A Study on Impact of Iron Folic Acid along with Vitamin-C on the Haemoglobin status of Adolescent Girls in an ICDS Block

National Institute of Public Cooperation and Child Development
Regional Centre, Lucknow

FOREWORD

Adolescence is a great transition and vulnerable phase that one has to pass through while reaching adulthood. Hence, this period demands prompt care and attention to avoid any kind of serious consequences that endangers the life and Nation by affecting its human resources. In India anaemia is one such problem particularly prevalent in adolescent girls, who enter the reproductive cycle soon after the menarche. This typical feature of rural areas clubbed with lack of awareness on the importance of nutrition & health among adolescent girls and families, aggravate the situation further and so leaves ample scope for maternal deaths and poor pregnancy out come.

Realising the need, government and non-government agencies/bodies started various interventions through programmes/schemes for prevention and management of anaemia. Despite the efforts still anaemia is on raise, which is clearly evident from NFHS-3 data. The present study, therefore would be a supplementation to the efforts already being made in this field, as it had come up with useful recommendations regarding Iron Folic Acid supplementation. The study also laid special emphasis on the impact of Nutrition and Health Education on dietary and hygienic practices of adolescent girls. In view of this, it is hoped that the findings and recommendations would be helpful in developing suitable interventions under the programmes already being implemented for adolescent girls aimed at bringing down anaemia among them.

Here, I record my sincere greetings to all the members of Research Team headed by Dr. Madhu Agarwal for putting her meticulous efforts in bringing out this document.

Dr. A.K. Gopal

ACKNOWLEDGEMENTS

Words fall short to express my deep gratitude to Dr. A.K. Gopal, Director of the Institute for his overall guidance during the course of the study. His interventions and valuables suggestions at every stage have made the study enriching and of immense academic value. I would also like to extend my hearty thanks to Dr. Dinesh Paul, Additional Director, NIPCCD for his valuable technical inputs from the inception to the end of the study. I would also like to thanks to Dr. Sheila Vir, former Project Officer (Nutrition), UNICEF, Lucknow and Dr. Aruna Narayan, Jt. Director, Directorate of Health and Family Welfare, Govt. of U.P, for their constant support and relevant guidance throughout the course of the study.

Dr. A.K. Nigam, Director, Institute of Applied Statistics and Development Studies, deserves rich appreciation for his invaluable help in preparing tools and design and analysis of the data.

I especially thanks to Faculty members of NIPCCD, Regional Center, Lucknow for their valuable contribution, without which it would have not been possible for the Institute to conduct the study.

The study would not have been possible without the tireless efforts rendered by the Project Team throughout the study. I acknowledge their sincere efforts and dedicated involvement.

Last but not the least, I express my sincere gratitude to the ICDS functionaries involved and the respondents of the study and also to their parents for their cooperation during the study.

(Madhu Agarwal)

PROJECT TEAM

Principal Investigator	**:**	**Dr. Madhu Agarwal** **Regional Director Incharge** **NIPCCD, Regional Center, Lucknow**
Project Coordinator	**:**	**Mukesh Kr. Maurya** **Assistant Director**
Project Assistant	**:**	**Smita Singh**
Project Investigators	**:**	**Ankita Tewari** **Pragya Vajpayee**

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXURES

EXECUTIVE SUMMARY

Adolescence proves to be the most vulnerable phase in the path of human life cycle after infancy, characterized by rapid growth and development with a transition from childhood to adulthood. During this period they gain 50% of their adult weight and skeletal mass and more than 20 per cent of their adult height, where, nutrition plays a vital role in determining the growth, development and survival of an individual. Adolescents, especially adolescent girls, at this stage needs protein, iron and other micronutrients to support the adolescent growth spurt to meet the body's increased demand for iron during menstruation. The main nutritional problems identified in adolescents are micronutrient deficiencies in general and iron deficiency anaemia in particular.

Anaemia is defined as having haemoglobin below a specific level i.e. less than 12 grams of haemoglobin per decilitre of blood [g/dl] in non-pregnant women and less than 10 g/dl in pregnant women. The body uses iron to produce haemoglobin, a protein that transports oxygen from the lungs to other tissues in the body via blood stream. When the haemoglobin levels in the blood fall, it leads to weakness, exhaustion, breathlessness and low immunity, making person more susceptible to infections.

The pre-pregnancy anaemic status of adolescent girls is crucial and has long-term intergenerational consequences as the anaemic adolescent mother is at high risk of miscarriages, maternal mortality and giving birth to still born and low birth weight babies with low iron reserves. Evidence also supports that bodies of the still growing adolescent mother and her baby may compete for nutrients, raising the infant’s risk of low birth weight. This iron deficiency anaemia is also associated with impaired cognitive functioning, lower school achievement**,** and more susceptible to infections and lowers physical work capacity.

Thus, adolescence is a unique intervention point in the life cycle, which decides the health status of future generations. Presently, the basic approaches to the prevention of iron deficiency anaemia are deworming along with iron-folic acid supplementation and nutrition and health education (including sanitation and personal hygiene). These interventions are being covered under the programme “Kishori Shakti Yojana” aiming to bring about a difference in the lives of adolescent girls and provide them an opportunity to realize their full potential.

The Study

In the past decade, the widespread prevalence of anaemia in adolescent girls in India is gaining recognition. Adolescent girls are stated as an important beneficiary group in nutrition policy of 10th Five Year Plan at national level and state level (National Nutrition Policy, 1994 and State Nutrition Policy, 1998). This has resulted in the programmes to combat under nutrition and iron deficiency anaemia in this group through ICDS, which is known as Adolescent Girls (AG) Scheme. In the year 2000 this scheme was revised and renamed as Kishori Shakti Yojana. According to the Guidelines of Government of India (1995) under this scheme regular weekly IFA supplementation along with deworming interventions and NHEd have been recommended as a strategy to combat adolescent anaemia. Despites, the cases of nutritional anaemia are still on the higher side in adolescent girls particularly in rural areas. Further, most experiences of micronutrient supplementation come from iron supplementation studies among pregnant women. Therefore, the present study would be a case in discussing whether the impact of iron and folic acid supplementation alone is sufficient or is there any need for an enhancing factor like Vitamin C to improve the efficacy of iron absorption and subsequently improving the haemoglobin level.

Objectives of the Study:

- To study the prevalence of anaemia in adolescent girls
- To assess the impact of administration of Iron Folic Acid (IFA) supplementation (weekly and biweekly) with and without Vitamin-C on haemoglobin levels of adolescent girls for different durations (0-3, 0-6 & 3-6 months)
- To assess the impact of NHEd on practices pertaining to diet and hygiene.

Methodology:

Four hundred adolescent girls in the age group of 13-18 years from in and out of school, having attained menarche and expressed willingness in the study were selected at random from Nindura ICDS Project of Barabanki District in Uttar Pradesh. The adolescent girls were then divided into four intervention groups (A, B, C & D) comprising 100 subjects in each for

supplementation and intensive NHEd for a period of six months. Where, Groups A and B had weekly and biweekly supplementation of iron folic acid with out vitamin C, and Groups C & D had weekly and biweekly supplementation of iron folic acid with vitamin C, respectively. The haemoglobin status, height & weight of adolescent girls and impact of NHEd were assessed in three phases at initial (0 months) mid (3 months) and final (6 months). The data was collected through Personal interview & observation and haemoglobin estimation was done through Cyanmethaemoglobin method. Before proceeding for haemoglobin estimation deforming tablets and Supplementation Monitoring Calendars were provided to all the groups for ensuring data quality.

Major Findings

Profile of the Respondents

- Majority of the adolescent girls (87.6 %) were educated, where a higher percentage (66.2%) of them had received education upto primary level, followed by Metric (9.5%) and above Metric (8.5%) and a very small percentage (3.8%) of them knew to read and write, while the rest 12 percent of the subjects were found illiterate.
- Almost all the subjects (98.3 %) were unmarried.
- 68 percent of the subjects were Hindus and rest 32 percent were Muslims.
- The selected sample comprised 48.5 percent of subjects from scheduled castes, 44.5 percent other backward castes, 3.8 percent scheduled tribes and 3.2 percent of the subjects from general caste.
- 53 percent of the subjects belonged to families with monthly income ranging between rupees 1500-3000/- while 25 percent of the subjects had monthly family income above rupees 3000/- and only 22 percent of the subjects, have monthly income less than 1500/-.
- The eating habits of the subjects revealed that more than half of the subjects (53.5 percent) were non-vegetarian and rest 45.8 percent were vegetarian.
- 83.5 percent of the subjects belonged to nuclear families and the rest 16.5 percent were from joint families.

Living Conditions of Respondents

- Only 43.5 percent of the subjects were residing in *Pucca* houses and 36.3 percent of subjects had *Kuccha* house. Rests of them were residing in either *Thatched* house or *Pucca* house with thatched roof.
- Sanitation of the household surroundings was found to be poor as more than three-fourth (73.8 %) of the houses were mainly located in the areas congested with puddles while only 26.2 percent of houses had clean and open surroundings.
- Considerably a large (70.5 %) number of respondents did not have toilet facility at their home.
- It was observed that the source of drinking water for almost all (96 %) the respondent's households was bore well.

Prevalence of Anaemia

- At the start of the study, more than two- third of the adolescent girls (77.2 %) were found anaemic with severe (3.5 %), moderate (28.2 %) and mild (45.5 %) degrees of anaemia and only 22.8 percent subjects were observed non-anaemic with their haemoglobin levels 12 g/dl or above. **(See Table 4.13)**

IMPACT OF IFA SUPPLEMENTATION

Haematological Status of the Subjects

- All the four intervention groups (A, B, C & D) had shown an improvement in the haemoglobin level of the subjects due to the impact of IFA supplementation. Where, the haemoglobin range of the groups A,B,C & D with their respective mean values were recorded as 10.0-13.8(12.0), 4.8-13.0(10.8), 8.2-12.3(10.5) & 6.2-13.0(9.2) in the initial phase of haemoglobin estimation.
- At the end of third phase of the study, prevalence of anaemia in Group B (Moderate), C (Mild) & D (Severe) was found to be almost reduced and the haemoglobin status of the subjects raised to Normal value of haemoglobin level (i.e. >= 12.0 g/dl)

- When compared, Group D i.e. supplementation of IFA and Vitamin C Biweekly was found to be the best intervention.
- The improvement in haemoglobin status after three months duration (i.e. 3 to 6 months) was found insignificant.

Clinical Signs and Symptoms

- There was a continuous decline in prevalence of anaemia associated symptoms by the end of third phase of study coming down to 2.8 percent, 2.7 percent, 2.6 percent and 3.4 percent in Group A,B,C and D respectively. The maximum positive result inferred in the Group D subjects was that the clinical symptoms reduced from 49.4 percent (0 month) to 3.4 percent (6 month).
- The incidence of side effects due to IFA supplementation was found to be negligible during the study. It indicates that it may not be acting as barrier in promotion of consumption of IFA tablets which usually perceived as a fear by the adolescent girls and their parents in the community.

IMPACT OF NUTRITION AND HEALTH EDUCATION

Household Sanitation

a. Cleanliness of the House

- A positive impact of NHEd was observed among the respondents in the practice of maintaining cleanliness of house from 62.5 percent (0 month) to 84.6 percent (6 months)

b. Methods of Disposal of Household Wastes

- Though a small rise was observed in the methods of disposal of household wastes during the study period of six months but it also indicates that a continue activity of NHEd proves to be a key input in bringing out a significant change in the sanitation practices of community

Personal Hygienic Practices

- At the start of the study 58.5 percent of the subjects were aware of healthy personal hygienic practices but at the end of the study almost all (99.6%) the respondent had started practicing them. Significantly, a major positive response was observed among adolescent girls in the

practice of using clean and sanitized napkins from 31 percent (0 month) to 99.1 percent (6 months) due to NHEd.

Food Hygienic Practices

- Initially (i.e. at 0 month) 92.8 percent of the subjects were found following good food hygiene practices of washing raw food and utensil before cooking and storage of cooked food and drinking water in clean utensil with cover and by the end of the study (6 months) an improvement was noticed among all (99.9%) of the subjects.

Dietary Pattern

- A significant impact of NHEd was also observed in the use of food groups helpful in reducing anaemia among the subjects during the study. The subjects whose intake of leafy vegetables and fruits found low or nil in the first phase had improved in subsequent phases to twice or more in a day. Similarly improvements were also observed in consumption of milk/ dairy products, dal/ sprouts, amla/ guava and fats & oils.

Dietary Practices

- At the first phase only 37.5 percent of the subjects were found following good dietary practices but by the end of the study an improvement was observed in almost two- third (73 .6 %) of the respondents due to regular activity of NHEd. Notably, a decline was observed in use of tea or coffee with meals from 21.50 percent (0 month) to almost zero percent (0.59 %) at the end of the study.

Specific Recommendation

The main finding emerged out of the study sincerely recommends, that adolescent girls may be supplemented with iron folic acid along with Vitamin C bi-weekly for a period of three months with parallel support of intensive nutrition and health education/counselling to adolescent girls and their families for better compliance and improvement in personal hygienic & dietary practices through government programmes/schemes such as National Rural Health Mission or Integrated Child Development Services or Sarva Siksha Abhiyan to cover maximum rural adolescent population, and thus could yield better results than the existing intervention, where IFA tablets were being supplemented weekly for a period of 52 weeks under National Rural Health Mission/ Integrated Child Development Services Scheme in Uttar Pradesh for combating anaemia in adolescent girls.

Introduction

Adolescence proves to be the most vulnerable phase in the path of human life cycle after infancy, characterised by rapid growth and development with a transition from childhood to adulthood. During this period they gain 50% of their adult weight and skeletal mass and more than 20 per cent of their adult height, where, nutrition plays a vital role in determining the growth, development and survival of any individual. Adolescents, especially adolescent girls, at this stage need protein, iron and other micronutrients to support the adolescent growth spurt and meet the body's increased demand for iron during menstruation. Adolescents often receive few health care resources and scant attention as they are been typically considered as low risk group for poor health. The main nutritional problems identified in adolescents are micronutrient deficiencies in general and iron deficiency anaemia in particular.

WHO estimates that 27 percent of adolescents in developing countries are anaemic. It is also vivid from the studies that the prevalence of severe anaemia is much higher among adolescent girls than in children. World Health Organization has defined adolescence as the age between 10-19 years. The term 'Adolescence' means to emerge or achieve identity. According to census 2001, adolescents constitute 22.8 percent or about 230 million of total Indian population in the age group of 10 to 19 years. Anaemia affects about 43 per cent of women of reproductive age in less developed countries (Lindsay, 2000). In India alone, depending on age and sex, Iron Deficiency Anaemia (IDA) has been reported to range between 38-72 per cent while majority of them are being women and children (Choudhury P and Vir S., 1994). According to NFHS-3 the prevalence of anaemia among married women in the age group of 15-49 years has risen from 51.8 percent in 1998-99(NFHS-2) to 56.1 percent in 2005-06 and no less than 57.9 percent of pregnant women suffer from anaemia. This again raised anaemia among children in the age group of 6-36 months from 74.2 percent in 1998-99 to 79 percent in 2005-06.In India 50 percent of first births are taking place in those below 19 years of age. It is also evident from the studies that there is high prevalence of nutritional anaemia among adolescent girls. A WHO study shows that in developing countries 52 per cent of pregnant women and about 35 to 40 percent of non-pregnant women suffer from iron deficiency anaemia (WHO, 1992).

Anaemia is defined as having haemoglobin below a specific level i.e. less than 12 grams of haemoglobin per decilitre of blood [g/dl] in non-pregnant women and less than 10 g/dl in pregnant women. The body uses iron to produce haemoglobin, a protein that transports oxygen from the lungs to other tissues in the body via blood stream. When the haemoglobin levels in the blood fall, it leads to weakness, exhaustion, breathlessness and low immunity, making person more susceptible to infections.

