

Improving the Quality of Iron Supplementation Programs

The MotherCare Experience



Introduction

The MotherCare Project/John Snow, Inc is funded by the United States Agency for International Development (USAID) and works to improve the quality of health care given to women and newborn infants. This document includes abstracts presented at the 16th International Congress of Nutrition from MotherCare-funded projects to reduce maternal anemia.

In MotherCare I (1988-1993), a number of research studies were conducted to determine program approaches to reduce maternal mortality and morbidity. One of these studies, the *Indramayu Project*¹, conducted formative research to determine the most appropriate strategies to improve the existing iron supplementation program for pregnant women.

Results of the formative research showed that women were not taking iron-folate pills because they never visited their health center for prenatal care, pills were in short supply at the health facility and health workers did not believe it was important to give women iron-folate pills. Since most pregnant women were receiving health care from traditional birth attendants (TBAs), a program was designed to improve the availability of iron-folate pills using community-based distribution through TBAs. Health care providers, including TBAs, were trained to counsel women about the seriousness of anemia, why it was important that they take iron-folate pills daily, how and when to take the pills, and how to address compliance problems (e.g., women forgetting to take the pills, the unpleasant side effects that some women experience). Information, education and communication (IEC) materials and messages informed women in the community about the importance of taking iron-folate pills, how to take the pills and where to obtain them. This study, summarized in the abstract by Hessler-Radelet et al., showed that coverage of and compliance with iron-folate supplementation could be dramatically improved through an IEC campaign by itself but that the community-based distribution and improved counseling scheme was most effective at improving coverage and compliance.

In MotherCare II (1993-1998), the *Indramayu Project* model is being used to improve existing iron-folate supplementation programs in MotherCare country programs in Bolivia, Guatemala and Indonesia² and in the programs of six private voluntary organizations in Indonesia³, Malawi⁴ and India⁵. In Bolivia, Guatemala and Indonesia, MotherCare anemia

¹The *Indramayu Project* was implemented in the Indramayu Regency of West Java, Indonesia, by MotherCare/JSI and its partners, the Center for Child Survival of the University of Indonesia, the Manoff Group and the Population Council.

²MotherCare partners in Guatemala and Indonesia include the Program for Appropriate Technologies in Health (PATH). In Guatemala, Family Health International has provided technical assistance and in Indonesia, the London School of Hygiene and Tropical Medicine has provided technical assistance.

³MotherCare is funding Project Concern to implement an anemia control program using a community-based distribution of iron-folate pills. Helen Keller International has provided technical assistance to the program.

control strategies are working to improve supplies, distribution and delivery compliance and behavior, and monitoring of iron supplementation which is an integral component of more comprehensive programs to improve the quality of care during the antenatal, intrapartum and postpartum periods. While these programs are still being implemented, much of the formative research to confirm the validity of the *Indramayu Project* model has been completed for each country setting. Abstracts from these programs are presented in this booklet for Guatemala (Grajeda, Hurtado, Bocaletti, and Recinos, Grajeda, Hurtado, and Bocaletti, Hurtado et al), Indonesia (Achadi et al), Malawi (Sibale et al), and India (Abel et al, Kanani and Agarwal Raina et al). In addition, MotherCare funded research in Peru⁶ to determine how to reduce anemia in adolescent girls (Zavaleta et al, and Respicio et al) and how to improve dietary intake of iron in the slums of Lima, Peru (Creed-Kanashiro et al). MotherCare has also funded research on the usefulness of pallor as a screening tool for severe anemia (Dusch et al).

