DRAFT VERSION M... 30

RESEARCH & TRAINING CENTRE FOR COMMUNITY DEVELOPMENT (RTCCD)

ELIMINATING VITAMIN A AND IRON DEFICIENCY IN VIETNAM:

A pilot project to determine the effectiveness of a monthly combined Vitamin A and iron supplementation program integrated with existing health activities in Tam Nong district, Phu Tho Province

Project Duration: March 2000 – December 2001

Final Report to MI

(Research grant [redacted])
5600-0004-12-300
10-0137-1-1

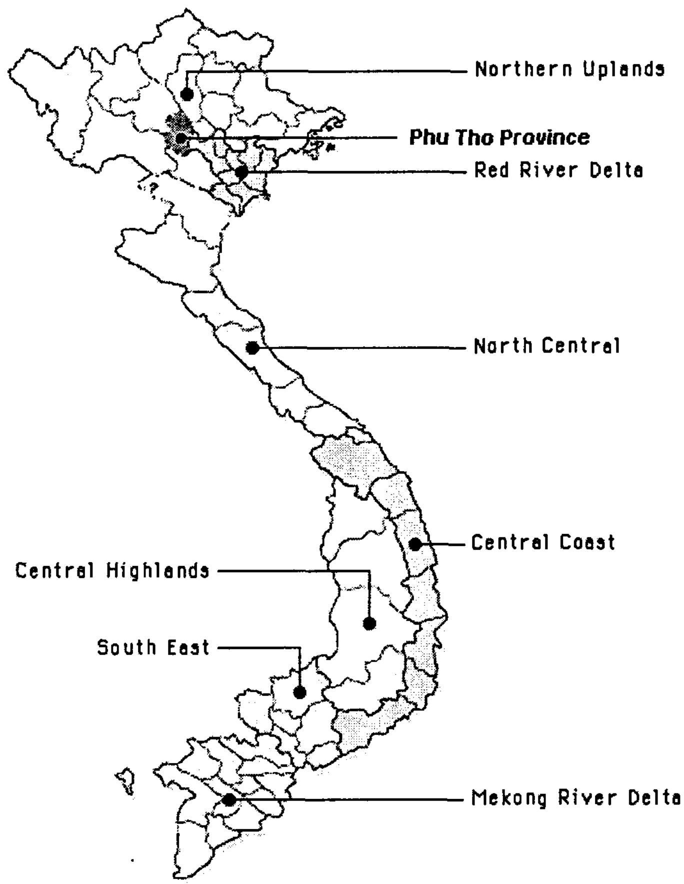
Prepared by

Van Thi Mai Dung
Tran Tuan
Tran Duc Thach
Hoang Quynh Hoa
Le Thi Chi Phuong

Satisfactory Tech. Report
June 3, 02

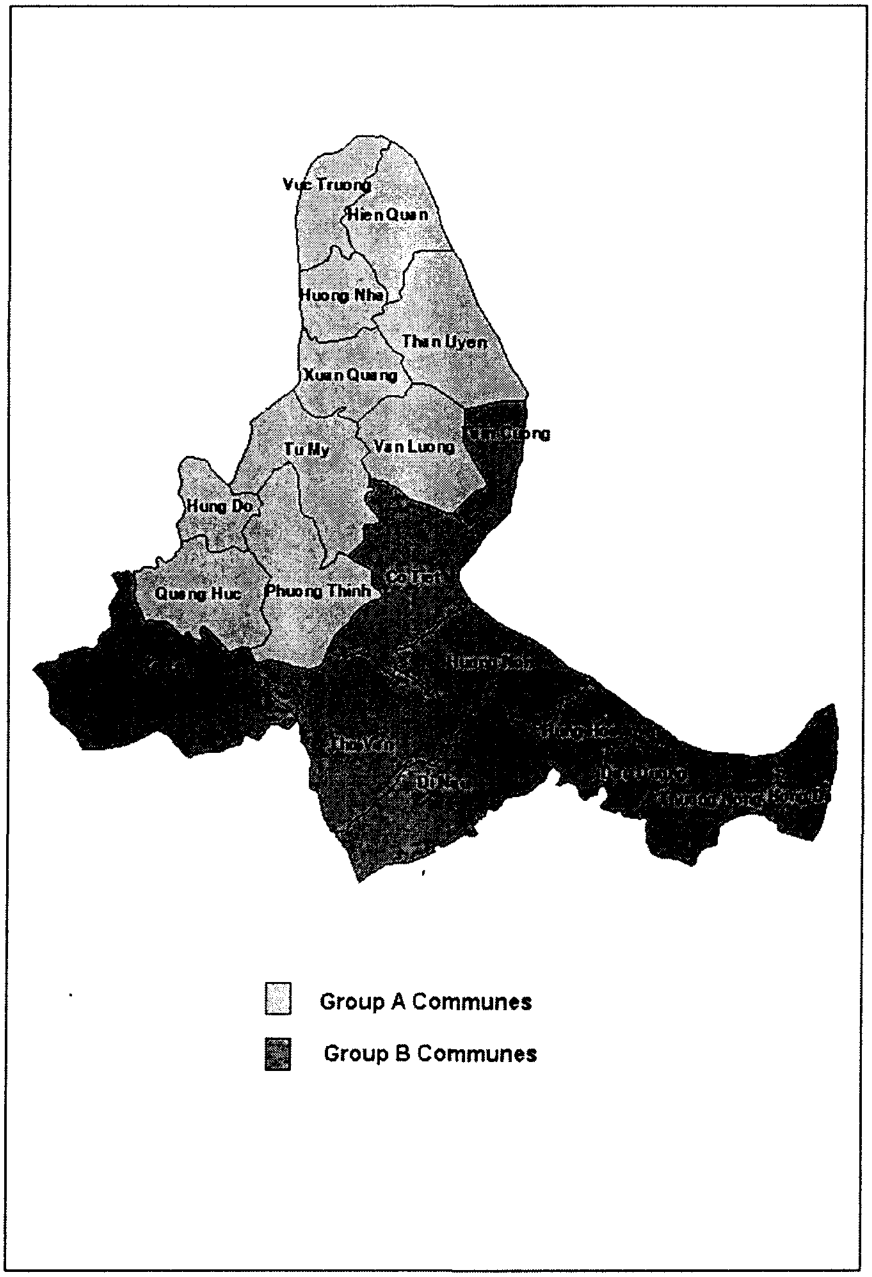
Hanoi, May 2002

MAP OF VIETNAM



Map of Tam Nong district (Phu Tho province)

Distribution of 20 communes to group A and B corresponding to different intervention strategies on vitamin A and iron supplementation



Contents

List of Tables

List of Figures

Abbreviations

CHC	Commune Health Centre
CHW	Commune Health Worker
DHW	District Health Worker
EPI	Expanded Program on Immunisation
IU	International Unit
MI	Micronutrients Initiative (Canada)
MOH	Ministry of Health
NIN	National Institute of Nutrition
RTCCD	Research and Training Centre for Community Development
VHW	Village Health Worker

Executive Summary

Background: Vietnam was known as a country with a strong network of rural health services making the EPI coverage rate of more than 80% nationally in the 1990's. Since 1993, Vietnam has conducted the national-bi-annual campaign of vitamin A 200000IU supplementation to targeted groups of children and women. Iron supplementation however has been launched in a much more smaller scale, about 12% of all communes, and mainly to pregnant women in the last trimester. The Government of Vietnam recently considered a strategy of monthly vitamin A and iron supplementation integrated with other community health activities to reduce a burden of micronutrient deficiency in children and women.

Aims: This study, supported by a grant (5600-0005-68-300) from the Micronutrient Initiative –MI (Canada), to the Research and Training Center for Community Development –RTCCD (Hanoi, Vietnam), was carried out to determine the cost- effectiveness of a monthly vitamin A supplementation and iron supplementation integrated with other community health activities for women and children.

Methods: A community-based quasi-experimental study was conducted in a district of Phu Tho province for 18 months commencing March 2000. Before starting the study, all communes in this district launched EPI monthly and bi-annual vitamin A supplementation, but no iron supplementation at all.