The pre-pregnancy anaemic status of adolescent girls is crucial and has long-term intergenerational consequences as the anaemic adolescent mother is at high risk of miscarriages, maternal mortality and giving birth to still born and low birth weight babies with low iron reserves. Evidence also supports that bodies of the still growing adolescent mother and her baby may compete for nutrients, raising the infant's risk of low birth weight. This iron deficiency anaemia is also associated with impaired cognitive functioning, lower school achievement, and more susceptible to infections and lowers physical work capacity.

The causes of anaemia are multi-factorial and the prevalence rate increases in girls beyond the age of 6 yrs. Most women who develop anaemia in less developed countries neither consume enough iron rich foods nor avoid taking foods that inhibit the absorption of iron as the Indian diet includes phytate fibre rich foods that reduces the bio availability of iron. Like in any other age group inadequate quality and quantity of food are the prime determinants of nutritional problems. These conditions may be due to household food insecurity, intra household allocation of food that does not meet their full range of dietary needs, livelihoods insecurity and lack of nutrition knowledge. Often these factors combined with unhealthy practices such as bathing in unclean water ponds, repeated use of cloth in place of sanitary towel, long unclean nails eating disorders (consumption of junk foods accompanied by slimming regimes, etc.) and infectious diseases like malaria, schistosomiasis, hook worm, HIV/AIDS, make adolescent girl more vulnerable to anaemia apart from other micronutrient deficiencies and genetic disorders.

Nutritional megaloblastic anaemia due to folic acid deficiency occurs at any age but more often affects adult women, infants and young children when compared to men. Generally, this is manifested through pregnancy and is prevalent among Indian women. If the problem is not addressed during the pre or periconceptual period, it may cause irreversible fetal damage resulting in neural tube defects, as these defects occur only in early weeks of pregnancy. Therefore many of the unplanned adolescent pregnancies need to take a preventive approach.

Thus, adolescence is a unique intervention point in the life cycle, which decides the health status of future generations. Presently, the basic approaches to the prevention of iron deficiency anaemia are deworming along with iron-folic acid supplementation and nutrition and health education (including sanitation and personal hygiene). These interventions are being covered under the programme “Kishori Shakti Yojana” aiming to bring about a difference in the lives of adolescent girls and provide them an opportunity to realise their full potential.

Compared to the vast amount of work done on pregnant women and young children, there are relatively few studies on the prevalence of anaemia among adolescent girls. The following text presents the literature relevant to the topic of the present study.

Review of Literature

2.1 Prevalence

Iron Deficiency Anaemia is the most common nutritional disorder, affecting the population across many countries.

In a study carried out by International Center for Research on Women Washington D.C. (1994) it was observed that the population groups with highest prevalence of anaemia are: pregnant women (about 50%) followed by infants and children 1 to 2 years (48%), school children (40%), nonpregnant women (35%), and preschoolers (25%). Further, four out of six studies on adolescents revealed that the prevalence of anaemia was 32 to 55% in both genders. (Kurz and Johnson, 1994). These estimates of the prevalence of anaemia in different regions and population groups were generally not representative because only few countries have reported their data on anaemia to WHO. As much of the information comes either from hospital records or isolated reports, the data is scanty on age groups other than pregnant women. Studies have also shown that adolescent girls of high and low socio-economic groups shown alarmingly high incidence of IDA. The prevalence of anaemia in female teenagers from Brazil was reported to be 17.6 percent (1996) and was higher in the groups that had not reached menarche (Fujimari and de Oliveriva, 1996).

A study from England (1994) indicated that the overall prevalence of anaemia (Hb<12 gm/dl) was 20 percent among adolescent girls.(Nelson and Trivedi 1994)

Studies from Asia have shown that iron deficiency is more prevalent in females than males, the highest rate being in teenage girls (Shaw1996). A study on adolescents in China (1990) revealed that the prevalence of anaemia among adolescent girls was 61.8 percent (Cai and Yan 1990).

Many other studies also suggest that the incidence of anaemia in school age children tends to increase with age and is highest during periods of growth and adolescence.

A WHO study conducted in the year 2000, estimated that about 2 billion individuals or about 40% of the world's population was suffering from anaemia and therefore it is considered as a major public health problem of epidemic proportions demanding special attention.

A study by Nutrition Research Laboratories, Hyderabad on 500 normal pregnant women in Madras showed that haemoglobin values between 10.5 g/ dl. percent to 11.5 g/ dl percent as found in only 10 percent of the subjects and none of them had values more than 11.5 g/dl percent and 70 percent of the subjects had values between 8.7 g/dl percent to 10.15 g/dl percent while rest of them (20 %) fell below 8.7 gm percent (Krishna Menon 1967).

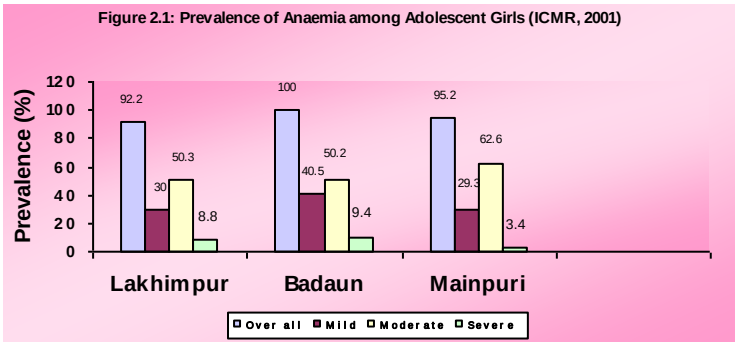
Studies conducted in Lucknow, Hyderabad and Madras indicated that 25 percent of non-pregnant females had haemoglobin 10gm percent or less and 42 percent of pregnant females had similar values. The diseases are of particular significance among adolescent girls due to its high prevalence (78 – 90 percent) and adverse functional consequences (WHO, 1962).

In a study conducted by Nutrition Foundation of India (1999) on 520 women and 185 rural adolescent girls (aged 11 to 19 years) found that nearly 17 per cent of the rural and 96 per cent of the urban adolescent girls had Hb level <10 gm/dl (Awate and Somaiya, 1997). Thus, the pregnancy aggravates pre-existing anaemia in these adolescent girls. Under these circumstances the need to combat anaemia in adolescent girls had been suggested by the Nutrition Foundation of India (Gopalan C., 1993).

In another study, it was found that the haemoglobin status of the urban girls was better than their rural counter parts who were largely out of school. Thus, the rural girls were worse off, in comparison to the urban sample, in terms of anthropometric and the haemoglobin status. It was also observed that the girls with better grades of height (percent) or weight (percent) had higher haemoglobin value ($P<0.05$) than those with poorer grades. In other words prevalence of anaemia was lower in those who were taller or heavier or live in urban area than those who were shorter or lower in weight for given age in rural areas. The prevalence of anaemia was higher (25 percent) among girls who tried to lose weight in the previous year and among those who belonged to a lower social class. Other predicator of anaemia included socio economic status, schooling of parents and specific home characteristics. In urban areas of developing countries, symptoms of iron deficiency have been linked to changing dietary intakes of iron and Vitamin C, which are often seen inadequate. Hookworm disease, malaria and other infections, if present, further aggravate iron deficiency anaemia and increase its prevalence. The most vulnerable groups are pre- school children, pregnant women and adolescent girls among whom prevalence of anaemia was usually high. (Narasinga Rao, 1991).

The National Family Health Survey (NFHS –2), India reported that anaemia was a major health problem with over half of every married woman in the age group of 15-45 years having the condition. The level of anaemia in women aged 15-49 years was reported as 53.9 percent among rural women and 45.7 per cent among urban women. Again the data in NFHS-3 revealed that among married women between the age of 15-49 years, the prevalence of anaemia has risen from 51.8 percent in 1998-99 (NFHS-2) to 56.1 percent in 2005-06 (NFHS-3). Thus, it was observed that this problem clearly requires immediate attention and intervention.

In the State of Uttar Pradesh, the prevalence of anaemia has been studied most extensively in pregnant women followed by pre-school children. There are very few studies with reference to the adolescent girls.



In a study on 568 schools going adolescent girls in an urban area of Lucknow, the prevalence of anaemia was found to be 14 percent. In another community based study conducted at Meerut on 504 adolescent girls aged 10-18 years, 34.5 percent girls were found to be anaemic comprising mild (19 %), moderate (14 %) and severe (1.4 %) degree of anaemia. In a community based study on 740 adolescent girls in the 3 districts of UP viz. Lakhimpur, Badaun and Mainpuri, the prevalence of anaemia amongst adolescent girls was found to be 92.2 percent in Lakhimpur, 100 percent in Badaun and 95.2 percent in Mainpuri district. The majority of these girls had moderate degree of anaemia. (Srivastava and Nigam, 2005).

2.2 Iron Deficiency Anaemia

Nutritional deficiencies are the primary cause of iron deficiency anaemia affecting over 500 million people globally. Iron deficiency can result from a failure to consume high amounts of iron required for growth and also failure to replace losses during menstruation and pregnancy; a low intake of either total iron or absorbable (bioavailability) iron; or excessive iron losses due to parasitic infections.(Cook, Skikne and Baynes, 1994)

The World Health Organization (2000) estimates that more than one third of the world's population is anemic. An inadequate intake or impaired absorption of vitamin A, folic acid, or vitamin B_{12} accounts for a smaller but significant number of cases. The detection, prevention, and treatment of nutritional anaemia is further complicated by the high prevalence of infectious diseases that cause anaemia in many tropical countries. The most important are malaria and hookworm. Programs designed to control anaemia can have numerous public health benefits including reduced mortality among pregnant women and their infant children, improved developmental and cognitive performance in childhood, and increased productivity in adults. Successful intervention, however, depends on accurate identification of the causative factors. It is therefore important to establish accurate and reliable criteria for both identifying the specific nutritional causes of anaemia and evaluating the impact of intervention strategies.

Adolescents with increased height, weight and blood volume expansion, the overall iron requirement increases from a preadolescent level of approximately 0.7 –0.9 mg iron per day to as much as 2.2 mg iron per day or perhaps more in heavily menstruating young women.

The main cause of iron deficiency is inadequate food intake as well as poor bio-availability of dietary iron in the habitual cereal-based diets. Bio-availability of iron from predominantly cereal-based habitual diets in India has been shown, with radio isotopic technique, ranging between 1.5 and 6 per cent depending upon the type of cereal in the diet (Narasinga Rao,1983). Apart from phytate, tannins present in Indian diets also suppress/ iron absorption to a significant extent (Narasinga Rao and Prabhavati 1982). The chemically determined iron content of the diets eaten in India was apparently as high as 14.8 mg/1,000 kcal, but when corrected for the presence of a significant amount (30 per cent) of unabsorbable ‘contaminant’ iron, the true dietary iron content was reduced to 10.4 mg/1,000 kcal (Prabhavati and Narasinga Rao, 1981)

2.3 Folic Acid Deficiency

An analysis of data from the second health and nutrition examination survey conducted in 1985 suggested that Folic acid deficiency can produce a megaloblastic, macrocytic anaemia because this nutrient is required for the synthesis of erythrocytes. Changes in red blood cell morphology and the number of cells occur later than the drop in serum and red blood cell folate

concentrations. New data is needed on the global prevalence of folate' deficiency. In the U.S., prior to folic acid supplementation of flour, about 15% of women had suboptimal folate status assessed by low serum and erythrocyte folate concentrations.(Senti and Pilch 1985) The prevalence has been reported to be higher in Africa and Asia but few data is available. Various studies conducted in these continents have observed no abnormal values for folic acid in serum and/or red blood cells. The folate content of foods such as legumes, leafy greens, and fruits are considerable and in some poorer regions these may be consumed in larger amounts than in industrialized countries. Thus the prevalence of folic acid deficiency is uncertain.(Baker 1981)

2.4 Consequences of Anaemia

Anaemia, characterised by decreased levels of circulating haemoglobin and tissue iron contents, is known to lead to several functional abnormalities with health consequences. The consequence of a mild form of anaemia is not yet clearly recognised. Although mild anaemia with haemoglobin levels above 10 g/d is not known to result in any serious impairment of function, moderate to severe anaemia is known to have several functional consequences which includes Impaired maximal work capacity (Hallberg and Scrimshaw,1981); Decreased immunological competence (Dallman1987); Behavioural abnormalities and Reduced learning ability among children (Narasinga Rao and Prabhavati 1982) ; and Poor pregnancy outcome (Yusufji, *et al*, 1973)

Although a moderate degree of anaemia may not seriously affect day-to-day work, most of which corresponds to sedentary to moderate levels of activity, impaired work capacity that was seen only in those engaged in hard physical labour with moderate to severe anaemia (WHO, 1975). Iron deficiency anaemia with haemoglobin level below 10 g/dl is known to reduce cell-mediated immunity (Srikantia, Prasad, Bhaskaram and Krishnamachari 1976).

In the guidelines developed by INACG (International Nutrition Anaemia Consultative Group, Washington D.C. 1998) for the use of Iron supplements to prevent an treat IDA it was mentioned that Iron deficiency anaemia is highly prevalent in less-developed countries but also remain as a problem in developed countries where, other forms of malnutrition have already been virtually eliminated. Iron deficiency is not the only cause of anaemia, but usually the most common cause where anaemia is prevalent. The prevalence of anaemia, defined by low

hemoglobin or haematocrit, is commonly used to assess the severity of iron deficiency in a population (INACG, 1998).

2.5 Control of Anaemia

Several food based (dietary improvement, fortification of foods with iron) and nonfood based (iron supplementation and helminth control) strategies can be used effectively to prevent and control nutritional anaemia among adolescents.

2.5.1 Helminth Control

In populations where hookworm is endemic, anthelminthic therapy may be given presumptively to anyone with severe anaemia, because the treatment is safe and much less expensive than diagnosing hookworm infection. Anthelminthic treatment to school children without prior screening is currently recommended. Anthelminthic chemotherapy (deworming) alone may help in preventing moderate-to-severe anaemia, but the most effective strategy for anaemia control is to combine anthelminthic chemotherapy with iron supplementation. Anthelminthic therapy combined with iron and folate supplementation enhances the hemoglobin response to iron supplementation. Mebendazole, albendazole, levamisole, and pyrantel may all be safely administered to adolescent girls and pregnant women after the first trimester (INACG, 1998).

Complementary parasite control measures in anaemia

Albendazole	400 mg single dose
Mebendazole	500 mg single dose or 100 mg twice daily for 3 days
Levamisole	2.5 mg/kg single dose, best if a second dose is repeated on next 2 consecutive days
Pyrantel	10 mg/kg single dose, best if dose is repeated on next 2 consecutive days

Source: International Nutrition Anaemia Consultative Group (1998) Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anaemia. INACG, Washington, DC.

2.5.2 Supplementation

The dietary intake of Vitamin C along with iron rich sources enhances the absorption of iron significantly(De Maeyer, 1989) Vitamin C, whether naturally present in food or added in the form of crystalline ascorbic acid, has an enormous effect on the absorption of iron. Based on data from in developing countries, where meat intake is low, ascorbic acid is the single most important enhancer of iron absorption. Adding as little as 50 mg of ascorbic acid to a meal, whether in pure form or in vegetables or fruits (for example, an orange, or a lemon, or 100 g of

cabbage, or 200 g of amaranth), doubles the iron absorption. The results of the study also denotes that anaemia in poor-cereal eating population is as much (if not more) due to deficiency of Vitamin C as to the deficiency of Iron. (Monsen et at, 1979).