To date, most developing countries recommend that pregnant women receive iron pills, however, there is little evidence that these programs have had much impact on reducing high rates of maternal anemia prevalence. Many people believe that non-compliance due to gastrointestinal side effects is a major reason why these programs have failed. From MotherCare-funded research, however, there is little evidence that non-compliance due to gastrointestinal side effects is an important reason that women are not taking the recommended number of iron-folate pills. Instead, most pregnant women say they like taking iron-folate pills because the pills make them feel stronger and better. The main reasons they are still not taking iron-folate pills is because coverage for antenatal care is low, the pills are not available at their health facility, and health care providers are not always convinced that iron-folate pills are needed by all pregnant women. Research also shows that both women and health providers support the idea of delivering iron-folate pills to the community where they are more convenient for women to obtain.

It is anticipated that anemia prevalence will be reduced in MotherCare program areas by the end of MotherCare II by using strategies to increase the supplies of pills at facilities and in communities, improving distribution and delivery mechanisms, addressing behavioral barriers in both health care providers and pregnant women, and establishing simple systems to monitor coverage and compliance (See box below). While these approaches appear to be useful to improve iron-folate supplementation during pregnancy, other approaches are needed to reduce the prevalence of anemia in women of reproductive age. While the medical compliance

⁴MotherCare is funding Project Hope to implement an anemia control program using community-based distribution. London School of Hygiene and Tropical Medicine, the University of Malawi and the Manoff Group have provided technical assistance.

⁵MotherCare is funding the Baroda Citizens Council (with technical assistance from the M S University of Baroda), St John's Medical College, Bangalore, the Survival for Women and Children Foundation (SWACH), Chandigarh, and RUHSA Department, Christian Medical College of Vellore, in a variety of different community-based approaches.

⁶MotherCare is funding the Instituto de Investigacion Nutricional in Lima, Peru and the Johns Hopkins University in Baltimore, Maryland, USA, to conduct this study.

literature suggests that taking any medication over a lifetime would be difficult for even the most motivated individuals, supplementation may be acceptable during the discrete periods of adolescence and postpartum. Other approaches include iron fortification of a commonly consumed food staple and improving dietary intakes of cheap sources of iron that are highly bioavailable or that increase the bioavailability of iron sources found in plants.

MotherCare would like to thank the USAID for funding work to reduce maternal anemia and anemia in women of reproductive age. In addition, MotherCare would like to acknowledge and thank Dr. Mary Ann Anderson, MotherCare COTR, USAID Office of Health and Nutrition, in MotherCare I and the beginning of MotherCare II, who has given her support to reducing anemia prevalence and other micronutrient deficiencies affecting women and newborn infants. Ms. Mary Ellen Stanton, MotherCare's current COTR, USAID Office of Health and Nutrition, has since given her support to integrating anemia and other nutrition activities into all MotherCare II activities and deserves our overwhelming thanks for facilitating that process. MotherCare would also like to thank its partners and subcontractors who gave valuable technical assistance to this work, including the American College of Nurse

Midwives, the Baroda Citizens Council, Family Health International, Helen Keller International, the Instituto de Investigacion Nutricional, the Johns Hopkins University, the London School of Hygiene and Tropical Medicine, the Manoff Group, the Ministries of Health in the countries where MotherCare is working, M S University of Baroda, PATH, the Population Council, Project Concern, Project HOPE, RUHSA Department, St. John's Medical College, SWACH, and the University of Indonesia. Finally, MotherCare would like to acknowledge and thank Dr

Improving Iron Supplementation Programs Lessons Learned From MotherCare

Components of these programs should be balanced to give attention to the following

**Supplies ⇨ Distribution/Delivery ⇨ Compliance/
Demand ⇨ Monitoring/Evaluation ⇨ Policy**

- **Ensure enough iron pills for pregnant women**
- **Provide iron pills that consumers like (e.g., small, coated and red) and preserve the quality through appropriate packaging**
- **Ensure that iron pills reach all levels of the health system and promote community-based distribution to improve coverage**
- **Utilize the private pharmaceutical sector to ensure the availability of pills**
- **Determine barriers to taking iron pills through qualitative research or participatory methods and develop strategies to address the barriers**
- **Train health workers so that they understand the importance of reducing anemia and use the strategies to address barriers to taking iron pills**
- **Augment work to reduce maternal anemia through other strategies (e.g., parasitic control, dietary approaches, supplementing women outside of pregnancy, particularly during the adolescent and postpartum periods)**

