

Community Based Preventive Measures to Combat Iron Deficiency Anaemia among Young Pregnant and Non-pregnant Women

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ABSTRACT A total of 175 young married women (18-35 yrs.) were selected from six nearby villages of the Ludhiana city. Out of these, 17 subjects were dropped during the course of the study. Remaining 158 subjects were divided in two sub-groups (109 non-pregnant and 49 pregnant). The effectiveness of nutrition intervention was evaluated through various parameters viz. Body Mass Index (BMI), haemoglobin (Hb) level, knowledge, attitude and practice (KAP) scores. The record of pregnant subjects was maintained at 18th week, 28th week and after the delivery. An extensive extension approach was adopted to disseminate nutrition education. Consequently, the gain in weight was observed as 1.2 - 3.7 kg and 2.4 - 5.5 kg at 18th and 28th week of pregnancy, respectively. The average Hb value was recorded as 9.8 g/dl which significantly ($p \leq 0.01$) increased to 10.3 g/dl after nutrition intervention.

INTRODUCTION

Anaemia among pregnant women is a serious global health concern (Dunneeram and Jee-won 2015). According to World Health Organisation (WHO) report, about 32.4 million pregnant women suffer from anaemia worldwide, of which 0.8 million women are severely anaemic (WHO 2015). Moreover, fifty percent cases of anaemia are attributable to iron deficiency anaemia. Anaemia in pregnancy accounts for one-fifth of maternal deaths worldwide and is a major factor responsible for low birth weight (Sharma et al. 2008; Kalaiivani 2009).

In India, there is the 'vicious cycle of anaemia' for women since girls are married and enter motherhood with poor iron status at a very young age (Barfield and Warner 2012; Sandhu and Geethalakshmi 2017). The prevalence of anaemia is the highest among adolescents, that is, 97.8

percent. More than half of the pregnant women in the country are mildly anaemic and 42.6 percent are moderately anaemic (Chellan and Paul 2010). In Punjab, the situation is on the troublesome front, wherein 38.4 percent young women and 41.6 percent pregnant women were recorded as suffering from anaemia (NFHS-III 2007). Iron deficiency anaemia during pregnancy increases the risk of low birth weight, pre-term birth, maternal and perinatal mortality (Bartley et al. 2005; Kulasekaran 2012; Prashant et al. 2017). Therefore, an adequate nutrition before the reproductive years helps to ensure achievement of proper adolescent growth, sufficient nutrient store during reproductive years for a healthy pregnancy and an appropriate nutritional status especially to maintain skeletal health during the postmenopausal period (Yajnik et al. 2008; Sunitha and Gururaj 2014; Garg et al. 2017).

Hence, nutrition education (NE) is an essential consideration to optimise health of women of reproductive age in addition to pregnancy outcomes (Elsinga et al. 2009). NE programmes are important as they target at enhancing subject's dietary intakes by promoting behavioural changes such as food choice and cooking ability, goal-setting, motivation, and support the efforts for a change (Liu et al. 2008).

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Objectives

The present study was planned to assess the prevalence of anaemia among young married women (18-35 years) and to improve their dietary behaviour so as to combat iron deficiency anaemia.

METHODOLOGY

Selection of Locale and Subjects

Six nearby villages of Ludhiana located at a distance of 15-25 km from the working centre were identified and selected for the present study. The information on the number of households and total population was collected. A door-to-door survey was conducted to identify the subjects. A total 175 young women (18-35 years) were selected from these villages for detailed study. Out of these, 17 subjects were dropped during the course of the study. The visit to the subjects was conducted regularly and pregnant subjects were identified out of the selected subjects. Further, remaining 158 subjects were divided into two sub-groups (109 non-pregnant and 49 pregnant). The record of pregnant subjects on height and weight were maintained at 18th week, 28th week and after the delivery.

Data Collection

A benchmark survey of the selected subjects was conducted to collect information pertaining to their general profile, socio-economic status, anthropometric measurements (height and weight), and clinical history using a pre-tested interview schedule. This work was a part of the project (SSD/WS/078/2009 dated 08.03.2010) funded by Department of Science and Technology (DST), New Delhi. It took two years to accomplish the present research work.