Most iron supplementation programs typically do not include school age children. However, this has been suggested as a promising strategy in the prevention and control of anaemia, especially in settings where diets have poor iron availability, the overall prevalence of anaemia is high as seen in South Asia. On the other hand, various studies had indicated that with continued daily administration, iron absorption could be decreased due to 'tiredness' of the intestinal mucosa. According to a study, absorption from single dose of iron reduces from 30-40 per cent on the first day to as low as 3-6 per cent after a few days of continuous daily administration (Palupi et al, 1997 and Schultink et al, 1995). Weekly iron supplementation for school age children (36 to 50 doses of 60 mg of iron per year) could serve as a cost effective, community based strategy, aimed at the primary prevention of iron deficiency as well as increasing iron reserves among adolescents and adult women. (Viteri 1997).

A study done by UNICEF, New York (1997) suggested weekly pharmaceutical as a cost effective method of addressing the problem of anaemia in adolescent girls since the requirement for iron tablets will be reduced to 52 units per year, and weekly doses may ensure more, effective absorption of iron with reduced side effects and possibly higher compliance (Gillespie,1997). A Chinese study has shown that weekly supplementation with 120 mg iron was more effective than a daily 60 mg dose which in turn was as effective as daily 120 mg dose (Gillespie, 1997). Thus studies carried out supports that iron supplementation once or twice a week, increased the haemoglobin status significantly.

In a conducted by Nutrition Foundation of India study in Delhi and Rajasthan showed that the increase in Hb levels of adolescent girls were greater among those who received vitamin C along with iron and folic acid supplements compared to those who received only iron-folate supplements alone; these benefits were seen only among iron deficient anaemic children (Sharma and Rao, 2000). No change was observed in non-anaemic children with iron supplementation or anemic children who received placebos. These findings support the need to examine multinutrients strategies and appropriate targeting of supplementation. The difference in the response of the subjects getting Vitamin C supplementation with Fe/folate as compared to those receiving only Fe/folate seems to highlight the above said point. In a study, on volunteer addition

of 25 to 125 mg of Vitamin C to diet after cooking increased percentage iron absorption from 13% to 33%. (Apte,1967) Thus, inclusion of Vitamin C in Fe/folate as part of a Public Health Operation may be recommended. For daily administration, it is a costly affair and thus may not be feasible. On the other hand, in case where administration is once in a week, this may still be possible. However, the need to improve the diet through increased intake of green leafy vegetables and fruits like lemon, guava is even more important in the long run to combat anaemia. (Sharma, 2003).

Based on the preliminary findings of the ongoing multicentric study in three regions of India, the expert working group at the National Consultation recommended that adolescent girls upon reaching menarche should consume weekly dosages of one IFA tablet containing 100 mg elemental iron and 500μg folic acid -accompanied by appropriate dietary counseling.(Agarwal,1998).

A "girl-to-girl" approach has been recommended by Passi et al in the year 2000 for reaching adolescent girls, i.e., linking one schoolgirl with 4 to 5 girls in the community who are not at school. The school network offers an excellent opportunity to reach "captive" adolescent girls. A group of girls could be trained (supplying, counselling, and monitoring of IFA tablets) to take on the responsibility for nonstudent girls. A group of 42 adolescent girls (aged 12 to 18 years) participating in the girl-to-girl approach of the Integrated Child Development Program (1CDS) was recruited for a study; they received 25 iron folate tablets containing 100 mg of elemental iron and 500µg of folate and were advised to consume one tablet per day. After 8 weeks, unlike the schoolgirls, the ICDS beneficiaries showed a little improvement in Hb, weight, or height status. The poor impact could be attributed to non-compliance irregularity of consumption, or lack of motivation and monitoring. In case of the school children, the teachers performed the monitoring function very well. This strategy needs to be further tested in different settings through linkages with schools and other development programs.

Thus, the review reveals the prevalence of anaemia among adolescent girls and the various studies also supports the importance of IFA supplementation along with Vitamin C to improve the situation. The present study would be a case in strengthen the fact and enable the policy makers in developing the interventions accordingly.

METHODOLOGY

3.1 Rationale of the Study

In the past decade, the widespread prevalence of anaemia in adolescent girls in India is gaining recognition. Adolescent girls are stated as an important beneficiary group in nutrition policy of 10th Five Year Plan at national level and state level (National Nutrition Policy, 1994 and State Nutrition Policy, 1998). This has resulted in the programmes to combat under nutrition and iron deficiency anaemia in this group through ICDS, which is known as Adolescent Girls (AG) Scheme. In the year 2000 this scheme was revised and renamed as Kishori Shakti Yojana. According to the Guidelines of Government of India (1995) under this scheme regular weekly IFA supplementation along with deworming interventions and NHEd have been recommended as a strategy to combat adolescent anaemia. Despites, the cases of nutritional anaemia are still on the higher side in adolescent girls particularly in rural areas. Further, most experiences of micronutrient supplementation come from iron supplementation studies among pregnant women. Therefore, the present study would be a case in discussing whether the impact of iron and folic acid supplementation alone is sufficient or is there any need for an enhancing factor like Vitamin C to improve the efficacy of iron absorption and subsequently improving the haemoglobin level. The objectives of the present study are as follows:

3.2 Objectives of the Study:

- To study the prevalence of anaemia in adolescent girls
- To assess the impact of administration of Iron Folic Acid (IFA) supplementation (weekly and biweekly) with and without Vitamin-C on haemoglobin levels of adolescent girls for different durations (0-3, 0-6 & 3-6 months)
- To assess the impact of NHEd on practices pertaining to diet and hygiene.

3.3 Locale of the study:

The present study was an action research and was so restricted to only one district i.e. Barabanki District of Uttar Pradesh. In the district, Nindura ICDS Project of Nindura Block was selected which is a rural project sanctioned in the year 1989-90 with 143 of Aanganwadi Centers.

The Block lies at a distant of 17 km from Lucknow, in the northwestern region of Barabanki district. It was carried out in 23 Anganwadi centers of 13 villages of Nindura ICDS Block. List of selected Anganwadi centers is annexed. **(See Annexure- I)**

3.4 Methods and Procedure

3.4.1 Selection of Sample:

Purposive sampling was used to select the households with adolescent girls, in the area of study. Adolescent girls in the age group of 13-18 years from in and out of school and who said to have reached their menarche and expressed their willingness were involved in the present study. Further, subjects with case history of any severe illness during the last two weeks for which they required hospitalization and those who were suffering from chronic illnesses or receiving any long-term allopathic or indigenous treatment were excluded from the study.

3.4.2 Sample Size:

The overall prevalence of anaemia among ever married women in the age group of 15-49 year population was found 50 percent in India (NFHS-2). Whereas prevalence of anaemia among female (15-49 yrs) population of U.P. in NFHS-2, was found 50.8 percent. Also, in a study called UMANG (Uplifting of Marriage Age, Nutrition and Growth) addressing anaemia among adolescent girls, carried out by Vatsalya (a non-government organization) in Bakshi ka Talab and Chinhat Block of Lucknow District in U.P, reveals that anaemia incidence is over 50 percent in girls of the age group of 11-18 years. (Vir, Singh, Nigam and Jain, 2007)

Thus assuming the mean prevalence of anaemia among adolescent girls as 50 percent, a sample of 400 girls were randomly selected, irrespective of their Hb levels, in the present study. The following formula was used in determining the sample size.

$$n = \frac{4PQ}{d^2}$$

Where n = Size of the sample

P = Proportion of female population (15-49 years) percent

Q = 1-P (here Q is the remaining proportion of the population)

d = permissible margin of error

Here permissible margin of error is taken as 0.05

Hence $$\frac{4 \times 0.5 \times 0.5}{0.05 \times 0.05} = 400$$

Thus a total of 400 subjects were selected for the present study.

3.5 Methods of Data Collection

3.5.1 Personal Interview and Observation

The data of the present study was collected through personal interviews and observation by administering the respective schedules.

3.5.2 Haematological Test

Haemoglobin level was assessed by Cyanmethaemoglobin method. In this method a 3ml of blood sample was collected through intra- artery prick and mixed it with 50 µltr EDTA, an anticoagulant agent. Thereafter, in the laboratory the blood sample was mixed with Drabkin's solution and vortexed in order to convert haemoglobin into cyanmethaemoglobin. The concentration of haemoglobin was determined by comparison with a known standard in a calorimeter. For this purpose service of a qualified technician of pathology laboratory was hired.

3.6 Tools for Data Collection:

3.6.1 Interview Schedule

A general interview schedule was designed to enquire about the family background of the subjects and other details like dietary habits, surrounding environment of households, source of water. **(See Annexure-II)**

3.6.2 Anthropometric Tools

Height and weight of the subjects were recorded using standard scales at initial, mid and final stage of the study.

3.6.3 Observation Schedule:

Observation schedule was designed to record the parameters including anthropometric (height, weight) measurements, clinical signs and symptoms, dietary and hygienic practices. **(See Annexure-III)**

3.7 Field Testing of the Research Tools:

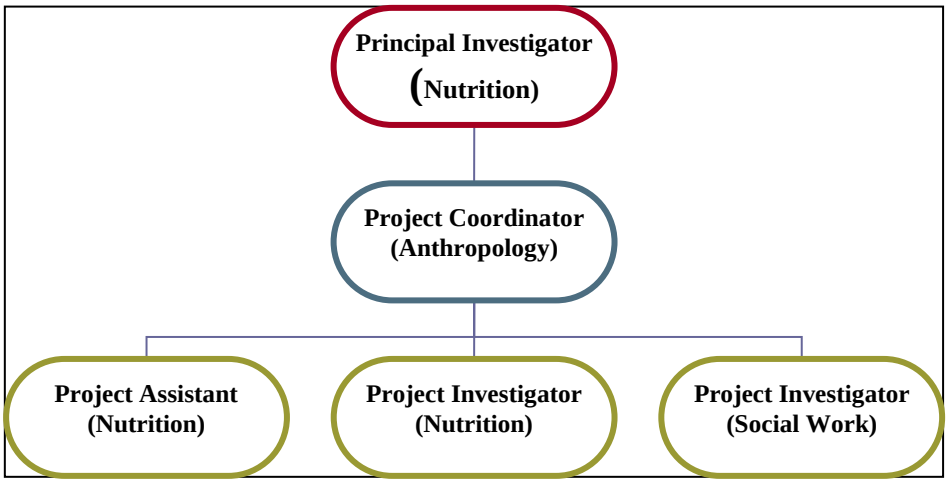
The tools developed to collect data for the present study were administered on 25 subjects in the study area to check the accuracy and there by modified and finalized the schedules accordingly.

3.8 Operational Details

Prior to the initiation of data collection of the study, operational strategies were worked out in cooperation with the Directorate of Health and Family Welfare and ICDS so as to extend their support in procurement of Iron Folic Acid and Vitamin C tablets and issuing the necessary orders for the concerned staff in providing field level assistance. At field level, AWWs of the selected villages coordinated with the research team in identifying the households of the subjects and in explaining the purpose of the study to the parents of the adolescent girls for obtaining consent of their parents to carry out the haematological test. Therefore, only girls who were agreeable to participate in the study were enrolled. At the same time village heads and school teachers were also oriented about the purpose of the study. Team members were provided with identity cards, authority letters and maps of the field area to facilitate the process of data collection.

3.9 Manpower Planning:

Since the study was focussed on adolescent girls, female investigators with previous research experience were deployed in the study. Thus the study included the following team:-



3.10 Ensuring Data Quality:

3.10.1 Orientation about the study

A one-day workshop was organized at NIPCCD, Regional Centre, Lucknow for the members of research team and oriented them about procedure of data collection with due focus on filling up the schedules accurately. Other minute aspects like involvement of community members were emphasized during the workshop.

3.10.2 Supplementation Monitoring Calendars

Supplementation Monitoring Calendars were designed and provided to each subject to monitor as well as promote the timely consumption of supplementation under the supervision of AWWs. The research team motivated the AWWs to ensure that the tablets would not be taken empty stomach by subjects. **(See Annexure-IV)**

3.10.3 Deworming

Deworming tablets (Alzole containing Albendozole 400 mg) were given to all the groups initially, before proceeding for the haemoglobin investigation to ensure the efficacy of iron and folic acid (with and without vitamin C) absorption.

3.10.4 Field Diary

Field diary was maintained by the investigators to record the daily events and field observations as it facilitates the interpretation of data and knowledge of factual cause of every event.

3.11 Interventions:

3.11.1 Iron and Folic Acid (with and without Vitamin C) Supplementation

The adolescent girls were divided into four groups (A, B, C and D) comprising 100 subjects in each for supplementation. The haemoglobin range of these groups at the initial phase of estimation found to be 10.0-13.8(12.0), 4.8-13.0(10.8), 8.2-12.3(10.5) & 6.2-13.0(9.2) respectively. The following table describes the particulars of supplementation given to the subjects for six months.

Table 3.1: Iron and Folic Acid (with and without Vitamin C) Supplementation

Groups	Range (Mean)	Supplementation	Periodicity
A	**10.0-13.8(12.0)**	Iron Folic Acid Tablet*	Weekly
B	**4.8-13.0(10.8)**	Iron Folic Acid Tablet	Biweekly
C	**8.2-12.3(10.5)**	Iron Folic Acid Tablet + Vitamin C**	Weekly
D	**6.2-13.0 (9.2)**	Iron Folic Acid Tablet + Vitamin C	Biweekly
Chemical Composition: ***IFA Tablet** **:** Dried Ferrous Sulphate IP 335mg equivalent to 100 mg Ferrous Iron and 0.5 mg Folic Acid ****Vitamin C Tablet :** I.P. 50 mg of Ascorbic acid			

3.11.2 Nutrition and Health Education (NHEd)

In the present study an intensive NHEd was imparted weekly to the adolescent girls for a period of 6 months mainly through Inter Personal Communication (IPC) techniques using posters, games, stories and lectures by covering the contents on functions of food, balanced diet, nutritional requirements during adolescence and pregnancy, age at marriage, hygienic practices, preparing simple iron rich recipes and right cooking methods. Subjects were also informed about the changes occurred in their height, weight and haemoglobin status during the three phases of study.

3.12 Data Computerisation and Analysis

Data gathered during the three phases of study was checked before entering it into computer to detect any errors in entries of the schedules. A service of external statistical institute (Institute of Applied Statistics and Development, Lucknow) was hired to proceed with data analysis. Simple statistical measures like percentages, mean values, test of significance, t-test, standard deviation and comparative analysis (t-value of haemoglobin rise in each group versus duration) was used to analyse the data for drawing conclusions. The statistical analysis was done using the software SPSS 10.0 version.

3.13 Field Constraints:

The study also experienced some field constraints during its course of implementation. Subjects in the selected villages initially showed their reluctance for haematological test due to fear of intra-artery prick. At the initial phase, rumors were spread about the blood sample collection and supplementation that these collected blood samples would be sold out in market and their adolescent girls would become infertile with supplementation and this is used as a

measure by the government to prevent population growth. As a result 63 subjects dropped out during the course of study. The research team also faced problem in convincing the subjects belonging to Muslim population to continue supplementation during '*Roza'* (Religious fast in Muslims)

3.14 Limitation of the Study:

A limitation of the study was that the respondents under each of these four interventions were not homogeneous in terms of Hemoglobin levels. The average Hemoglobin levels of respondents under interventions A, B, C, D were 12.0, 10.8, 10.5, and 9.2 respectively.

RESULTS & DISCUSSION

Prevalence of anaemia among adolescent girls is a matter of great concern, as these girls enter the reproductive life soon after the attainment of their menarche. The main cause of the dietary anaemia is inadequate food intake as well as poor availability of dietary iron in the habitual cereal- based diets. Compared to the vast amount of work done on pregnant women and young children, there are relatively few studies on the prevalence of anaemia adolescent girls. Keeping this in view the present research study was undertaken to analyse the impact of IFA supplementation with and without Vitamin C weekly and biweekly in adolescent girls.

The data under the study was collected in a rural ICDS project through personal interview and observation, was pooled, tabulated and analyzed broadly in respect of the general back ground of the respondents, household sanitation, personal hygienic and dietary practices, dietary pattern, height, weight and haemoglobin status of the sample adolescent girls with weekly and bi-weekly IFA supplementation with and without Vitamin-C in the respective groups up to six months along with NHEd, is presented and discussed in this chapter. An attempt has also been made to present the data in form of graphs for better illustration.