Margaret Bentley, the Johns Hopkins University, Dr Shubhada Kanani, M S University of Baroda, and Dr Usha Ramakrishnan, Emory University, for providing excellent technical assistance to projects in India

Rae Galloway
*Nutrition Advisor for
MotherCare*

5

Abstracts

Prevalence, KAP and Perceptions of Anemia among Pregnant Women in a Rural South Indian Population

R. Abel, S. Kumar, J. Rajaratnam

CMC&H, RUHSA Campus PO 632209, NAA Dist India

As part of a multicentric experimental study a cross sectional baseline survey was carried out with 524 pregnant women in the study area and 510 pregnant women in the control area. Prevalence of anemia as measured by Hb (<11g/dl) was 70.2% in the study area and 67.2% in the control area and serum ferritin (10ng/ml) was 31.6% in the study area and 22.2% in the control area. A KAP survey of the same mothers indicated that the level of knowledge of mothers on anemia in pregnancy was limited. However, a qualitative study indicated that anemia is known by a number of colloquial terminologies and they have some understanding of the causes, consequences and prevention.

The health care providers were conditioned by their organisational linkages in their knowledge of anemia, causes, complications, prevention, and treatment. Their observation was that low cost tablets of iron and folic acid available earlier are now in short supply. This study shows that anemia in pregnancy is high in this rural population and a uniform policy needs to be evolved to overcome this problem.

Identifying the Prevalence and Risk Factors of Maternal Anemia in South Kalimantan, Indonesia

E. Achadi, I. Jus'at and R. Galloway
JSI/MotherCare Project, Indonesia and USA

As part of an integrated reproductive health program in three districts of South Kalimantan, Indonesia, a community-based survey was conducted to determine the prevalence and risk factors for maternal anemia. Results show that in the 412 pregnant women surveyed 45.2% were anemic (Hb <11 g/dl) with the following breakdown: 1.2%, 17.1% and 26.8% of pregnant women had severe (Hb <7 g/dl), moderate (Hb 7.1 to 9 g/dl) and mild (Hb 9.1 to <11 g/dl) anemia, respectively.

Three or more pregnancies and low mid-upper arm circumference (<23.5 cm) were significantly ($p < 0.05$) associated with anemia. Record of previous stillbirth and maternal education were not associated with anemia. Ninety percent of pregnant women had heard of *kurang darah*, a local term for anemia and 63% thought that *kurang darah* was a serious illness; however, there was no association with having anemia and having heard of *kurang darah* or thinking it was a serious disease. These data will be used along with qualitative research findings to design and implement an intervention to control the high prevalence of maternal anemia in this population.

Relationship of Anaemia to Dietary Intake and Feeding Patterns in Women of Fertile Age and Adolescent Girls Participating in Community Kitchens in Peri-urban Lima, Peru

H Creed-Kanashiro, M Bentley, M Fukumoto, T Uribe R Bartolini, N Zavaleta
Instituto de Investigacion Nutricional, Lima, Peru, Johns Hopkins University Baltimore
Maryland, USA

Baseline data on the prevalence of anaemia, dietary intake, food frequency patterns of iron-rich or related foods, anthropometric and socioeconomic status (SES) indicators were collected in non-pregnant, non-lactating women of fertile age and adolescent girls participating in community kitchens in poor urban communities in Lima. This was part of a dietary education intervention study to prevent anaemia through community kitchens. Anaemia was common with prevalence rates of 31% as measured by haemoglobin levels in adult women 18-39 years (n=200) and 15.1% in girls, 12-17 years (n=120). Iron deficiency (serum ferritin) is the main cause of anaemia in these populations. Dietary iron intake in adult women was very low a mean of $47.4 \pm 23.2\%$ of recommended intakes (RI), and for adolescent girls, $47.7 \pm 12.2\%$ of RI. Mean ascorbic acid intake was near to recommended levels but vitamin C-rich foods are frequently consumed between meals. Data relating anaemia to nutrient intake, dietary feeding patterns, and SES indicators are presented. Ethnographic studies indicate that many women have experienced anaemia although it is not considered a priority illness. It is associated with poor eating habits, certain foods are considered good for treating anaemia. Adolescents are less knowledgeable of anaemia, diet and health. The intervention is designed to promote the consumption of haem iron-rich foods and to increase the intake of vitamin C-rich foods with non-haem sources through the community kitchens and in the home.

