q 3	(a) Do you think that your diet has increased than before? (b) If yes, then give score 0 1 2 3 / 4 5 6 7 / 8 9 10	Yes (2)	No (1)
Q 4	(a) Do you feel less tired than before? (b) If yes, then give score 0 1 2 3 / 4 5 6 7 / 8 9 10	Yes (2)	No (1)
Q 5	When you feel hungry and you tell your mother that you are feeling hungry, at that time what is the response of your mother?	Yes (2)	No (1)

Appendix - 5B

Visual Analogue Scale for Activity Pattern

Date | Code No

Name | Age

Class | Section

How easily (without getting tired) you can do the following tasks ?

Type of Activity	1	2	3	4	5	6	7	8	9	10
Washing clothes										
Washing utensils										
Mopping the floor										
Washing the kitchen area										
Cycling										
Running errands										
Cooking										
Walking										
Climbing stairs										
Concentrating on studies										
Playing in school										
Talking with friends										
Arranging school bag										
Praying										
Watching TV										
Listening to radio										
Doing homework										
Going to tutions										
Running										
Others										

Scores Lower score, less easy

More score, more easy

Appendix - 6B

Semi-Structured Interview
(10 to 19 Years Adolescent Girls)

1) Name
2) Religion
3) Date of Birth
4) Class and Section
5) School

HEALTH AND NUTRITION

1) Do you think that there are any differences between a healthy and an unhealthy person?

   Healthy Weak

2) Do you think you are healthy?

   Yes/No

   Why?

3) According to you, how can you improve the health of a weak girl?
4) Which are the foods that give you good health?
5) What is a nutritious diet?
6) What is the relation between health and nutritious diet?
7) For girls who are in the age group of 10 to 18 years what is the relationship of weight and height with their health?
   (a) Weight and health
   (b) Height and health

ANEMIA — PALENESS OF BLOOD

1) After seeing the picture, tell the difference between the health of the two girls

   Girl - 1 Girl - 2

2) Have you heard about paleness of blood (Anemia)?

   Yes / No

3) What do you call that state when there is paleness of blood?
4) What are the causes of paleness of blood?
5) How does the girl look like who has suffered from paleness of blood?
6) Do you think that you have pale blood?

   Yes / No

   Why?

7) What problems does a girl suffer from when she has pale blood?

8) How can you improve the state of pale blood?

9) (a) What is the treatment for pale blood?

(b) From where do you get this treatment?

10) By consuming which foods in the diet does blood becomes red?

11) Do you think that your diet contains iron _____ and vitamin C _____? If yes, then please mark _/ in the blank space, if no, then mark x

12) What are the foods which are rich in vitamin C and iron?

Iron rich diet	Vitamin C rich diet

13) Have you ever seen the iron tablets?

Yes / No

If yes, where?

14) What are the benefits of consuming these iron tablets?

15) Have you ever consumed these iron tablets?

Yes / No

16) (a) If yes, then who advised you to take the tablets?

(b) For how long you have consumed it?

(c) What benefits you experienced after consuming these iron tablets?

17) Will you take the tablets once a week for six months?

Yes / No

ADOLESCENCE AND MENSTRUATION

1) What are the physical differences between a 8-10 year old girl and 13-18 year old girl?

8-10 year old girl	13-18 year old girl

2) Have you started menstruating ?

Yes / No

3) When did you start menstruating?

(a) ____ year

(b) ____ class (in which class it started)

4) Were you aware about menstruation before it was started?

Yes / No

If yes, then who had informed you?

5) What did you feel when you started menstruating?

6) According to you, why do girls start menstruating? Do you have any information about it?

7) Do you feel that there is any relationship between menstruation and health?

Yes / No

If yes, why?

8) Do you suffer from any problem due to menstruation?

Yes / No

If yes, then what are those problems?

9) What changes take place in your body after the onset of menarche?

10) Do you suffer from any of the problems given below, after the onset of menarche?

a Tiredness

b Breathlessness

c Reduced appetite

d Footache

e Backache

f Giddiness

g Any other

GENDER BIAS

1) Household responsibilities Which of the following work do you do at home ?

a Sweeping and mopping the floor

b Washing clothes

c Washing utensils

d Cooking lunch

e Cooking both the meals

f Helping mother in household work

g Helping mother in cooking

h Looking after younger siblings

i Bringing vegetables regularly or other outside work

j Teaching young sibling

k Helping in family business/father's business

l Does not do any work at home

m Any other

2) What does your brother do at home?

3) How do you feel on seeing your brother not doing house work that you do at home?

4) Would you like to be a girl or a boy in your next birth? Can you explain?

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