4.1 Characteristics of Respondents

4.1.1 Age Group

Table 4.1 presents the age group of adolescent girls participated in the study. It is found that 41.75 percent (167) of the girls were in the age group of 15-16 years followed by the age groups 13-14 years (30%) and 17-18 years (28.25%).

Table 4.1. AGE GROUP

Groups	No. of Subjects (Percent)
13-14 Yrs	120 (30)
15-16 Yrs	167 (41.75)
17-18 Yrs	113 (28.25)
TOTAL	**400 (100)**

4.1.2 Educational Status

Table 4.2 Educational Status						
Groups	**Illiterate (Percent)**	**Know to Read & Write (Percent)**	**Primary Education (Percent)**	**Matric (Percent)**	**More than Matric (Percent)**	**TOTAL (Percent)**
A	13 (13)	2 (2)	63 (63)	10 (10)	12 (12)	**100 (100)**
B	13 (13)	6 (6)	68 (68)	6 (6)	7 (7)	**100 (100)**
C	10 (10)	3 (3)	71 (71)	9 (9)	7 (7)	**100 (100)**
D	12 (12)	4 (4)	63 (63)	13 (13)	8 (8)	**100 (100)**
TOTAL	**48 (12)**	**15 (3.75)**	**265 (66.25)**	**38 (9.5)**	**34 (8.5)**	**400 (100)**

Table 4.2 provides information on educational status of the subjects. It would be seen that a higher percentage (66.25%) of the sample subjects have received education upto primary level, while a meagre percentage (9.5% and 8.5%) of them studied upto Matric and above Matric respectively. On the other hand 12 percent of the subjects were found illiterates and the least percentage (3.75%) of them were literates (knew to read and write) who said to have received no formal education before.

4.1.3 Marital Status

The table 4.3 explains the marital status of the respondents. It is clear from the table that a large majority (98.25 %) of the sample subjects were unmarried and the rest included 5 married (1.25%), a divorcee and a widow. The married subjects did not have their "*Gauna*"(ceremonial bringing of a wife from her father's house to her husband's home on reaching puberty) and thus were still at their paternal home.

Table 4.3 MARITAL STATUS					
Groups	**Married (Percent)**	**Unmarried (Percent)**	**Divorce (Percent)**	**Widow (Percent)**	**Total (Percent)**
A	2 (2)	98 (98)	-	-	**100 (100)**
B	0 (0)	98 (98)	1 (1)	1 (1)	**100 (100)**
C	1 (1)	99 (99)	-	-	**100 (100)**
D	2 (2)	98 (98)	-	-	**100 (100)**
TOTAL	**5 (1.25)**	**393 (98.25)**	**1 (.25)**	**1 (.25)**	**400 (100)**

As the research study proceeded, twelve more subjects got married and six among them had left during the study.

Fig. 4.1: Age Breakup of the Subjects

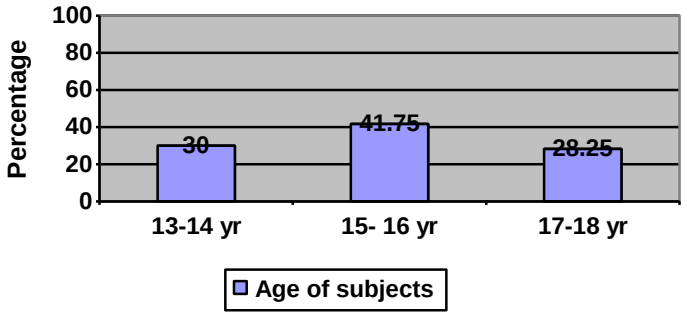


Fig. 4.2: Educational Status of the Subjects

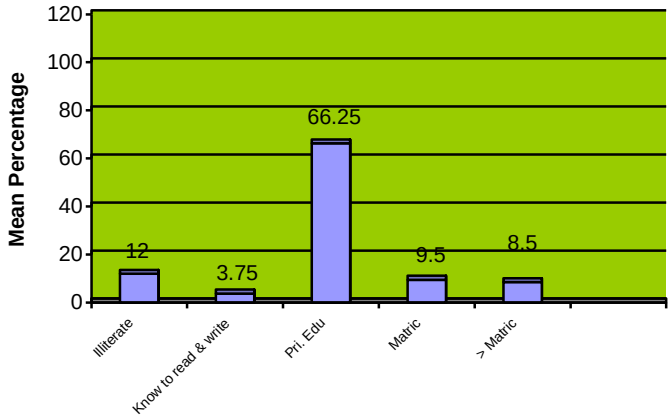
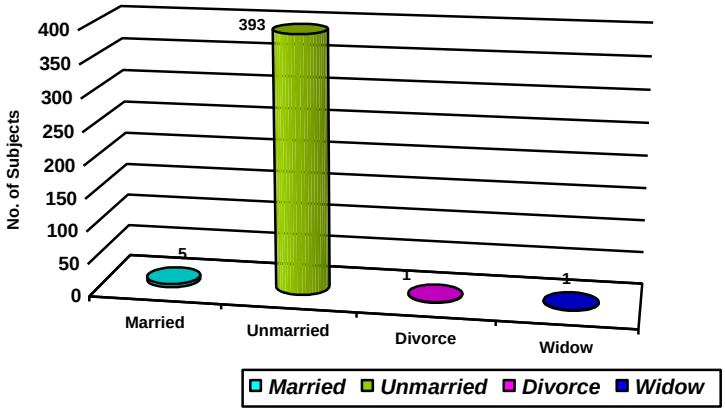


Fig. 4.3: Marital Status

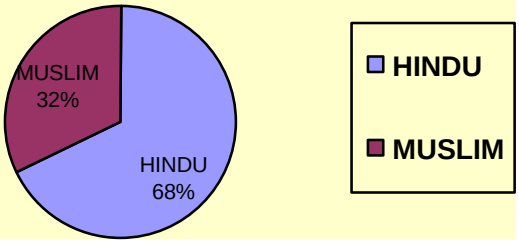


4.1.4 Religion

Table 4.4 Religion of the Subjects			
Groups	**HINDU (Percent)**	**MUSLIM (Percent)**	**TOTAL (Percent)**
A	69 (69)	31 (31)	**100 (100)**
B	65 (65)	35 (35)	**100 (100)**
C	72 (72)	28 (28)	**100 (100)**
D	66 (66)	34 (34)	**100 (100)**
TOTAL	**272 (68)**	**128 (32)**	**400 (100)**

Table 4.4 shows the religion of the subjects selected in the study. It shows that a higher percentage (68%) of the subjects were Hindus and rest (32 %) of them were Muslims.

Fig. 4.4: Religion

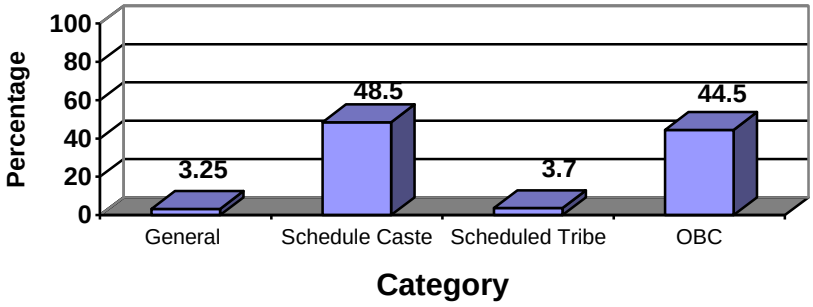


4.1.5 Caste wise Category

The table 4.5 reflects the caste wise category of the respondents. Out of 400 adolescent girls, nearly half of them belonged to Scheduled Caste (48.5 %) followed by the girls (44.5%) from Other Backward Category, and a very little percentage (3.75% and 3.25%) of them belonged to Scheduled Tribe and General Category respectively.

Table 4.5 Category of the Subjects					
Groups	**General (Percent)**	**Scheduled Caste (Percent)**	**Scheduled Tribe (Percent)**	**Other Backward Caste (Percent)**	**TOTAL (Percent)**
A	4 (4)	44 (44)	2 (2)	50 (50)	**100 (100)**
B	5 (5)	48 (48)	3 (3)	44 (44)	**100 (100)**
C	2 (2)	52 (52)	7 (7)	39 (39)	**100 (100)**
D	2 (2)	50 (50)	3 (3)	45 (45)	**100 (100)**
TOTAL	**13 (3.25)**	**194 (48.5)**	**15 (3.75)**	**178 (44.5)**	**400 (100)**

Fig. 4.5: Castewise Category



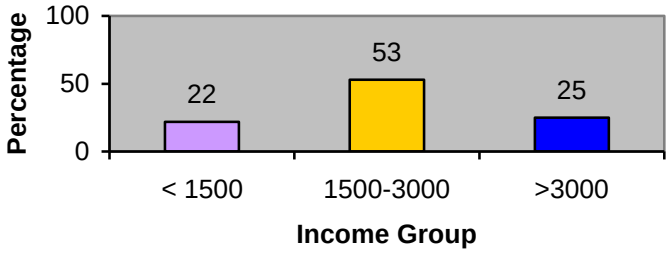
4.1.6 Family Income

Table 4.6 Family Income of the Subjects

FAMILY INCOME (p.m.)				
Groups	**<1500/- (Percent)**	**1500-3000/- (Percent)**	**>3000/- (Percent)**	**TOTAL (Percent)**
A	19 (19.0)	46 (46.0)	35 (35.0)	**100 (100)**
B	27 (27.0)	49 (49.0)	24 (24.0)	**100 (100)**
C	20 (20.0)	61 (61.0)	19 (19.0)	**100 (100)**
D	22 (22.0)	56 (56.0)	22 (22.0)	**100 (100)**
TOTAL	**88 (22.0)**	**212 (53.0)**	**100 (25.0)**	**400 (100)**

The table 4.6 depicts the family income of the subjects. It explains that only 25% of the subjects' monthly family income was above Rs. 3000/- while the family income for rest of the subjects was less than Rs.3000/- per month, where, more than half (53%) of the subject's family income ranged between Rs. 1500-3000/- per month.

Fig. 4.6: Family Income



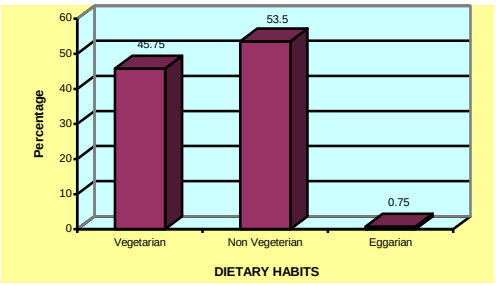
4.1.7 Eating Habits

Table 4.7 Eating Habits of the Subjects

EATING HABITS				
Groups	**Vegetarian (Percent)**	**Non Vegetarian (Percent)**	**Eggatarian (Percent)**	**TOTAL (Percent)**
A	49 (49.0)	51 (51.0)	-	**100 (100)**
B	45 (45.0)	54 (54.0)	1 (1.0)	**100 (100)**
C	42 (42.0)	56 (56.0)	2 (2.0)	**100 (100)**
D	47 (47.0)	53 (53.0)	-	**100 (100)**
TOTAL	**183 (45.75)**	**214 (53.5)**	**3 (0.75)**	**400 (100)**

Table 4.7 exhibits the eating habits of the subjects. Out of 400 subjects, a very negligible percentage (0.75%) of the subjects found to consume eggs apart from their vegetarian diet. However, more than half of the subjects (53.5 %) were found non-vegetarians, while the rest (45.75%) being vegetarians.

Fig 4.7: Eating Habits



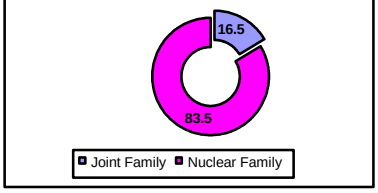
4.1.8 Family Type

Table 4.8 Family Type of the Subjects

FAMILY TYPE			
Groups	**Joint Family (Percent)**	**Nuclear Family (Percent)**	**TOTAL (Percent)**
A	18 (18)	82 (82)	**100 (100)**
B	16 (16)	84 (84)	**100 (100)**
C	15 (15)	85 (85)	**100 (100)**
D	17 (17)	83 (83)	**100 (100)**
TOTAL	**66 (16.5)**	**334 (83.5)**	**400 (100)**

The table 4.8 indicates the family type of the subjects. In which, majority (83.5%) of the sample subjects hailed from nuclear families and the remaining 16.5 percent of them were from joint families.

Fig. 4.8: FAMILY TYPE



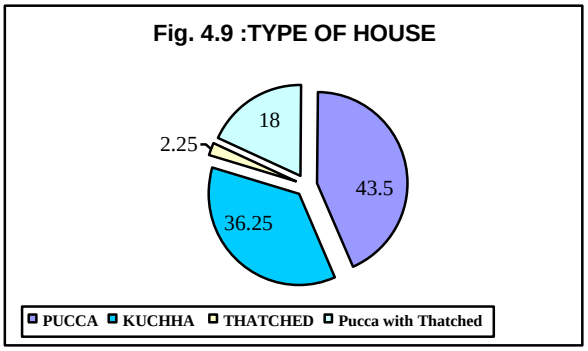
4.2 Living Conditions of the Respondents

4.2.1 Type of house

Table 4.9: Type of House

Groups	PUCCA (Percent)	KUCCHA (Percent)	THATCHED (Percent)	PUCCA with THATCHED (Percent)	TOTAL (Percent)
A	43 (43)	36 (36)	1 (1)	20 (20)	**100 (100)**
B	37 (37)	40 (40)	4 (4)	19 (19)	**100 (100)**
C	48 (48)	33 (33)	2 (2)	17 (17)	**100 (100)**
D	46 (46)	36 (36)	2 (2)	16 (16)	**100 (100)**
TOTAL	**174 (43.5)**	**145 (36.25)**	**9 (2.25)**	**72 (18)**	**400 (100)**

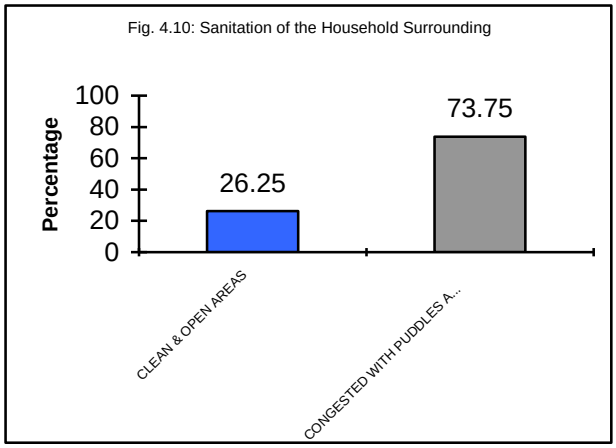
The table 4.10 describes the housing of the subjects. Around 43.5% of the subjects were living in Pucca houses followed by Kuccha (36.25%) and Pucca with thatched houses (18 %). While, fewer percentage (2.25%) of them were residing in exclusively thatched houses.



4.2.2 Sanitation of the Household Surroundings

Table 4.10 Sanitation of the Household Surroundings			
Groups	**Clean & Open Areas**	**Congested with Puddles around**	**Total**
A	22 (11)	78 (39.00)	**100**
B	23 (11.5)	77 (38.50)	**100**
C	31 (15.5)	69 (34.50)	**100**
D	29 (14.5)	71 (35.50)	**100**
TOTAL	**105 (26.25)**	**295 (73.75)**	**400 (100)**

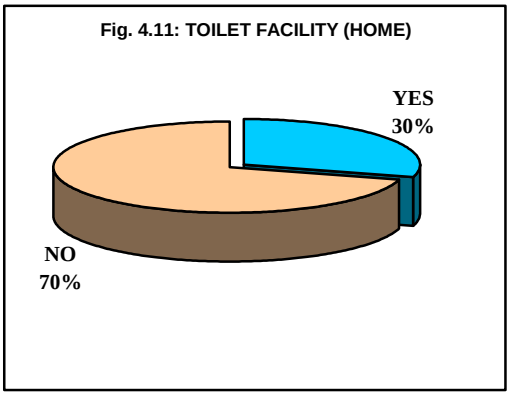
Table 4.10 represents the sanitation of the sample household surroundings. It is viewed from the table that almost three- fourth (74%) of the subjects' dwelling area was congested with puddles. While, remaining 26 percent of the sample households were surrounded by clean and open space/areas.