Nutrition Intervention

Development of Educational Material

Health education material with a holistic approach covering various aspects viz. balanced diet, hygiene and sanitation, weaning and supplementary foods, diet during pregnancy and lactation, importance of green leafy vegetables, anaemia- its causes and prevention, dietary

guidelines, iron and vitamin C rich recipes, sprouting- its importance, method and products and fermentation- its importance, method and products, was developed in the form of posters, booklet, folder and recipe book. Nutrition intervention was imparted to the subjects for a period of one year.

Interventions

Deworming tablets were given to the selected subjects. An extensive extension approach was adopted to disseminate nutrition education through live demonstrations, trainings, workshops and camps. A two-day training programme and demonstration on recipes developed from green leafy vegetables was conducted for the Self-help Groups and community workers on December 7-8, 2010. A one-day workshop on management of anaemia through consuming green leafy vegetables was organized on January 2, 2011. Training camps including lectures on given topics, demonstrations on standardized recipes and exhibitions were organized for young women during April to December, 2011. Two medical camps under the supervision of medical officer of primary health centre were organized in the month of August and September, 2011. To increase availability of iron rich leafy vegetables women and school children were provided with kitchen gardening kits including seeds of fenugreek, spinach, *chinese sarson*, coriander leaves, radish, carrots and turnip leaves. The community garden was developed in high school and *anganwadi* centre of Mansura village. The fruit plants like lemon, *amla* and guava were also distributed and planted.

Effectiveness of Nutrition Intervention

The following parameters were measured before and after the study to evaluate the effectiveness of nutrition intervention.

Body Mass Index (BMI)

BMI was calculated based on the height and weight of the subjects as per the formula (Anonymous 2005) given:

$$\text{BMI (Kg/m}^2\text{)} = \text{Weight (kg)/Height (m}^2\text{)}$$

BMI was categorized using the classification given by WHO (2004). A BMI of <18.50 kg/

m² was considered “underweight,” 18.50-24.99 kg/m² was considered “normal,” 25.00-29.99 kg/m² was considered “overweight,” and ≥ 30.00 kg/m² was considered “obese”.

Haemoglobin (Hb)

Blood samples were collected with the help of technician and Hb level of all the subjects was measured by the cynomethaglobin method (Dacie and Lewis 1974).

Frequency of Food Consumption

Information regarding frequency of commonly consumed foods rich in iron and vitamin C for the last one month was collected by administering food frequency questionnaire (FFQ). The pre-testing of 20 subjects for food-frequency questionnaire was done and the modification of the performa was completed accordingly. The frequency of food consumption was quantified by a score system that is, 10- thrice in a day, 9- twice in a day, 8- daily, 7- thrice in a week, 6- twice in a week, 5- weekly, 4- thrice in a month, 3- twice in a month, 2- monthly, 1- occasionally and 0- never. The mean frequency was calculated for each food item consumed by each subject.

Knowledge, Attitude and Practice

Nutrition knowledge of the subjects was assessed by using questionnaire based on knowledge, attitudes and practices (KAP). For evaluating the questionnaire, one score was awarded for each correct and zero for each wrong answer. The gain in knowledge was calculated using the following equation:

$$\text{Gain in knowledge} = \text{score of post-test} - \text{score of pre-test}$$

$$\text{Quantum of improvement} = \frac{\text{Post test score}}{\text{Pre-test score}}$$

Statistical Analysis

The data was analyzed statistically using appropriate statistical tools such as mean and percentage. To test the significance, student's t-test was applied using Statistical Package for the Social Sciences (SPSS) version 16.0 on all the parameters.

RESULTS

Socio-economic and General Background

A total number of 175 subjects were divided into five age groups, that is, 18-25 (50.6%), 25-30 (34.3%), 30-35 (13.9%), 35-40 (0.6%) and above 40 years (0.6%) respectively. Majority (62.8%) of the married women were studied up to 10th followed by secondary and above (28.5%) and only 8.7 percent were uneducated. All the married women were housewives except 0.6, 0.6 and 1.2 percent were involved in farming, service and other type of occupation. Majority of the subjects that is, 66.3 percent belonged to nuclear families and 33.7 percent were from joint families. Only 3.5 percent of the married women belonged to below poverty line.