(Supported by JSI/MotherCare Applied Research Program, Subcontract No 5024-28)

Clinical Screening Is Not a Sensitive Measure of Anemia

E Dusch, E Achadi, C Franco, C Sibale I Jus at S Cousens and L Williams
JSI/MotherCare Project USA and Indonesia Project HOPE/Malawi and London School of
Hygiene and Tropical Medicine

Screening for anemia is not cost-effective and it is generally recommended that in areas where anemia prevalence is high that pregnant women receive presumptive treatment for anemia. However, because severe anemia is associated with poor birth and delivery outcomes it would be useful to be able to identify women with severe anemia to give them special treatment. A cost-effective test is needed that is sensitive enough to detect severe anemia. While clinical screening for anemia has been shown to be an insensitive way to identify maternal anemia ($Hb < 11 \text{ g/dl}$), its sensitivity does increase with the severity of anemia. To determine the usefulness of pallor screening to identify women with severe anemia ($Hb < 7 \text{ g/dl}$), the sensitivities and specificities were calculated from prevalence surveys in two countries. In Indonesia, 409 pregnant women were examined for clinical signs of anemia by looking at the conjunctiva and asking about breathlessness. Conjunctival pallor gave a sensitivity and specificity of 100% and 81% respectively ($n=5$) for severe anemia. In Malawi, conjunctival pallor was examined in 197 pregnant women and gave a sensitivity of 83.3% and a specificity of 80% ($n=6$) for severe anemia.

Knowledge And Practices Regarding Anemia And Iron Supplementation During Pregnancy of Health Personnel in Guatemala

R Grajeda, E Hurtado and E Bocaletti, S Recinos
JSI/MotherCare Project/Guatemala

A self-administered questionnaire was completed by 90 health workers before training in anemia and iron supplementation during pregnancy. The symptoms of anemia most frequently recognized by health workers were sleepiness (58%), fatigue (48%), paleness (48%), listlessness (37%), and headache (37%). The signs of paleness of the skin and mucous membranes were recognized by more than half of personnel (by 70% and 59% respectively). Low hemoglobin level as a sign of anemia was recognized by only 17% of personnel and most did not know the correct cut-off points (g/100 ml) to make the diagnosis. Ninety percent of health workers knew that pregnant women are at greater risk of anemia and they attributed anemia to poor diet (67%) and poverty (43%).

Direct observation of practices of these health workers during 212 antenatal visits in health facilities showed that in less than half (48%) of visits did health personnel ask about symptoms of anemia and in only 30% were women checked for pale conjunctiva. More than half (62%) gave pregnant women a prescription to buy multivitamins or iron supplements.

Behavior Trials of Iron Supplementation During Pregnancy in Guatemala

R. Grajeda, E. Hurtado, E. Bocaletti and R. Galloway
JSI/MotherCare Project Guatemala and USA

There are many reasons women do not take iron supplements such as side effects and beliefs about taking "medicines" during pregnancy. To identify some of these barriers, two small-scale iron supplementation trials were conducted in Guatemala. In the first, 40 pregnant women received 10 iron pills each and a brief talk on anemia and instructions to take one pill each day for 10 days. Two weeks later, 37 women had taken the pills (one had taken some and had given some away and two gave away all the pills). Thirty-two women reported having taken the pills daily, four took them every other day and two said they took them every three days. Also, there was variability in the number of pills taken each time. Women usually took the pills with water. Most women (37) took the pill in the morning and 24 did so before breakfast. Most women did not do anything special to remember to take the pills. Sixteen women did not report positive or negative effects while the rest mentioned both positive and negative effects. Negative effects included, foul breath, headache, sleepiness, stomach ache, constipation, bad body smell, diarrhea, and fast heartbeat.