4.2.3 Toilet Facility

Table 4.11 TOILET FACILITY (HOME)			
Groups	**YES (Percent)**	**NO (Percent)**	**TOTAL (Percent)**
A	27 (27)	73 (73)	**100 (100)**
B	28 (28)	72 (72)	**100 (100)**
C	34 (34)	66 (66)	**100 (100)**
D	29 (29)	71 (71)	**100 (100)**
TOTAL	**118 (29.5)**	**282 (70.5)**	**400 (100)**

The table 4.11 shows the availability of toilet facility in the sample households. It was seen that a considerably large number (70.5%) of the households were devoid of toilet facility. Further, it was noticed that there is no proper system for draining wastewater and disposing household wastes in most of the households.



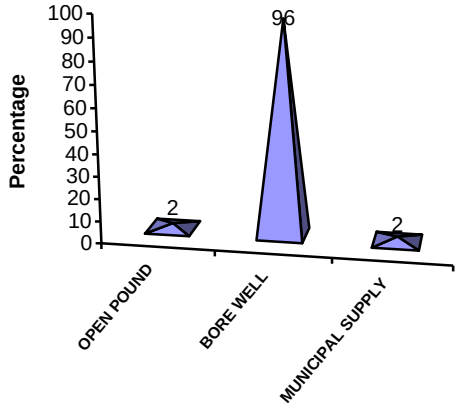
4.2.4 Source of Drinking Water

Table 4.12 gives information about the source of drinking water. It is evident from the table that the source of drinking water for a greater percentage (96%) of the sample households was bore well, while the rest of the households were either fetching water from the open pond or having Municipal supply (tap water).

Table 4.12 Source of Drinking Water

SOURCE OF DRINKING WATER				
Groups	**OPEN POND (Percent)**	**BORE WELL (Percent)**	**MUNICIPAL SUPPLY (Tap water) (Percent)**	**TOTAL (Percent)**
A	3 (3)	95 (95)	2 (2)	**100 (100)**
B	1 (1)	95 (95)	4 (4)	**100 (100)**
C	4 (4)	96 (96)	-	**100 (100)**
D	-	98 (98)	2 (2)	**100 (100)**
TOTAL	**8 (2)**	**384 (96)**	**8 (2)**	**400 (100)**

Fig 4.12: Source of Drinking Water

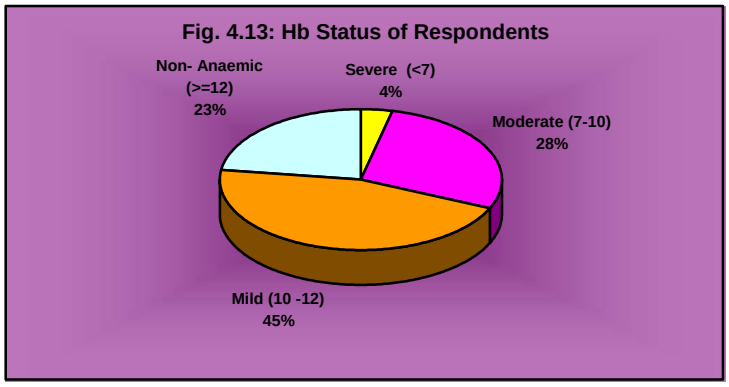


4.3 Haemoglobin Status

Table 4.13 : Haemoglobin Status of the Subjects

S.No.	Anaemic Condition (Hb%)	No of Subjects (Percent)
1.	Severe (<7 g/dl)	14 (3.5)
2.	Moderate (7-10 g/dl)	113 (28.25)
3.	Mild (10-12 g/dl)	182 (45.5)
4.	Non anemic (>=12 g/dl)	91 (22.75)
TOTAL		**400 (100)**

Fig. 4.13: Hb Status of Respondents



Hematological test was carried out among 400 adolescent girls to assess the haemoglobin levels and record the prevalence of anemia among subjects. Data from the above table clearly denotes that anaemia was prevalent among 76.25 percent of the subjects ranging from mild (45.5) to moderate (28.25 %) and severe (3.5 %) grades. While, the rest (22.5%) being non-anemic with haemoglobin levels 12g/dl or above as per the WHO classification.

4.4 IMPACT OF IFA SUPPLEMENTATION

The following tables clearly show the changes observed in the subjects, in respect of IFA supplementation with and without Vit-C and NHEd during the second (at 3 months) and third phases (at 6 months) of the study.

4.4.1 Anthropometric Measurements and Haemoglobin Status of the Adolescent Girls

The table 4.14 illustrates the changes in mean height, weight and haemoglobin percentage value among the four groups during the phases 0-3months and 3-6 months of the study. Group A (Weekly IFA supplementation) showed an increment in mean height by 0.6 cm at three months and 0.6 cm at six months. The raise in weight was observed by 2.1 kg at three months and 0.1 kg at six months. The haemoglobin percent was also changed by 0.1 percent on six months of supplementation. A decrease in mean Hb percent was recorded at the intermediate phase which might be due to the fact that most of the subjects in this group were catch up with viral fever during this phase.

Table 4.14:
Anthropometric Measurement and Haemoglobin Status of the Adolescent Girls

Ist Phase (0 mnths)	Mean Ht (cms)	Mean Wt. (Kg)	Mean Hb%
Group A	148.7	39.8	12.0
Group B	147.3	38.1	10.8
Group C	147.9	39.1	10.5
Group D	147.9	37.7	9.2
IInd Phase (After 3 mths)			
Group A	149.3 (+ 0.6)	41.9 (+ 2.1)	11.9 (- 0.1)
Group B	148.4 (+ 1.1)	40.0 (+ 1.9)	11.9 (+ 1.1)
Group C	148.8 (+ 0.9)	41.1 (+ 2.0)	11.8 (+ 1.3)
Group D	148.9 (+ 1.0)	39.9 (+ 2.2)	11.7 (+ 2.5)
IIIrd Phase (3- 6 mths)			
Group A	149.9 (+ 0.6)	42.0 (+ 0.1)	12.1 (+ 0.2)
Group B	148.7(+ 0.3)	40.0 (no change)	12.1 (+ 0.2)
Group C	149.2 (+ 0.4)	41.4 (+ 0.3)	12 (+ 0.2)
Group D	149.1 (+ 0.2)	39.9 (no change)	11.9 (+ 0.2)

The Group B (Biweekly IFA supplementation) showed greater improvement than Group A. The increment in mean height was 1.1 cm at three months and 0.3 cm at six months of supplementation. The mean weight of the subjects in this group was increased by 1.9 kg at three

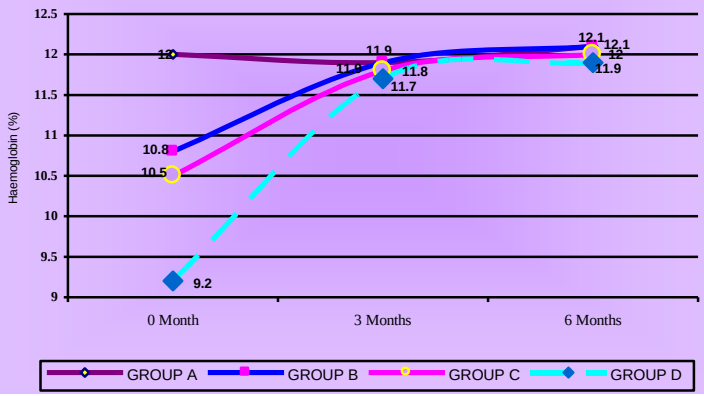
months, and it remains same at six months. The haemoglobin percent was also accounted more by 1.1 percent at three months and 0.2 percent after six months of supplementation.

Group C (Weekly IFA + Vitamin C) showed an appreciable change in comparison to the above-discussed groups. The mean height was gained by 0.9 cm at three months and 0.4 cm at six months of supplementation. The mean weight was gained by 2 kg at three months and 0.3 kg at six months and consequently, haemoglobin percent increased by 1.3 percent at three months and 0. 2 percent at six months.

When IFA supplementation was given with Vitamin C biweekly to the subjects in the Group D, significant gain was observed in the parameters. The increment observed was maximum in this group. The mean height calculated has grown up by 1.0 cm at three months and 0.2 cm at six months. The mean weight was also raised maximum by 2.2 kg at three months and it remains same at six months. The haemoglobin percent was magnified by 2.5 percent at three months and 0.2 percent at six months.

Thus, at the end of the third phase of the study, prevalence of anaemia in Group B (Moderate), C (Mild) & D (Severe) was found to be almost finished and the haemoglobin status of the subjects raised to Normal value of haemoglobin level (>= 12.0 g/dl) **(See Fig. 4.14)**

Fig 4.14: Rise in Hb level



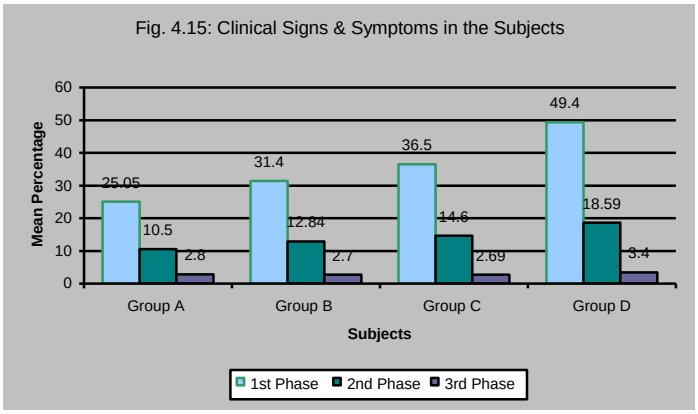
4.4.2 Prevalence of Clinical Signs & Symptoms in the Subjects

Table 4.15 Clinical Signs & Symptoms in the Subjects (Figures in parenthesis indicates percentage)

S.N.	Symptoms	Ist Phase (0 month)				II nd Phase (3 months)				III rd Phase (6 months)			
		Gp A (n=100)	Gp B (n=100)	Gp C (n=100)	Gp D (n=100)	Gp A (n=93)	Gp B (n=97)	Gp C (n=98)	Gp D (n=98)	Gp A (n=82)	Gp B (n=85)	Gp C (n=86)	Gp D (n=84)
1	Frequent fever/illness	23 (23)	40 (40)	38 (38)	52 (52)	8 (8.6)	15 (15.5)	16 (16.3)	14 (14.3)	-	1 (1.2)	-	1 (1.2)
2	Headache	44 (44)	61 (61)	67 (67)	86 (86)	15 (16.1)	23 (23.7)	27 (27.6)	37 (37.8)	3 (3.7)	8 (9.1)	1 (1.2)	10 (11.9)
3	Heartburn	11 (11)	20 (20)	16 (16)	36 (36)	5 (5.4)	3 (3.1)	2 (2.04)	3 (3.1)	-	-	-	1 (1.2)
4	Breathless with exertion	24 (24)	39 (39)	50 (50)	69 (69)	1 (1.1)	7 (7.2)	5 (5.1)	15 (15.3)	-	-	-	-
5	Fatigue with exertion	34 (34)	48 (48)	61 (61)	88 (88)	12 (12.9)	20 (20.6)	19 (19.4)	38 (38.8)	-	-	-	2 (2.4)
6	Fatigue during pds	65 (65)	71 (71)	80 (80)	91 (91)	29 (31.2)	38 (39.2)	42 (42.9)	60 (61.2)	7 (8.5)	5 (5.8)	5 (5.8)	5 (5.8)
7	Increased Palpitation	8 (8)	12 (12)	17 (17)	28 (28)	4 (4.4)	-	7 (7.1)	3 (3.1)	-	-	-	-
8	Lack of Concentration	39 (39)	41 (41)	48 (48)	66 (66)	13 (13.9)	17 (17.5)	16 (16.3)	17 (17.3)	-	1 (1.2)	-	-
9	Decreased Grasping	28 (28)	37 (37)	37 (37)	58 (58)	5 (5.3)	8 (8.2)	6 (6.1)	8 (8.2)	-	-	-	-
10	Forget fullness	23 (23)	31 (31)	32 (32)	46 (46)	3 (3.2)	4 (4.1)	8 (8.2)	9 (9.2)	-	-	-	-
11	Pallor Skin	6 (6)	12 (12)	16 (16)	37 (37)	1 (1.1)	1 (1.1)	2 (2.04)	1 (1.02)	-	-	-	-
12	Pale Eyelid	5 (5)	16 (16)	22 (22)	43 (43)	-	2 (2.1)	2 (2.04)	-	-	-	-	-
13	Sore Tongue & Mouth	21 (21)	13 (13)	17 (17)	32 (32)	2 (2.2)	4 (4.1)	7 (7.1)	3 (3.1)	-	-	-	-
14	Koilonychias	3 (3)	2 (2)	4 (4)	4 (4)	-	-	1 (1.02)	-	-	-	-	-
15	Numbness	38 (38)	47 (47)	55 (55)	72 (72)	26 (27.9)	28 (28.9)	31 (31.6)	45 (45.9)	10 (12.2)	2 (2.5)	4 (4.7)	2 (2.3)
16	Swelling in Legs	6 (6)	9 (9)	16 (16)	21 (21)	1 (1.1)	3 (3.1)	4 (4.1)	5 (5.1)	-	-	---	-
17	Loss of Hair	59 (59)	59 (59)	76 (76)	87 (87)	45 (48.4)	48 (49.4)	56 (57.1)	69 (70.4)	21 (25.6)	23 (27.1)	26 (30.2)	30 (35.7)
18	Loss of Hunger	37 (37)	36 (36)	39 (39)	60 (60)	16 (17.2)	23 (23.7)	21 (21.4)	18 (18.4)	3 (3.7)	4 (4.7)	8 (9.3)	4 (4.7)
19	Pica	2 (2)	3 (3)	2 (2)	11 (11)	1 (1.1)	-	-	1 (1.02)	-	-	-	-
Total Mean		**25.1 (25. 05)**	**31.4 (31.4)**	**36.5 (36.4)**	**49.4 (51.94)**	**9.8 (10.5)**	**12.8 (13.2)**	**14.3 (14.6)**	**18.2 (18.59)**	**2.3 (2.8)**	**2.3 (2.7)**	**2.3 (2.69)**	**2.8 (3.4)**

Table 4.15 elaborates the prevalence of clinical signs and symptoms associated with anaemia in the sample subjects, during the three phases of the study. In the initial stage, the clinical signs and symptoms were prevalent in almost half of the subjects in the Group D followed by Group C (36.5%) Group B (31.4%) and Group A (25.05%). Majority of the subjects in the Group D reported to have fatigue during periods, fatigue with exertion, loss of hair, headache. While a higher percentage (72%) of them had suffered from numbness. Other symptoms like loss of hunger, lack of concentration and breathlessness with exertion were also prevalent in 60-69% of the subjects in Group D. A very higher percentage (80%) of the Group C and 65% and 71% of Groups A and B respectively, reported to have fatigue during periods. Further, 76 percent of the Group C complained about loss of hair.