It was observed that maximum number of the married women (87.2%) had their own house and 12.8 percent were having ownership of house. The subjects were residing in *pucca* (91.3%) and *kaccha* (8.7%) houses. Minimum number of the subjects (25%) was involved only in farming. The data showed that 26.7 percent of families had their own land. The mean cultivated land among the families was 1.23 acres. It was reported that 20.9 percent of the subjects were growing vegetables for marketing, while only 4.1 percent were growing for self-consumption. The families (36.6%) had empty space at front and backyard of their houses. Further, 18.6 and 20.3 percent of the families used the empty space for animal husbandry and growing vegetables. In the present study, 19.8 percent of the families had kitchen garden in their homes.

Nutritional Status

In terms of weight gain by the subjects, the average weight of the pregnant women was 53.1 kg before nutrition intervention which significantly ($p \leq 0.01$) increased to 55.5 and 59.1 kg at 18th and 28th week of pregnancy, respectively. So, the gain in weight ranged between 1.2 - 3.7 kg and 2.4 - 5.5 kg at 18th and 28th week of pregnancy, respectively. According to BMI classification, it was observed that majority of the subjects (57.7 and 67.8%) were found in the normal category followed by pre-obese (that is, 36.7 and 36.7%) and underweight (25.6 and 14.7%) in non-pregnant women before and after nutrition intervention. It was also noticed that maximum

pregnant women (65.3, 65.3, 65.3 and 73.4%) were normal, whereas 14.3, 20.4, 32.6 and 73.4 percent were pre-obese and 20.4, 12.2, 2.0 and 4.1 percent were underweight, respectively before nutrition intervention at 18th, 28th weeks and after delivery (Table 1).

Biochemical Profile

The results of the present study revealed that the mean values of haemoglobin levels were 9.8 g/dl which increased to 10.8 and 10.3 g/dl after nutrition intervention among non-pregnant and pregnant women, respectively. Further, the mean values of haemoglobin levels were recorded as 9.4 and 9.1 g/dl at 18th and 28th week (Table 1). A highly significant ($p \leq 0.01$) improvement was observed in both the groups, but still the levels were lower than WHO standards (2001) which indicated their anaemic status.

According to classification, it was observed that 50.4 and 49.5 percent of non-pregnant women were moderately and mildly anaemic, respectively. The corresponding figures changed to 15.6 and 68.8 percent after nutrition intervention, respectively. Among pregnant women, the percentage of moderate anaemic was observed as 55.1 which increased to 67.3 at 18th week, 73.5 at 28th week whereas, the corresponding figure

decreased to 30.6 after delivery. Further, the percentage of mild anaemic was recorded as 42.8 which decreased to 32.6 at 18th and 28th week whereas the subsequent value increased to 67.3 after delivery. Whereas, the percentage of normal subjects remained same that is, two percent after delivery (Table 2).

Clinical History

In the present study, maximum number of subjects (42.7%) attained menarche at the age of 13 years. A very few that is, 5.3 and 2.3 percent married women attained menarche at the age group of 15 and 16 years, respectively. A total of ninety-four percent of subjects were observed to have regular menstrual cycle. As far as the haemoglobin estimation was concerned, only 31.6 percent of subjects used to get it done on the advice of doctors due to some health problems otherwise no one was aware of Hb check-up for anaemia control and prevention. The present data on the intake of deworming tablets revealed that no subject was having it before.

The subjects (35.1 and 31.6%) were married at the age of 19-21 and 22-24 years and 21.1 and 10.5 percent were married between the age of 25-27 and 16-18 years, respectively. Only 1.7 percent of the subjects were married in the age of

Table 1: Anthropometric and biochemical profile of young pregnant and non-pregnant women

Age (yrs.)	Non pregnant women (n=109)			Pregnant women (n=49)				
	Before	After	t-value	Before	18 weeks	28 weeks	After delivery	t-value
Height (cm)	158.8±0.5	158.8±0.5	0.2 ^{ns}	157.7±0.5	157.7±0.5	157.7±0.5	157.7±0.5	-
Weight (Kg)	53.8±0.9	55.2±0.8	6.9*	53.1±1.2	55.5±1.2	59.1±1.2	57.1±1.2	4.4*
BMI (Kg/m ²)	21.3±0.3	22.0±0.3	7.0*	21.3±0.5	22.3±0.5	24.0±0.5	23.0±0.5	4.4*
Hb (g/dl)	9.8±0.1	10.8±0.1	15.3*	9.8±0.1	9.4±0.1	9.1±0.1	10.3±0.1	16.0*