In the second, 25 pregnant women received 20 iron pills to take one per day accompanied by a beverage rich in vitamin C (citric fruit juice or other). A week later when women were interviewed, 11 of them had taken one pill a day, four women had taken more than one per day, and 5 women had taken a pill every 2 days. One woman took a tablet every three days and one had not taken any pills. Twelve women had followed the recommendation to take the iron pill with a vitamin C drink.

Improving the Coverage of and Compliance with Iron-folate Supplementation in the Indramayu Regency of Indonesia

C. Hessler-Radelet, B Utomo T Budiono, E Achadi N Sloan and M Moore
JSI/MotherCare Project, University of Indonesia, Indonesia, The Population Council USA The Manoff Group, USA

Formative research revealed that the main reason women did not take iron-folate (IFA) pills during pregnancy was because they had one antenatal care visit which tended to be late in pregnancy. Women did seek care from traditional birth attendants (TBAs) who also delivered their babies. An "iron trial" found that the majority of women took their IFA pills for the first two weeks if they were counseled on how to manage side effects. Based on these results, a two-phase program was designed in two subdistricts of the Indramayu Regency of Indonesia. Phase 1 consisted of training all health workers about the importance of iron supplementation, distributing iron pills through TBAs, and ensuring iron-pill supplies at health centers. In Phase 2 this program continued but an information, education and communication (IEC) campaign consisting of radio spots, reminder cards, banners, posters, etc. was added to the intervention. The IEC campaign also was implemented in another subdistrict where there was no TBA distribution and no ensured supplies of IFA pills at health facilities.

Results showed that the intervention in Phase 1 had the greatest impact on coverage and compliance and that there was little comparative advantage to adding an IEC campaign. The proportion of pregnant women taking IFA pills (coverage) increased from 51% to 92% while the average total number of IFA pills taken over pregnancy (compliance) increased from 24 to 62 pills. However, an IEC campaign alone with no TBA distribution and no ensured supply of iron folate did have an impact on compliance by doubling the average total number of pills taken over pregnancy (from 24 to 48 pills).

Knowledge, Attitudes and Practices of Pregnant Women Regarding Anemia and Iron Supplementation in Guatemala

E Hurtado, R Grajeda, E Bocaletti
JSI/ MotherCare Project, Guatemala City, Guatemala

Women of reproductive age participating in nine focus groups did not recognize the term anemia, but identified "weakness" or "weak blood" as a condition characteristic of pregnancy. Weakness is associated with other symptoms such as lack of strength, lack of desire to work, listlessness, tiredness, sleepiness and paleness. The cause of "weak blood" is the pregnancy itself which makes the woman lose her appetite. There are also economic and emotional factors which contribute to lack of appetite or not eating during pregnancy. The consequence of "weak blood" during pregnancy most frequently mentioned is that the woman will not have enough strength to push at the time of delivery. Although participants recognized that "vitamins" can help in case of weakness, few of them had taken prenatal multivitamins or iron when pregnant. External and internal factors make women distrust taking pills during pregnancy. Results were used to define behavior change recommendations for a communication intervention.