Fig. 4.15: Clinical Signs & Symptoms in the Subjects



As the intervention proceeded, some of the clinical signs and symptoms in the second phase disappeared and the prevalence of remaining signs and symptoms was reduced. While coming to the end of the third phase the prevalence of the above mentioned clinical signs and symptoms have reduced to a greater extent, while other signs and symptoms disappeared completely. This change is more visible from the graph as it shows a continuous decline in prevalence of clinical signs & symptoms associated with anaemia by the end of third phase, which comes down from 25.05%,31.4%,36.5% and 49.4% to 2.8%, 2.7%, 2.7% and 3.4% respectively in the Groups A,B,C and D.

4.4.3 Clinical Manifestations due to IFA Supplementation

Though appropriate dosage of iron is determined for therapeutic intervention to control anaemia, but one has to contend with its side effects such as constipation, black stool, nausea and diarrhea. The frequency of such side effects is directly related to the dosage of iron, which could be reduced to minimum on continued intake of supplement, which is clearly pictured in the table below.

Table 4.16 Clinical Manifestations due to IFA Supplementation

Clinical Manifestation due to IFA supplementation	II nd Phase (3 months)				III rd Phase (6 months)			
	Group A (n=93)	Group B (n=97)	Group C (n=98)	Group D (n=98)	Group A (n=82)	Group B (n=85)	Group C (n=86)	Group D (n=84)
Constipation	-	1 (1.03%)	-	1 (1.02%)	-	-	-	-
Black stool	1 (1.10%)	-	1 (1.02%)	2 (2.04%)	-	-	-	-
Nausea	1 (1.10%)	2 (2.10%)	-	9 (9.20%)	-	-	-	-
Diarrhoea	-	1 (1.03%)	-	1 (1.02%)-	-	-	-	-

Table 4.16 depicts the clinical manifestations due to IFA supplementation. The effects of IFA supplementation appeared in few of the subjects during the second phase. When the observation of these subjects was made in respect of their Groups for clinical manifestations, it was found that the Groups A and C with weekly supplementation of IFA showed lesser side effects than those in Groups B and D with bi-weekly supplementation of IFA. However, with continued intake of supplements the intensity of side effects was reduced gradually and disappeared in the final stage of the study.

4.5 IMPACT OF NUTRITION AND HEALTH EDUCATION

The following tables describe the impact of nutrition and health education on the personal and dietary practices of the subjects.

4.5.1 Household Sanitation

I. Cleanliness of the House

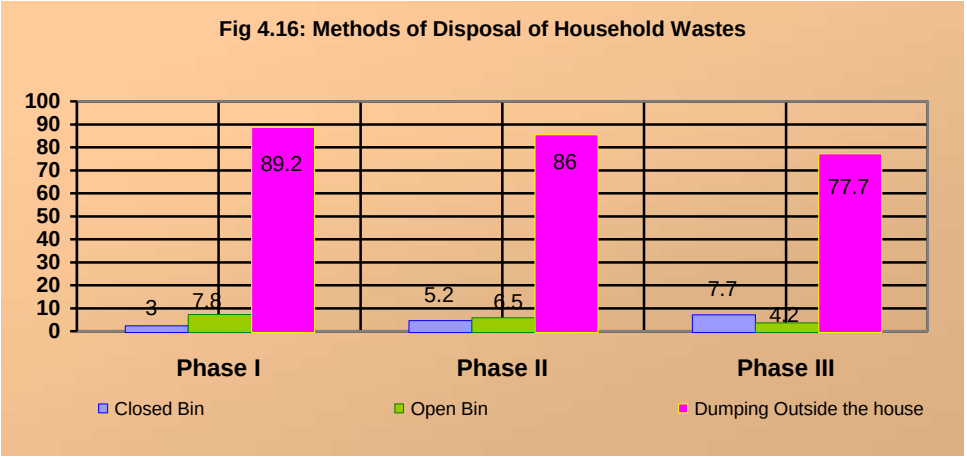
Cleanliness of the House	Table 4.17: Cleanliness of the House		
	I Phase (0 mths) n=400 (Percent)	II Phase (After 3 mths) n= 386 (Percent)	III Phase (After 6 mths) n=337 (Percent)
	250 (62.5)	306 (79.3)	285 (84.6)

Table 4.17 reveals a positive impact of health education imparted during the study as the percentage of the households maintaining cleanliness of house was increased from from 62.5 percent at the start of study to 84.6 percent at the end of the final phase.

II. Method of disposal of household wastes

Table 4.18: Method of disposal of household wastes			
Methods	**I Phase (0 mths) n=400 (Percent)**	**II Phase (After 3 mths) n= 386 (Percent)**	**III Phase (After 6 mths) n=337 (Percent)**
a. Closed bin	12 (3.0)	20 (5.2)	26 (7.7)
b. Open bin	31 (7.8)	25 (6.5)	14 (4.2)
c. Dumping outside the house	357 (89.2)	344 (86.0)	311 (77.7)

Table 4.18 reflects the methods of disposal of household wastes and it shows that there was a small rise (from 3 percent to 7.7 percent) in the



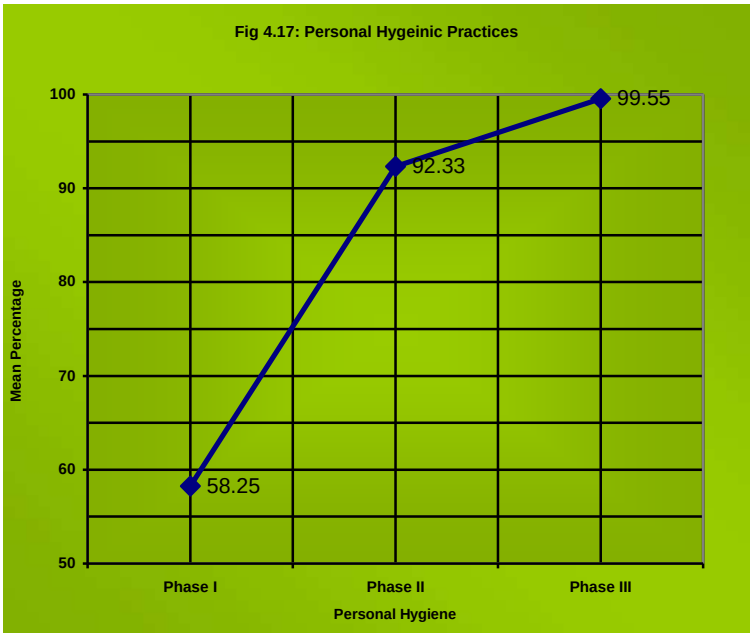
number of households using closed bin for disposal of household wastes. It also exhibits a decline in malpractice of disposing wastes using open bin and dumping outside the house from 7.8 percent and 89.2 percent at the initial phase to 4.2 percent and 77.7 percent respectively at the end of the study.

4.5.2 Personal Hygienic Practices

Table 4.19 Personal Hygienic Practices

S.No.	Habits of Personal Hygiene	I Phase (0 mnth) n=400 (Percent)	II Phase (After 3mnth) n=386 (Percent)	III Phase (After 6 mnth) n=337 (Percent)
1	Regular Bathe	233 (58.25)	369 (95.59)	337 (100)
2	Regular Brush Teeth	319 (79.75)	384 (99.48)	337 (100)
3	Wearing clean cloths	297 (74.25)	381 (98.70)	337 (100)
4	Clean & tied hair	300 (75.00)	383 (99.22)	337 (100)
5	Short & Clean Nails	251 (62.75)	381 (98.70)	336 (99.70)
6	Wearing slipers / shoes on their feet	170 (42.50)	348 (90.15)	336 (99.70)
7	Washing hands with soap/ash after lavoratory	247 (61.75)	383 (99.22)	336 (99.70)
8	Washing hands before & after meals	201 (50.25)	376 (97.41)	337 (100)
9	Taking daily bath during periods	248 (62.00)	326 (84.46)	328 (97.33)
10	Use of clean & sanitized napkins	124 (31.00)	237 (61.39)	334 (99.11)
11	Regular change of napkins during periods	201 (50.25)	359 (93.01)	337 (100)
12	Regular change of inner clothes	218 (54.50)	350 (90.67)	334 (99.11)
Total Mean		**234.08 (58.52)**	**356.41 (92.33)**	**335.50 (99.55)**

Table 4.19 illustrates the personal hygienic practices of the subjects. It was found that only 31% and 42 % of the sample subjects had the habits of using clean sanitized napkins and wearing slippers /shoes on their feet respectively and the corresponding percentages in the final phase increased to 99.70% and 99.11%. On the other hand a higher percentage of the sample subjects were found following hygienic practices of brushing teeth regularly, having clean and tied hair and wearing clean clothes, which further increased to cent percent at the end of final phase on account of imparting NHEd regularly. Similar improvements were also noticed in respect of taking regular bathe, washing hands before and after meals and regular change of napkins during periods. On the whole, it is concluded that, though, the hygienic practices are found in only 58.52 percent of the sample subjects in the initial phase, within three months, the percentage of the sample subjects following hygienic practices has raised to 92.34 percent and by the end of six months almost all the subjects have inculcated those hygienic practices. This shows the magnitude of the change in the sample subjects through NHEd.



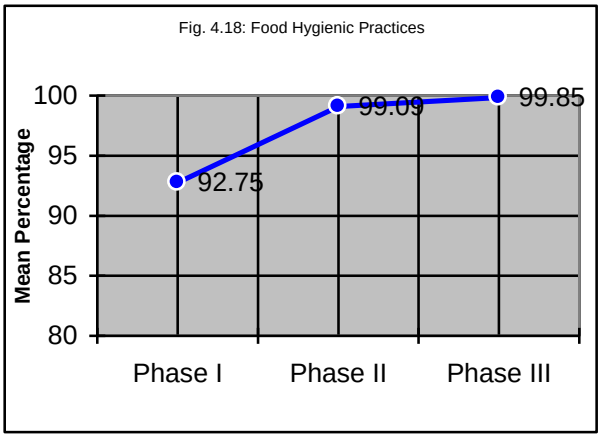
4.5.3 Food Hygienic Practices

Table 4.20 Food Hygienic Practices

S.No.	Food hygienic Practices	I Phase n=400 (Percent)	II Phase n=386 (Percent)	III Phase n=337 (Percent)
1	Wash raw foods & utensils before cooking	391 (97.75)	385 (99.74)	337 (100)
2	Storage of cooked food & drinking water in clean utensils with cover	351 (87.75)	380 (98.45)	336 (99.70)
	Total Mean	371 (92.75)	382.5 (99.09)	336.5 (99.85)

Table 4.20 reveals food hygienic practices of the subjects in the study. It shows that initially 92.75 percent of the subjects were found following good food hygiene practices and by the end of the third phase an improvement was noticed in almost all (99.85%) the subjects.

Fig. 4.18: Food Hygienic Practices



4.5.4 Dietary Pattern

Table 4.21 Dietary Pattern

S.N.	Food item/ groups	I Phase (0 mths) n=400 (Percent)				II Phase (After 3mths) n=386 (Percent)				III Phase (After 6 mths) n=337 (Percent)			
		NONE	ONCE	TWICE	THRICE OR MORE	NONE	ONCE	TWICE	THRICE OR MORE	NONE	ONCE	TWICE	THRICE OR MORE
1	Milk / dairy products	194 (48.5)	51 (12.75)	78 (19.5)	77 (19.25)	9 (2.33)	8 (2.07)	127 (32.90)	242 (62.69)	-	-	76 (22.55)	261 (77.45)
2	Dal/sprouts	11 (2.75)	27 (6.75)	45 (11.25)	317 (79.25)	-	-	15 (3.89)	371 (96.11)	-	-	6 (1.78)	331 (98.22)
3	Green leafy vegetables	15 (3.75)	52 (13)	142 (35.5)	192 (48)	-	1 (0.25)	79 (20.46)	306 (79.27)	-	-	26 (7.71)	311 (92.28)
4	Seasonal Fruits	65 (16.25)	117 (29.25)	163 (40.75)	55 (13.75)	1 (0.25)	7 (1.81)	135 (34.97)	243 (62.95)	-	-	45 (13.35)	292 (86.64)
5	Amla/Guava	123 (30.75)	109 (27.25)	148 (37)	20 (5)	2 (0.51)	14 (3.62)	185 (47.92)	185 (47.92)	-	-	119 (35.31)	217 (64.39)
6	Fats & Oils	21 (5.25)	8 (2)	23 (5.75)	348 (87)	-	-	6 (1.55)	380 (98.44)	-	-	2 (0.59)	335 (99.40)

Nutritional management of anaemia includes adequate intake of protein rich foods like milk & dairy products, pulses, iron rich foods like green leafy vegetables apart from Seasonal fruits and especially Vitamin C rich fruits like Amla and guava, which enhances the iron

absorption, should be chiefly incorporated in the diet. The calories can also be increased by adequate intake of fats and oils.

Table 4.21 explains the dietary pattern of the sample subjects. Initially, 48.5 percent of the sample subjects were found not consuming milk or dairy products, while only 19.5 percent of subjects were consuming it twice a week and 19.25 were taking it thrice a week. But at the end of six months the frequency of the consumption of milk/dairy products has increased. Around, 77 percent of the sample subjects were consuming it thrice a week or more, while the rest of them were having it twice a week. It is appreciative that initially, 79.25 percent of the subjects' diet included pulses thrice a week and it further increased to 98.22 percent. The same pattern of impact of nutrition and health education was also observed regarding consumption of green leafy vegetables.

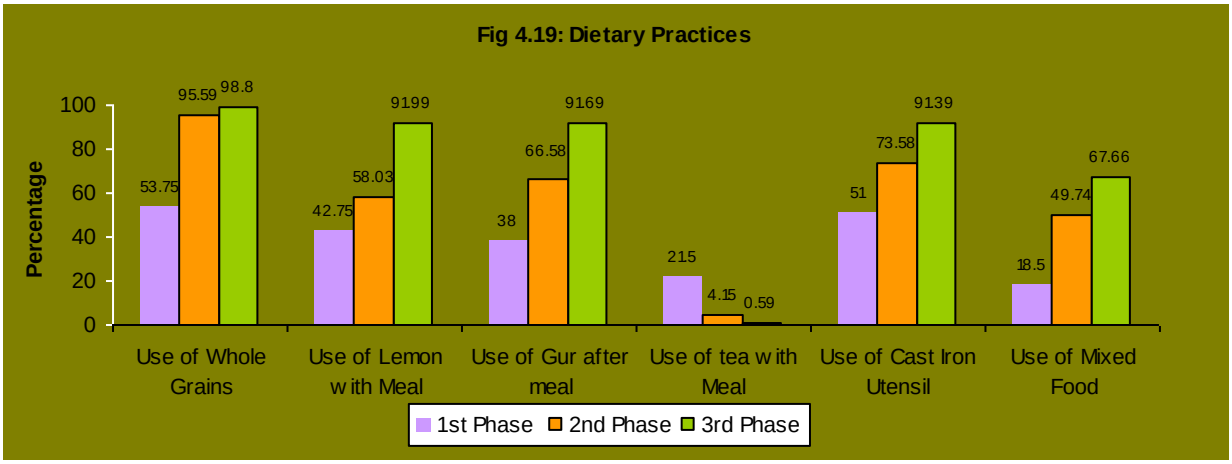
The consumption of seasonal fruits by the subjects in the initial phase denotes that initially, 40.75 percent of the sample subjects consume twice a week followed by once (29.25%) and thrice or more (13.75%) in a week, but the weekly consumption of seasonal fruits for rest 16.25 percent of subjects was nil. However, at the end of the third phase majority (86.64%)of the sample subjects were found consuming it thrice a week. With regard to the intake of vitamin- C fruits amla and guava, it is noticed that 30.75 percent of the girls were taking amla and guava (citrus fruits). When the subjects were made aware of the importance, a moderately higher percentage (64.39 %) of the girls started consuming it twice or more in a week at the end of the final phase. Intake of fats and oils was also increased after six months of NHEd.