Value are Mean ± SE

*Significant at 1% level of significance

Table 2: Impact of nutrition intervention on prevalence of anaemia among young pregnant and non-pregnant women

Categories of anaemia (g/dl) with haemoglobin level	Non-pregnant women (n=109)			Pregnant women (n=49)		
	Percentage			Percentage		
	Before	After	Before	18 weeks	28 weeks	After delivery
Severe (<7)	0	0	0	0	0	0
Moderate (7-9.9)	50.4	15.6	55.1	67.3	73.5	30.6
Mild (10-11.9)	49.5	68.8	42.8	32.6	32.6	67.3
Normal (>12)	0	15.6	2.0	0	0	2.0

28-35 years. The maximum percentage of women that is, 62.6 percent had conceived, whereas thirty-five percent had not conceived so far. Only 2.3 percent of the married women did not know about their conception. The information recorded in the present investigation revealed that majority (78.4%) of the women had ≤ 1 conception. Further, it was observed that 18.7 and 2.9 percent of women conceived 2-3 and 2-5 times, respectively. As far as the outcome of conception was concerned, it was found that 19.3 percent led to abortions while 2.8 percent led to still births. The results showed that 84.4 percent women were having ≤ 2 living children followed by 6.4 percent women who had 3-5 living children. In 14.7 percent cases, result of immediate previous pregnancy was abortion or stillbirth. This condition was observed in 2-4 months (56.3%), 5-7 months (31.2%) and 8-10 months (12.5%), respectively. Besides, it was also observed that 31.2 percent women had visited hospital during pregnancy for antenatal check-up. During pregnancy twenty-five percent respondents reduced work load.

Result of immediate previous pregnancy was live child among eighty-seven percent. Further, it was observed that 85.2 and 14.8 percent women delivered full term and pre-term babies, respectively. About 63.2 percent of children had birth weight more than 2500g which was found normal as per the recommendations given by WHO (2004). The data regarding feeding practices observed that 50.6 percent of mothers initiated breastfeeding within six hours and 16.8 percent after six hours to the birth. Around 50.6 percent of the children received colostrum on the second day of birth. Further, it was observed that 67.4 percent mothers gave any other liquid to the baby on first day of birth. The data regarding exclusive breast feeding revealed that all the children received exclusive breast feeding up to

the age of 2 months only. As far as the duration of partial breast feeding was concerned, majority (48.4%) were on partial breast feeding for 7-12 months whereas 15.8 percent of children were breast fed partially for less than 6 and 19-24 months. Only 7.4 percent of children received partial breast feeding for more than 25 months.

Food Frequency

Young Non-pregnant Women

Cereals were consumed as a staple food (*roti, parantha, poori* and rice) and in the form of snacks by the subjects. The mean frequency score of cereals was 4.7 which remained almost same after nutrition intervention among non-pregnant women. In comparison, the mean frequency score of cereal consumption among pregnant subjects was 5.5 before pregnancy which reduced to 4.9 and 4.7 after 18th and 28th week of pregnancy. Whereas, the corresponding figure was 5.4 after pregnancy. Further, the mean recorded value for pulses consumption was 4.3 which reduced to 4.0 among non-pregnant women after intervention. Though, the corresponding figure was same that is, 4.3 among pregnant women at initial stage but it reduced to 3.3 at 18th and 28th week of pregnancy while after delivery there was a slight increase in frequency scores that is, 3.4 (Table 3).

In terms of green leafy vegetables, the average frequency score was recorded as 1.4 which increased to 2.3 after intervention among non-pregnant subjects. Similar trend was observed among pregnant women but the mean scores of GLV were relatively less. But an increase was observed in the mean frequency scores of consumption of recipes prepared using GLV that is, 3.4 after intervention among pregnant subjects.