Reducing Anemia and Improving Growth in Early Adolescence - Nutrition Education Alone *Can* Make a Difference

S Kanani and V Agarwal

Department of Foods and Nutrition, M S University of Baroda. Baroda 390 002 India

The present study implemented a nutrition communication strategy (NCS) to improve dietary intake (especially iron and vitamin C rich foods) and to reduce anemia and undernutrition in school girls in early adolescence. The experimental (E) school girls (N=225) were nutritionally and socioeconomically similar to control (C) school girls (N=299) at baseline. The NCS, implemented over 6 months, contained modules communicating messages on anemia, dietary improvements, adolescent growth. Each module consisted of behavioral/cognitive content, overcoming attitudinal barriers, motivational appeal, message approach, audio/visual aids. Post-intervention data after one year revealed highly significant increases ($p < 0.01$) in growth velocity, mean Hb level, anemia related knowledge and dietary behavior in the E group as compared to the C group. Culturally appropriate and relevant nutrition communication has a marked potential for reducing anemia and improving growth in early adolescence.

Operational Study on Nutritional Anemia in Pregnant Women, Lactating Women and Adolescent Girls in a Rural Community in India

N. Raina, A Gupta, M Sharma, S Verma, K Dhingra
SWACH Foundation, Panchkula (Haryana), India

This operational study supported by the MotherCare Project has been in progress since January 1996. It covers a rural population of 140,000 in 176 villages in Haryana State, India. The objective is to tackle the problem of nutritional anemia among these selected groups through improved intake of iron rich foods and better compliance with oral iron therapy. The first phase of the study comprised determination of incidence of anemia and behavioral research addressing compliance issues.

Anemia is widely prevalent in the community. Fifty-six percent of pregnant women, 44% of lactating women, 37% of adolescent girls had a hemoglobin level of less than 8g/dl (determined by cyanmethemoglobin method). Severe anemia with Hb less than 6g/dl was found in 15% of pregnant and 14% of lactating women.

Anemia is not recognized as a specific disease and there is no local term for it. An anaemic individual is covered under the term "Kamzori" (weakness) which is described in different ways. The knowledge of iron rich foods is poor and vague. Target groups feel that milk, clarified butter, green leafy vegetables, and fruits are rich in iron. Dietary recalls on 211 pregnant women, 103 lactating women and 200 adolescent girls have revealed that 96% of pregnant women, 46.5% of lactating women and 62.5% of adolescent girls have less than the recommended daily intake of iron. These groups are heavy tea drinkers. Although all women know about iron pills, the knowledge of dose and duration is poor. They consider it to be a "hot" medicine. The compliance to iron pills was found in 10% of women. About 42% of women did not take iron pills at all or took less than 30 pills. Most women forget to take these tablets regularly while a large proportion discontinue the medicine because of mild side effects.

The study has identified the need to stress interpersonal communication to improve dietary iron intake and reduce faulty feeding habits. Among innovative strategies to improve iron compliance, the project is involving school going adolescent girls to participate in direct observation therapy. A basket approach is under consideration to enhance the acceptability of iron treatment.

Iron Balance in Adolescent Girls in Lima, Peru

G Respicio, N Zavaleta, T Garcia, F Pizarro

Instituto de Investigacion Nutricional Lima, Peru Instituto de Nutricion y Tecnologia de los Alimentos (INTA) Chile

To assess the factors that contribute to the development of iron deficiency and anemia in adolescent girls iron balance studies were carried out in a group of 296 girls (ages 12-18 years) randomly selected from schools in the southern part of Lima Iron status was measured using hemoglobin, free protoporphyrin and serum ferritin Dietary iron intake was assessed using consecutive days of 24-hour recalls and a food frequency questionnaire Absorbed iron was calculated by the method of Mosen Iron expenditure was estimated by measuring menstrual blood losses in 2 consecutive periods and the method of Hallberg was used to calculate iron losses Basal Fe requirements were 14 ug/kg/day Iron requirements for growth were estimated as detailed in the WHO/FAO report and total iron requirements were estimated using the sum of basal iron losses, growth requirements, and menstrual iron losses Mean values are reported in the following table

n	Basal Losses (mg)	Growth Requirements (mg)	Menstrual Iron Losses (mg)	Iron Absorbed Iron/day (mg)
296	0.69	0.36	0.91	1.07