4.5.5 Dietary Practices

Table 4.22 Dietary Practices

S.N.	DIETARY PRACTICES	I Phase (0 mths) n=400 (Percent)	II Phase (After 3mths) n=386 (Percent)	III Phase (After 6 mths) n=337 (Percent)
1	**Use of whole wheat or grains like Bajra**	215 (53.75)	369 (95.59)	333 (98.81)
2	**Use of lemon with the meals**	171 (42.75)	224 (58.03)	310 (91.99)
3	**Use of tea/coffee with the meals**	86 (21.50)	16 (4.15)	2 (0.59)
4	**Taking of Jaggery (*Gur)* after the meal**	152 (38.00)	257 (66.58)	309 (91.69)
5	**Use of cast iron utensils for cooking**	204 (51.00)	284 (73.58)	308 (91.39)
6	**Use of mixed food in their diet**	74 (18.50)	192 (49.74)	228 (67.66)
	Total Mean	**150.3 (37.5)**	**223.6 (57.9)**	**248.3 (73.6)**

Table 4.22 describes the dietary practices of the subjects. The use of whole wheat and grains has its own importance in the diet and use of cast iron utensils for cooking is a cost effective method in increasing the iron content of the diet. Around 51 to 53.75 percent of the subjects were found using cast iron utensils for cooking and consuming whole wheat or grains



like bajra in the initial phase while the corresponding percentages in the final phase raised to 91.39% and 98.81% respectively. With regard to use of lemon with the meals only 42.75 percent of the girls had the habit of using lemon with meal initially, after educating them on the importance of lemon or vitamin C the consumption has increased to 92 percent in the final phase. Where as the practice of taking tea/coffee(inhibitor of nutrient absorption) with meal was followed by 21.5 percent of the sample subjects initially, which greatly declined to 0.59 percent at the end of the third phase after educating them about its interference in nutrient absorption. Gur, again is a good source of iron that is readily available in most of the house. At the initial phase, moderately a smaller percentage of the sample subjects found consuming Gur after meal; later the consumption was increased to 91.69 percent at the end of the third phase through NHEd. In respect of the use of mixed food in the diet, only 18.50 percent of the subjects were found to follow the practice initially, later i.e by the end of third phase a higher percentage (67.6%) of the subjects' started consuming mixed food.

4.6 ANALYSIS BASED UPON TESTS OF SIGNIFICANCE

The data on adolescents had the following features:

- There were four types of interventions with two durations 3 and 6 months. These were A – IFA weekly, B - IFA biweekly, C – IFA and Vitamin C weekly, and D - IFA and Vitamin C biweekly.
- The average Hemoglobin levels for each of four interventions (A, B, C, D) is compared at different durations: (0,3), (0,6), and (3,6).

4.6.1 Comparison between durations

For the intervention A, which was weekly administration of IFA, there was no impact on the basis of durations as none of the 3 comparisons (0,3), (0,6) and (3,6) months duration were significant. A possible reason for this could be that average Hb level before interventions was 12.0, which is the cut-off for any anemia. The Hb values had minimum 10 and maximum 13.8, and 45% of the girls were below the cut-off for any anemia.

Table 4.23. Comparison between durations

Type of Interventions	Durations (months)	N	Mean Hb levels	t value
A	0	100	12.0	0.38
	3	93	11.9	
	0	100	12.0	0.89
	6	82	12.1	
	3	93	11.9	1.84
	6	82	12.1	
B	0	100	10.8	6.08**
	3	98	11.9	
	0	100	10.8	7.20**
	6	88	12.1	
	3	98	11.9	1.66
	6	88	12.1	
C	0	100	10.5	11.56**
	3	98	11.8	
	0	100	10.5	13.58**
	6	86	12.0	
	3	98	11.8	2.48*
	6	86	12.0	
D	0	100	9.2	14.62**
	3	97	11.7	
	0	100	9.2	15.12**
	6	81	11.9	
	3	97	11.7	1.51
	6	81	11.9	

**-significant at 5% level; **-significant at 5%level of significance*

For the intervention B, the bi-weekly administration of IFA, 3 and 6 months durations compared to pre-intervention were highly significant but the mean Hb levels of 3 and 6 months were statistically non-significant (the probability level was close to 0.06). The results viewed that there is not significant progress after three months of intervention and suggest that a three month intervention deliver adequate results. These results should be viewed in conjunction with the knowledge that at pre-intervention stage, the average Hb level was low (10.8 in comparison to 12

as was in the category A). The minimum and maximum values were 4.8 and 13 respectively, and a very high 74% of the girls were below the cut-off for any anemia.

The intervention C had weekly administration of IFA along with Vitamin C, which increases the absorption of iron. In this case, all the three comparisons were statistically significant (highly significant for each of 3 and 6 months when viewed with other interventions) showing all round impact of the intervention. Though (3,6) months of intervention showed slight significance, which reveals that first three months intervention, is better. The minimum and maximum values were 8.2 and 12.3 respectively, and a very high 95% of the girls were below the cut-off for any anemia. The average Hb level before interventions was 10.5, which was lower than the corresponding figures in groups A and B.

For the intervention D, the bi- weekly administration IFA along with Vitamin C, 3 and 6 months durations compared to pre-intervention were highly significant but the mean Hb levels of 3 and 6 months were statistically non-significant.This shows that increasing IFA does not help any further. The minimum and maximum values were 6.2 and 13 respectively, and a very high 95% of the girls were below the cut-off for any anemia. The average Hb level before interventions was 9.2, which was lowest among all the four groups. Thus, Group D was found to be best intervention statistically than other groups.

4.6.2 Comparison between Interventions

Table 4.24 Comparisons between Interventions

Durations (months)	Comparisons between	T value
0- 3	(A,B)	1.88
	(A,C)	2.59*
	(A,D)	8.38**
	(B,C)	0.46
	(B,D)	5.63**
	(C,D)	5.61**
3- 6	(A,B)	2.73*
	(A,C)	3.14**
	(A,D)	8.04**
	(B,C)	0.03
	(B,D)	4.71**
	(C,D)	5.06**
*-significant at 5% level; **-significant at 5%level of significance		

As stated earlier, the respondents under the four interventions A, B, C, D were not homogeneous in terms of average Hemoglobin levels, which were 12.0, 10.8, 10.5, 9.2

respectively. In view of this pre-intervention variability, the comparisons among the interventions over durations would be valid only if the Hemoglobin levels at durations 3 and 6 months are adjusted for the initial levels. This means that the Hemoglobin levels for the 3 and 6 months durations would be adjusted values depicting change over values at 0 month. Table 4.25 gives t values for pairwise comparisons among interventions adjusted for initial values. One readily notices that intervention D, is most effective. Combining this with the earlier finding on impact of durations, it is concluded that the intervention D, bi-weekly administration of both IFA and Vitamin C up to 3 months is most effective.

Major Findings

5.1 PROFILE OF THE RESPONDENTS

- Majority of the adolescent girls (87.6 %) were educated, where a higher percentage(66.2%) of them had received education upto primary level, followed by Matric(9.5%) and above Metric(8.5%) and a very small percentage(3.8%) of them knew to read and write, while the rest 12 percent of the subjects were found illiterate.
- Almost all the subjects (98.3 percent) were unmarried.
- 68 percent of the subjects were Hindus and rest 32 percent were Muslims.
- The selected sample comprised 48.5 percent of subjects from scheduled castes, 44.5 percent other backward castes, 3.8 percent scheduled tribes and 3.2 percent of the subjects from general caste.
- 53 percent of the subjects belonged to families with monthly income ranging between rupees 1500-3000/- while 25 percent of the subjects had monthly family income above rupees 3000/- and only 22 percent of the subjects, have monthly income less than 1500/-.
- The eating habits of the subjects revealed that more than half of the subjects (53.5 percent) were non-vegetarian and rest 45.8 percent were vegetarian.
- 83.5 percent of the subjects belonged to nuclear families and the rest 16.5 percent were from joint families.

5.2 LIVING CONDITIONS OF RESPONDENTS

- Only 43.5 percent of the subjects were residing in *Pucca* houses and 36.3 percent of subjects had *Kuccha* house. Rest of them were residing in either *Thatched* house or *Pucca* house with thatched roof.
- Sanitation of the household surroundings was found to be poor as more than three-fourth (73.8 %) of the houses were mainly located in the areas congested with puddles while only 26.2 percent of houses had clean and open surroundings.

- Considerably a large (70.5 %) number of respondents did not have toilet facility at their home.
- It was observed that the source of drinking water for almost all (96 %) the respondent's households was bore well.

5.3 PREVALENCE OF ANAEMIA

- At the start of the study, more than two- third of the adolescent girls (77.2 %) were found anaemic with severe (3.5 %), moderate (28.2 %) and mild (45.5 %) degrees of anaemia and only 22.8 percent subjects were observed non-anaemic with their haemoglobin levels 12 g/dl or above. **(See Table 4.13)**

5.4 IMPACT OF IFA SUPPLEMENTATION

5.4.1 Haematological Status of the Subjects

- All the four intervention groups (A, B, C & D) had shown an improvement in the haemoglobin level of the subjects due to the impact of IFA supplementation **(See Table 4.14)**.
- At the end of third phase of the study, prevalence of anaemia in Group B (Moderate), C (Mild) & D (Severe) was found to be almost reduced and the haemoglobin status of the subjects raised to Normal value of haemoglobin level (i.e. >= 12.0 g/dl) **(See Fig 4.14)**
- When compared, Group D i.e. supplementation of IFA and Vitamin C Biweekly was found to be the best intervention.
- The improvement in haemoglobin status after three months duration (i.e 3 to 6 months) was found insignificant. **(See Table 4.24)**

5.4.2 Clinical Signs and Symptoms

- There was a continuous decline in prevalence of anaemia associated symptoms by the end of third phase of study coming down to 2.8 percent, 2.7 percent, 2.6 percent and 3.4 percent in Group A,B,C and D respectively. The maximum positive result inferred in the Group D

subjects was that the clinical symptoms reduced from 49.4 percent (0 month) to 3.4 percent. (6 month) **(See Table 4.15)**

5.4.3 Clinical Manifestation Due to IFA Supplementation

- The incidence of side effects due to IFA supplementation was found to be negligible during the study. It indicates that it may not be acting as barrier in promotion of consumption of IFA tablets which usually perceived as a fear by the adolescent girls and their parents in the community. **(See Table 4.16)**

5.5 IMPACT OF NUTRITION AND HEALTH EDUCATION

5.5.1 Household Sanitation

a. Cleanliness of the House

- A positive impact of NHEd was observed among the respondents in the practice of maintaining cleanliness of house from 62.5 percent (0 month) to 84.6 percent (6 months)

b. Methods of Disposal of Household Wastes

- Though a small rise was observed in the methods of disposal of household wastes **(See table 4.18)** during the study period of six months but it also indicates that a continue activity of NHEd proves to be a key input in bringing out a significant change in the sanitation practices of community

5.5.2 Personal Hygienic Practices

- At the start of the study 58.5 percent of the subjects were aware of healthy personal hygienic practices but at the end of the study almost all (99.6%) the respondent had started practicing them. Significantly, a major positive response was observed among adolescent girls in the practice of using clean and sanitized napkins from 31 percent (0 month) to 99.1 percent (6 months) due to NHEd. **(See Table 4.19)**

5.5.3 Food Hygienic Practices

- Initially (i.e at 0 month) 92.8 percent of the subjects were found following good food hygiene practices of washing raw food and utensil before cooking and storage of cooked food and drinking water in clean utensil with cover and by the end of the study (6 months) an improvement was noticed among all (99.9%) of the subjects.

5.5.4 Dietary Pattern

- A significant impact of NHEd was also observed in the use of food groups helpful in reducing anaemia among the subjects during the study. The subjects whose intake of leafy vegetables and fruits found low or nil in the first phase had improved in subsequent phases to twice or more in a day. Similarly improvements were also observed in consumption of milk/ dairy products, dal/ sprouts, amla/ guava and fats & oils. **(See Table 4.21)**

5.5.5 Dietary Practices

- At the first phase only 37.5 percent of the subjects were found following good dietary practices but by the end of the study an improvement was observed in almost two- third (73 .6 %) of the respondents due to regular activity of NHEd. Notably, a decline was observed in use of tea or coffee with meals from 21.50 percent (0 month) to almost zero percent (0.59 %) at the end of the study. **(See Table 4.22)**

RECOMMENDATIONS

The following recommendations were drawn based on the findings of the study:

- The main finding emerged out of the study sincerely recommends, that adolescent girls may be supplemented with iron folic acid along with Vitamin C bi-weekly for a period of three months with parallel support of intensive nutrition and health education/counselling to adolescent girls and their families for better compliance and improvement in personal hygienic & dietary practices through government programmes/schemes such as National Rural Health Mission or Integrated Child Development Services or Sarva Siksha Abhiyan to cover maximum rural adolescent population, and thus could yield better results than the existing intervention, where IFA tablets were being supplemented weekly for a period of 52 weeks under National Rural Health Mission/ Integrated Child Development Services Scheme in Uttar Pradesh for combating anaemia in adolescent girls.

The operational strategy may be worked out in the following ways

<u>Capacity building</u>

- Skill Training on NHEd may be organized time to time for Anganwadi Workers, ASHAs and ANMs with due focus on anaemia and its management. Further, School teachers and community should be made aware of the consequences of the anemia as well as the factors that influence the absorption of iron.
- Anaemia needs to be dealt as a major component during the scheduled three day training programme organized for KSY girls on NHEd.

The curriculum should include the following key contents apart from basics of nutrition, health & sanitation

a) Food fads and fallacies that are common in rural areas
b) Right cooking methods preventing nutrient loss
c) Promotion of kitchen gardens
d) Demonstration of iron rich low cost recipies

e) Information Education and Communication & communication for Behavioural Change.
f) Organizing effective NHEd sessions
g) Estimation of haemoglobin through simple method
h) Clinical signs &symptoms of anaemia, its causes and consequences
i) Nutritional counselling

Service delivery

- Regular and timely distribution and consumption of IFA with Vitamin-C to adolescent girls would be ensured and monitored by grass root level functionaries of ICDS and Health Department as well as staff of Education Department.
- The same team would be responsible for imparting NHEd to adolescent girls and their families with due emphasis on myths and mis-conceptions surrounding IFA supplementation and hematological test in the community.
- The anaemic status of adolescent girls needs to be assessed at the initial stage and at the end of three months to check the rise in haemoglobin status of the adolescent girls by the health department. Therefore monitoring tools with specific indicators that could be helpful in keeping track of the anaemic status of the adolescent girls may be developed.

BIBLIOGRAPHY

1. Agarwal, K.N., Assessment of the prevalence of anaemia and iron stores in response to daily and weekly iron and folic acid supplememtation in adolescent girls (10-18 years) from urban slums of northeast Delhi, UNICEF Project Report, 1998.

2. Apte, S.V., in Proceedings of the Nutrition Society of India, 2, 46, Nutrition Research Laboratories, Hyderabad, 1967.

3. Awate R.V., Kekkar Y.A. and Somaiya P.A. Prevalence of Nutritional Deficiency disorders among Rural Primary School Children (5-15 years), J Indian Med. Assoc. 95 (7), 410. 1997.

4. Baker, S.J., Nutritional anaemias.Part2: Tropical Asia., *Clinical Haemat.*, 10, 843, 1981.

5. Cai M.Q, Yan W.Y, Study on Iron Nutritional Status in Adolescence, Biomed Environ. Sci. 1990; 3: 113-119.

6. Cook, J.D., Skikne, B.S., and Baynes. R.D., Iron deficiency: the global perspective, *Adv. Experimental Biol. Med.,* 356,219,1994.

7. Dallman, P.R.: *Am J Clin Nutr,* 46, 329, 1987.

8. De Maeyer E.M. Preventing and Controlling Iron Deficiency anaemia Through Primary Health Care. Geneva. World Health Organisation, 1989; pp 24-25

9. Fujimari E. Szarfara .S. and de Oliveriva, J.M. Prevalence of Iron Deficiency anaemia in females Adolescents in Toboaoa de Serro, Brazil, Rev. lat. Am. Entermagem 4, 149, 1996.