Table 3: Food frequency of young married women

Food group	Non pregnant women (n=109)		Pregnant women (n=49)			
	Before	After	Before pregnancy	Pregnancy 18 th week	Pregnancy 28 th week	After delivery
Cereals	4.7	4.6	5.5	4.9	4.7	5.4
Pulses	4.3	4.0	4.3	3.3	3.3	3.5
Green leafy vegetables (GLV's)	1.4	2.3	0.8	0.8	0.6	1.1
Recipes from GLV's	3.4	4.7	3.1	2.9	1.6	3.4
Fruits	0.7	1.7	0.4	1.1	1.1	1.0
Nuts and dry fruits	0.4	1.0	0.2	0.8	0.3	1.5
Non-vegetarian foods	0.3	0.2	0.3	0.1	0.2	0.3
Milk and milk products	2.8	3.0	2.5	2.8	3.3	3.9

The average food frequency scores of other food group's viz. fruits, nuts and dry fruits and non-vegetarian foods showed comparatively low values in both groups. Further, the data revealed that the mean frequency score of milk and milk products was 2.5 which continuously increased at different stages of pregnancy that is, 2.8, 3.3 and 3.9 respectively at 18th, 28th week and after pregnancy. Similar trend was also observed among non-pregnant subjects wherein the scores were 2.8 and 3.0 before and after nutrition intervention, respectively (Table 3).

Knowledge, Attitudes and Practices

The mean knowledge, attitude and practice scores were recorded as 12.0, 15.0, and 8.0 which significantly ($P < 0.01$) increased to 28.0, 16.0 and 12.0 after nutrition intervention. So, nutrition education led to 16.0, 1.0 and 4.0 times gain in knowledge, attitude and practices scores, respectively. Further, the calculated figures for quantum of improvement in knowledge, attitude and practices scores were observed as 2.3, 1.0 and 1.5, respectively (Table 4).

DISCUSSION

The requirement for optimal food habits throughout a woman's lifetime is vital to maintain both her and her offspring's health. Women need to be encouraged to participate in health promotion endeavours so as to achieve optimal nutritional status (Dunneram and Jeewon 2015). So, the present study was based on these realistic facts through which authors undertook the research work in order to prevent and combat the iron deficiency anaemia. There is 'Double Burden' in the society due to prevalence of anaemia both in mother as well as in children. Moreover, girl at younger age are more prone to severe anaemia than their male counterpart, be-

cause with increasing age, the prevalence of anaemia declines among males (Swami et al. 1998; Teni et al. 2017). Similarly, most of the subjects in the present study were also between 18 to 25 years of age that is, 50.6 percent. Previous studies reported that prevalence rate is high among children with illiterate mother, low standard of living, and working mother, belonging to Scheduled Caste (SC) and whose mothers are also anaemic (Krishna Mohan 2003). In contrast, majority of the subjects in the present work were studied up to 10th standard and had their own houses. The percentage of severely anaemic children declines with increase in mother's educational level, living standard and age (Mostafa Kamal and Md Aynul 2010). Malnutrition is primarily a matter of concern for women of reproductive age as a poor nutritional status obstruct the health of mother and her offspring (Blössner and de Onis 2005; WHO 2013). But, the present study witnessed that most of the subjects were in normal category as per the BMI classification given by WHO (2004), whereas, 36.7 percent subjects were also found in pre-obese category. Though anaemia is widely prevalent among women belonging to lower socio-economic strata, but situation is also prevailing among upper middle classes of the society (Sharma et al. 2008; Inskip et al. 2009). In terms of prevalence, most of the subjects in pregnant as well as non-pregnant group were found moderately anaemic followed by mild anaemia in the present study. Among pregnant women, severity of anaemia is low in prime child bearing ages because the physical condition is suitable for child birth whereas complications related to pregnancy may rise with age and hence lower the Hb level (Galtier et al. 2008; Nguyen et al. 2017). Previous studies have reported that nutrition education plays an important role to curb the degree of anaemia among pregnant women as it increases the awareness regarding proper nutrition during

Table 4: Gain in KAP scores obtained by young married women before and after nutrition intervention

Parameters	Married women (n=100)			Gain in scores	Quantum of improvement
	Pre test	Post test	t-value		
Knowledge	12.0±3.1	28.0±6.0	24.5	16.0	2.3
Attitude	15.0±2.5	16.0±1.5	3.9*	1.0	1.0
Practice	8.0±2.2	12.0±1.1	17.3*	4.0	1.5
Overall	11.6±4.0	18.7±7.9	15.8*	7.1	1.6

Value are Mean±SE

*Significant at 1% level of significance

pregnancy to keep Hb at normal level (Contento 2008; Everette 2009). Similarly, the findings of the present studies were found in line with previous studies as an increase in Hb levels was observed in the subjects of both groups (Green-Raleigh et al. 2005; Chellan and Paul 2010).