These data indicate that this population of adolescent girls is at risk for iron deficiency

(Supported by MotherCare Applied Research Program Subcontract No 5024-28)

Determining The Prevalence And Risk Factors For Anaemia in Women of Reproductive Age in Thyolo, Malawi

C Sibale L Williams S Cousens L Semo and C Franco

Project HOPE Malawi, London School of Hygiene and Tropical Medicine UK and University of Malawi, Malawi

To help design an anaemia intervention in Thyolo District in Southern Malawi a community-based survey was conducted to determine the severity of anaemia and behavioural barriers to addressing the problem. The research found the following: 47.6%, 15.7% and 3.3% of pregnant women (n=210) had mild (Hb 9 to <11 g/dl), moderate (Hb 7 to <9 g/dl) and severe anaemia (Hb <7 g/dl), respectively, 41.0%, 18.6%, and 1.4% of recently delivered (within six months) women (n=210) had mild (Hb 10 to <12 g/dl), moderate (Hb 8 to <10 g/dl) and severe anaemia (Hb <8 g/dl), respectively, and 28.6%, 6.7%, and 0.3% of men (n=315) had mild (Hb 11 to <13 g/dl), moderate (Hb 9 to <11 g/dl) and severe anaemia (Hb <9 g/dl), respectively.

Semi-structured interviews and group discussions with women showed that women recognize the symptoms of anaemia which they identify as "low blood" and associate taking iron tablets as a way to cure "low blood". However, the same women also feared that taking the recommended number of iron tablets would cause them to have "too much blood" which would cause them to bleed more at delivery. The main reason women said they didn't take all their iron tablets during pregnancy was because they weren't available at antenatal classes. If iron tablets did become available, women with experience with taking the tablets said they would have trouble taking a full course more because they feared having too much blood and not because of side effects caused by the iron tablets.

Efficacy of an Intermittent Iron Dose Compared to Daily Iron Supplementation in Adolescent Girls

N. Zavaleta, G. Respicio, T. Garcia
 Instituto de Investigacion Nutricional, Lima, Peru

The efficacy of two Fe supplementation schedules was assessed by a double blind study in a group (n=296) of adolescent girls (ages 12-18 years), attending a secondary school in a peri-urban community of Lima, Peru. Subjects were assigned randomly into 3 groups: a) *daily*, 60mg of Fe/day as Fe sulfate, b) *intermittent*, 2 days/week of 60 mg Fe as Fe sulfate and the other days as placebo, c) *placebo*, daily placebo. Adolescent girls were supplemented for 16 weeks. They received the supplement at school, between meals with a flavored sugar drink that did not contain ascorbic acid. Anthropometry and analysis of hemoglobin, serum ferritin and free protoporphyrin were done at entry and at the end of the supplementation period. ANOVA of a completely randomized design with one covariate, paired t-tests and chi-square were used to compare differences between groups. The results are detailed below ($\bar{x} \pm s$).

Group	n	Age (years)	Initial Wt. (kg)	Initial Hb (g/L)	Final Hb (g/L)	Anemia Prevalence	
						Initial (%)	Final (%)
Intermittent	98	15.1 ± 1.6	47.9 ± 7.5	127 ± 7.8	128 ± 7.8	18.4	17.3
Daily	101	15.3 ± 1.6	49.3 ± 7.8	127 ± 7.6	129 ± 7.6	19.8	10.9
Placebo	97	15.3 ± 1.5	49.1 ± 7.8	125 ± 10.0	125 ± 10.0	15.5	22.7

Statistically significant differences ($p < 0.05$) were found in the final Hb values between the 3 groups. The prevalence of anemia significantly decreased in the daily group, no difference was observed with the intermittent dosage. Fe supplementation was beneficial although daily Fe dosing was significantly better than intermittent Fe dosing.
 (Supported by MotherCare Applied Research Program Subcontract No. 5024-28)