10. Gillespie S. Major issues in the control of Iron Deficiency The Micronutrient Initiative Publication 1998, pp 22-30

11. Gillespie, S., Improving adolescent and maternal nutrition: An overview of benefits and options, Nutrition Sereis # 97-002, UNICEF, New York, 1997

12. Gopalan C., Child Care in India – Emerging Challenges NFI Bull 1993; 14: 1-4.

13. Hallberg, L. and Scrimshaw, N.S. (Eds): Iron Deficiency and Work Performance, INACG, Washington D.C, 1981.

14. INACG- International Nutrition Anaemia Consultative Group (1998) Guidelines for the Use of Iron Supplements to Prevent and Treat Iron Deficiency Anaemia. INACG, Washington, DC.

15. Joint FAO/WHO Expert Committee on Nutrition, Sixth Report, WHO – TRS, 24, WHO, Geneva, 1962.

16. Krishna Menon, M.K.; In Proceedings of the Nutrition Society of India, No.2, p – 1, Nutrition Research Laboratories, Hyderabad, 1967.

17. Kurz, K.M. and Johnson-Welch, C.,The Nutrition and Lives of Adolescent Girls Research Program, International Center for Research on Women, Washington, D.C., 1994.

18. Monsen E.R. et al. Absorption of iron from breakfast meals. American Journal of Clinical Nutrition, 32: 2484-2489 (1979)

19. Narasinga Rao, B.S., Prevention And Control Of Anaemia In India: Theory And Practice, April, 1991.

20. Narasinga Rao, B.S. and Prabhavati, T.: *J Sc Food Agr*, 33:89, 1982.

21. Narasinga Rao, B.S.: *Proc Nutr Soc*, 28:1, 1983.

22. Nelson, M. Balalion. F, and Trivedi A, Iron Deficiency anaemia and Physical Performance in Adolescent Girl from different ethnic backgrounds, Br. J. Nutr.72 (3) (427), 1994

23. Palupi L, Schultink W, Achadi E, Gross R. Effective Community Intervention to improve Haemoglobin Status in Pre schoolers receiving once –weekly iron supplementation. J. Clin Nutr, 1997; 6: 1057-1061.

24. Passi, S.J., Tamber, B., Murgai, T., and Anand, M., Impact of iron-folate suplementation among school age children and adolescents, 2000, in preparation.

25. Prabhavati, T. and Narasinga Rao, B.S: *Ind J Med Res*, 74:37, 1981.

26. Schultink W, Gross R, Gliwitzki M, Karyadi D, Matulessi P. Effect of daily vs twice weekly iron supplementation in Indonesian Pre school children with low iron status. Am J. Clin Nutr 1995; 61: 111-115.

27. Senti. F.R. and Pilch, S.M., Analysis of folate data from the 2nd Health and Nutrtion Examination Survey, *J. Nutr.*, 115, 1398,1985.

28. Sharma Anshu, Nutrition Foundation of India, New Delhi, India Pediatrics 2003; 37: 261-267

29. Sharma, A., Prasad, K., and Rao, K.V., Identificationm of an appropriate strategy to control anaemia in adolescent girls of poor communities, *Indian Pediatr.*, 17(3), 261,2000.

30. Shaw N.S. Iron Deficiency and anaemia in School Children and Adolescents. J

Formos Med.Assoc. 1996; 95 692-698.

31. Srikantia, S.G., Prasad, J.S., Bhaskaram, C. and Krishnamachari, K.A.V.R.: *Lancet*, 1:1307, 1976

32. Srivastava V.K., Nigam A.K., Micronutrient Profile of Women and Children in Uttar Pradesh, India, 2005

33. Vir, Sheila, Singh Neelam, Nigam Arun K. and Jain Ritu, Weekly Iron Folic Acid Supplementation to Adolescent Girls in School and out of Schllod in a Large District Level Programme (under publication)

34. Viteri, F.E., Iron supplementation for the control of iron defieciency in populations at risk, *Nutr. Rev.*, 55(6), 195,1997

35. WHO: *Technical Report Series 580*, Control of nutritional anaemia with special reference to iron deficiency, 1975

36. World Health Organization : Malnutrtion, The Global Picture, Geneva, 2000.

37. Yusufji, *et al*: *WHO Bulletin*, 48, 15, 1973.

Annexure- I

List of Anganwadi Centres

	Name of Selected Villages	Name of Selected AWCs
1	**Kursi**	Brahmani Tola Bhitaribazar Tamboli Tola Mulla Tola
2	**Behrauli**	Behrauli 1 Behrauli 2 Behrauli 3
3	**Mausand**	Mausand 1 Mausand 2 Mausand 3
4	**Tikaitganj**	Tikaitganj 1 Tikaitganj 3 Parsadipurva
5	**Anwari**	Anwari
6	**Hemapurva**	Hemapurva
7	**Basara**	Basara
8	**Gadi**	Gadi
9	**Jahagirabad**	Jahagirabad
10	**Paltupur**	Paltupur
11	**Pindsawa**	Pindsawa
12	**Babaganj**	Babaganj Narayanpur
13	**Bisai**	Bisai

Annexure-II

NATIONAL INSTITUTE OF PUBLIC COOPERATION AND CHILD DEVELOPMENT

(A study on impact of IFA supplementation with Vitamin C on Haemoglobin status of Adolescent girls)

SCHEDULE (A) : GENERAL INFORMATION

	Schedule Code	_____	
	Name of Village	_____	
	Name of the AWC	_____	
1	**Name of the Respondent**	_____	
2	**Age:**	1) 11-14 years	2) 15-18 years
3	**Educational Status:**	1) Illiterate	2) Know to read & write
		3) Primary Education	4) Matric
		5) More than matric	
4	**Marital Status:**	1) Married	2) Unmarried
		3) Divorce	4) Widow
5	**Religion**	1) Hindu	2) Muslim
		3) Other (specify)	
6	**Category:**	1) General	
		2) Schedule Caste	
		3) Schedule Tribe	
		4) OBC	
7	**Family Income per month**	1) Rs.1500/- or less	
		2) Rs.1500- 3000/-	
		3) Rs.3000 and more	
8	**Eating Habits**	1) Vegetarian	
		2) Non vegetarian	

3) Eggarian

9 **Family Type:** 1) Joint family 2) Nuclear family

10 **Type of House:** 1) Pucca 2) Kuchcha

3) Thatched house 4) Pucca with thatched house

11

Sanitation of the Household Surroundings:	**Yes (1)**	**No (2)**
a)Clean and Open Area		
b) Congested with Puddles around the house		

Toilet facility at home 1)Yes 2)No

12

Source of Drinking Water:	**Yes (1)**	**No (2)**
a) Open pound/ well		
b) Bore well hand pump		
c) Municipal supply		
d) Any other (specify)		

Any comments:

(Signature of the Investigator)
Date:

Annexure-III

NATIONAL INSTITUTE OF PUBLIC COOPERATION AND CHILD DEVELOPMENT

(A study on impact of IFA supplementation with Vitamin C on Haemoglobin status of Adolescent girls)

SCHEDULE (B) : OBSERVATION SCHEDULE

Schedule Code

Name of Village

Name of the AWC

Name of the Respondent

				INITIAL PHASE (0month)	**INTERMEDIATE PHASE (after 3 month)**	**FINAL PHASE (after 6 months)**
I	**Haemoglobin Status (g/dl)**					
II	**Anthropometric Measurements**					
1	Height (cms)					
2	Weight (Kg)					
III	**Clinical Signs & Symptoms in the Subjects**					
1	Frequent fever/illness	1) Yes	2) No			
2	Complaints of Headache	1) Yes	2) No			
3	Complaints of Heartburn	1) Yes	2) No			
4	Get Breathless with Exertion	1) Yes	2) No			
5	Get Fatigue with Exertion	1) Yes	2) No			
6	Feel fatigue during periods	1) Yes	2) No			
7	Increased heart palpitation	1) Yes	2) No			
8	Lack of concentration	1) Yes	2) No			
9	Decreased grasping power	1) Yes	2) No			
10	Forgetfulness.	1) Yes	2) No			
11	Pallor skin	1) Yes	2) No			
12	Pale Eyelid.	1) Yes	2) No			

13	Sore Tongue and Mouth	1) Yes	2) No	
14	Koilonychias	1) Yes	2) No	
15	Numbness	1) Yes	2) No	
16	Swelling in Legs.	1) Yes	2) No	
17	Loss of Hair	1) Yes	2) No	
18	Loss of Hunger	1) Yes	2) No	
19	Pica	1) Yes	2) No	
IV	**Clinical Manifestation due to IFA Supplementation**			
1	Constipation	1) Yes	2) No	**NA**
2	Black stool	1) Yes	2) No	**NA**
3	Nausea	1) Yes	2) No	**NA**
4	Diarhoea	1) Yes	2) No	**NA**
5	Any Other (specify)			
V	**Household Sanitation**			
1	Cleanliness of the House	1) Yes	2) No	
VI	**Methods of Disposal of Household Wastes**			
1	Closed Bin	1) Yes	2) No	
2	Open Bin	1) Yes	2) No	
3	Dumping outside the house	1) Yes	2) No	
VII	**Personal Hygienic Practices**			
1	Regular Bathe	1) Yes	2) No	
2	Regular Brush Teeth	1) Yes	2) No	
3	Wearing Clean Cloths	1) Yes	2) No	
4	Clean and tied hair.	1) Yes	2) No	
5	Short and Clean Nails.	1) Yes	2) No	

6	Wearing slippers/ shoes on their feet	1) Yes	2) No
7	Washing hand with soap/ ash after lavoratory.	1) Yes	2) No
8	Washing of hands before and after meals.	1) Yes	2) No
9	Take daily bath during periods.	1) Yes	2) No
10	Use of clean and sanitized napkins	1) Yes	2) No
11	Regular change of napkins during periods.	1) Yes	2) No
12	Regular change of inner clothes.	1) Yes	2) No
VIII	**Food Hygienic Practices**		
1	Wash raw foods and utensils before cooking.	1) Yes	2) No
2	Storage of cooked food and drinking water in clean utensils with cover.	1) Yes	2) No
IX	**Dietary Pattern**		
1	Milk/dairy products		
2	Dal/Sprouts		
3	Green leafy vegetables.		
4	Seasonal fruits		
5	Amla/guava		
6	Fats and oils		
X	**Dietary Practices**		
1	Use of whole wheat or grains like bajra	1) Yes	2) No
2	Use of lemon with the meals.	1) Yes	2) No
3	Use of tea/coffee with the meals.	1) Yes	2) No
4	Taking of gur after the meal.	1) Yes	2) No
5	Use of cast iron utensils for cooking.	1) Yes	2) No
6	Use of mixed food in their diet	1) Yes	2) No

Codes: 1. None 2. Once 3. Twice 4. Thrice or More

Any other observations:

(Signature of the Investigator)
Date:

Annexure-IV

किशोरियों के लिए 26 साप्ताहिक
आई0एफ0ए0 की एक गोली सप्ताह में एक बार खाने का कैलेंडर

(प्रत्येक ..... वार)

किशोरी का नामः..... माता/पिता का नामः	आँगनवाड़ी केन्द्र का नाम : ....

1 सप्ताह	2 सप्ताह	3 सप्ताह	4 सप्ताह
5 सप्ताह	6 सप्ताह	7 सप्ताह	8 सप्ताह
9 सप्ताह	10 सप्ताह	11 सप्ताह	12 सप्ताह
13 सप्ताह	14 सप्ताह	15 सप्ताह	16 सप्ताह
17 सप्ताह	18 सप्ताह	19 सप्ताह	20 सप्ताह
21 सप्ताह	22 सप्ताह	23 सप्ताह	24 सप्ताह
25 सप्ताह		26 सप्ताह	

National Institute of Public Cooperation and Child Development
Regional Centre, Lucknow – 226026, U.P., India;
Phones: +91 (0522) 2362643, 2362543, 2365421, 2732816; Fax: +91 (0522) 2361885;
Website: www.nipccd.org; e-mail: nipccdlko@yaho.co.in

Annexure-V

किशोरियों के लिए 26 साप्ताहिक
आई0एफ0ए0 की दो गोली सप्ताह में दो बार खाने का कैलेंडर

(प्रत्येक ..... वार एवं ..... वार)

किशोरी का नामः..... माता/पिता का नामः	आँगनवाड़ी केन्द्र का नाम : ....

1 सप्ताह	2 सप्ताह	3 सप्ताह	4 सप्ताह
5 सप्ताह	6 सप्ताह	7 सप्ताह	8 सप्ताह
9 सप्ताह	10 सप्ताह	11 सप्ताह	12 सप्ताह
13 सप्ताह	14 सप्ताह	15 सप्ताह	16 सप्ताह
17 सप्ताह	18 सप्ताह	19 सप्ताह	20 सप्ताह
21 सप्ताह	22 सप्ताह	23 सप्ताह	24 सप्ताह
25 सप्ताह		26 सप्ताह	

National Institute of Public Cooperation and Child Development
Regional Centre, Lucknow – 226026, U.P., India;
Phones: +91 (0522) 2362643, 2362543, 2365421, 2732816; Fax: +91 (0522) 2361885;
Website: www.nipccd.org; e-mail: nipccdlko@yaho.co.in

Annexure-VI

किशोरियों के लिए 26 साप्ताहिक
आई0एफ0ए0 एवं विटामिन सी की गोली सप्ताह में एक बार खाने का कैलेंडर

(प्रत्येक ..... वार)

किशोरी का नाम:..... माता/पिता का नाम:	आँगनवाड़ी केन्द्र का नाम : ....

1 सप्ताह	2 सप्ताह	3 सप्ताह	4 सप्ताह
5 सप्ताह	6 सप्ताह	7 सप्ताह	8 सप्ताह
9 सप्ताह	10 सप्ताह	11 सप्ताह	12 सप्ताह
13 सप्ताह	14 सप्ताह	15 सप्ताह	16 सप्ताह
17 सप्ताह	18 सप्ताह	19 सप्ताह	20 सप्ताह
21 सप्ताह	22 सप्ताह	23 सप्ताह	24 सप्ताह
25 सप्ताह		26 सप्ताह	

National Institute of Public Cooperation and Child Development
Regional Centre, Lucknow – 226026, U.P., India;
Phones: +91 (0522) 2362643, 2362543, 2365421, 2732816; Fax: +91 (0522) 2361885;
Website: www.nipccd.org; e-mail: nipccdlko@yaho.co.in

Annexure-VII

किशोरियों के लिए 26 साप्ताहिक आई0एफ0ए0 एवं विटामिन सी की गोली सप्ताह में दो बार खाने का कैलेंडर

(प्रत्येक ..... वार एवं ..... वार)

किशोरी का नाम:..... माता/पिता का नाम:	आँगनवाड़ी केन्द्र का नाम : ....

1 सप्ताह	2 सप्ताह	3 सप्ताह	4 सप्ताह
5 सप्ताह	6 सप्ताह	7 सप्ताह	8 सप्ताह
9 सप्ताह	10 सप्ताह	11 सप्ताह	12 सप्ताह
13 सप्ताह	14 सप्ताह	15 सप्ताह	16 सप्ताह
17 सप्ताह	18 सप्ताह	19 सप्ताह	20 सप्ताह
21 सप्ताह	22 सप्ताह	23 सप्ताह	24 सप्ताह
25 सप्ताह		26 सप्ताह	

National Institute of Public Cooperation and Child Development
Regional Centre, Lucknow – 226026, U.P., India;
Phones: +91 (0522) 2362643, 2362543, 2365421, 2732816; Fax: +91 (0522) 2361885;
Website: www.nipccd.org; e-mail: nipccdlko@yaho.co.in