The awareness regarding proper feeding practices for infant and young children is reasonably higher among educated mother (Campbell et al. 2004; Percy and Mansour 2017). Similarly, older mothers are more experienced with child's nutrition and it may be the key factor to keep the degree of anaemia low (Contento 2008; Everette 2009). An improvement in the feeding practices was also observed in the present study after nutrition intervention. The present research corroborate the findings of the previous studies wherein the awareness of proper feeding practices for infant and young children with adequate supplement of iron was found higher among educated mothers. The data indicated that nutrition education improved the food frequency scores of the entire Hb forming food items among the subjects of both groups. The findings were supported by previous studies wherein a significant impact of NE was observed in the use of food groups helpful in reducing anaemia among the subjects during the study (Lotton et al. 2017; Jalambo et al. 2017a; Jalambo et al. 2017b). 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. An improvement was observed in almost two-third (73.6%) of the respondents due to regular activity of nutrition intervention. A decline was observed in use of tea or coffee with meals from 21.5 percent (0 month) to almost zero percent (0.59%) at the end of the study. Similarly improvements were also observed in consumption of milk/dairy products, dal/ sprouts, amla/ guava and fats and oils.

Further, a significant ($p \leq 0.01$) gain in KAP scores of young married women was observed after nutrition intervention. Similar findings were also reported in the earlier studies (Bandyopadhyay et al. 2017). For instance, Rahimi et al. (2010) studied the effect of nutrition education on nutritional knowledge, attitude and practice among female employees and reported that 29, 62.2 and 8.95 percent and 33.6, 59.3 and 7.1 percent had good, moderate and poor nutritional attitude, respectively before and after nutrition counselling. Likewise, Singla et al. (2012) imparted nutrition education to 60 adolescent girls aged between 16-18 years which led to high score in

knowledge and quantum of improvement. Similar findings were also reported by the recent studies.

CONCLUSION

The present study concluded that nutrition interventions had a positive impact on the nutritional status of women of reproductive age as well as pregnant women resulting in optimistic health outcomes. Further, it had been observed that multiple health intervention strategies were more successful in modifying health behaviours of women.

RECOMMENDATIONS

Community based approaches and nutrition education imparted at community level in schools and primary health centres can contribute to positive health behaviour modifications. Thus, clinical as well as public health nutritionist should aim at multiple health interventions at community level to have better outcomes.

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Also, pregnant women with anemia are at a greater risk of perinatal mortality and morbidity [10, 11]. Fetal iron metabolism is completely dependent upon maternal iron delivery via the placenta and so the effects of anemia on the fetus are directly related to the extent of maternal iron deficiency with increased mortality linked to severe IDA [6]. The prevalence of IDA varies among countries but is a major public health problem in the developing world, reflecting differences in race, socioeconomic factors, nutritional habits, medical care, and the frequency of parasitic illnesses [7]. In Palest For treatment of pregnant woman with iron deficiency anemia, doses of oral elemental iron between 65â€“200 mg per day are recommended. While oral iron is presently the gold standard for mild to moderate iron-deficiency anemia,[2] treatment doses of elemental iron often result in significant gastrointestinal side effects, resulting in reduced compliance. If oral iron cannot be tolerated or is proven ineffective, intravenous iron can induce repletion of iron stores within 1â€“2 days and normalization of hemoglobin levels in 1â€“3 weeks.[1][2]. Treatment should target the underlying disease or conditio Healthy pregnant women, aged 18-40 years at different stages of pregnancy belonging to district Mardan were selected, whose Haemoglobin level were below 11 g/dl.Â The fact that every 2nd pregnant woman is anemic requires some serious measures to be taken towards improvement. This study also reflected that most of the women (72.2%) were multi gravida, while 19.1% were having their first pregnancy.Â Non-compliance of iron supplementation was also observed to be an important contributory factor. Almost all the South Asian countries including Pakistan has national level anemia control programs but this problem still persists. This study will provide a base upon which strategies against the eradication of IDA will be made.