Ten intervention communes[1] received monthly administration of vitamin A capsules 50000IU to children 6-35 months, a vitamin A capsules 200000IU to postpartum women, daily doses of 1 iron tablet (60mg iron + 0.4mg folic acid) to pregnant women from diagnosis of pregnancy to one month postpartum, and weekly doses of 1 iron tablet to women 15-34 year old. The supplementation of vitamin A capsules and irons tablets was integrated with EPI and family planning activities for the duration of 12 months[3] (June 2000 – May 2001).

[1, 2] *Intervention* and *control* in this context is more focusing on the presence of delivering vitamin A low dose in communes, rather than on iron supplementation. In addition, in the intervention communes, micronutrient supplementation was delivered through a model of integrating all activities during the EPI day, while in the control commune, it was supposed to be delivered through the system of "as they usually do".

[3] Iron supplementation to women 15-34 years old was launched into two phases of 4 month each: July-November 2000, and February-May 2001.

Ten control communes[2] received the same scheme of iron supplementation to pregnant women, and continued the activities of national programs (bi-annual vitamin A supplementation, routine EPI and family planning activities). For women 15-34 years old, weekly dose of 1 tablet was applied from July –November 2000, then was changed to 2 tablets per week for the duration February – May 2001. In addition, iron syrup supplementation with a dose of 1mL of 25mg iron/week was provided to children 6-23 months for the duration of November 2000-May 2001. All these programs were organized with a usual way.

Baseline survey, mid-term evaluation and final evaluation with representative samples of each commune group were carried out to assess hemoglobin, serum and breast milk retinol in the targeted beneficiary groups. The baseline survey was in April 2000 before the national campaign of high dose vitamin A supplementation; the mid-term evaluation was in December 2000, immediately after the campaign; and the final evaluation was organized in April 2001.

A standard HPLC method was used to measure serum and breast milk retinol in the study samples. Finger blood was taken and hemoglobin level was read on the Corning machine with its wave-length of 540nm.

Project monitoring system was organized to measure all costs incurred when the project were introduced into the both groups of communes. The costs were recorded in details of five components: (1) supplements, (2) training costs, (3) social mobilization, (4) supervision, and (5) administration.

In addition women's non-compliance with iron tablet consumption, and coverage rate of vitamin A and iron supplementation to the targeted groups, were also measured through the baseline, mid-term, and evaluation surveys, as well as from project monitoring system.

Results:

Cost-effectiveness of Vitamin A low dose supplementation: Mean of serum retinol levels of children 6-35 months in the intervention group increased from 0.90 to 1.44, and 1.27 μmol/L between baseline, mid-term, and final evaluation ($P<0.0001$), while in the control commune, the corresponding values were 0.87, 1.05, and 1.09 μmol/L ($P=0.0001$). After one year of intervention, there was only 1.5% children in the intervention communes had serum retinol below 0.7μmol/L, compared with 9.9% of the control communes ($\chi 2=8.38$; $P = 0.0029$). Mean of breast milk retinol increased significantly during the study period in the intervention communes (0.96; 1.36; and 1.51) as well as in the control communes (0.97; 1.09; and 1.15). However, prevalence of women with breast milk retinol < *1.05 μmol/L* was still high (31.9% for intervention and 39.1% for control ; $\chi^2 = 1.05$; P = 0.305).

Project cost was reduced progressively during implementation and was stable after 6 months of implementation. Cost per person in whom vitamin A deficiency was prevented during the one year of intervention was VND 211,823 equivalent to $US14.42. The project cost for delivering one-year- low dose vitamin A to children 6-35 months was VND50577 or $US3.44 equivalently. The project cost for delivering one vitamin A capsule 50000 IU during study period was VND4214 or 29 cent (US).

When the monthly vitamin A supplementation program became fully integrated in to the commune health system, the cost for a child 6-35 months to receive one-year dose 50000IU vitamin A capsules was approximately VND 8424 (US$0.57), compared with VND4614 (US $ 0.31) for the biannual supplementation program in the control commune group. The cost of monthly vitamin A supplementation after 6 months of running the integrated model consisted of cost of medicine (41%), supervision (36%), and communal administration (including incentive to village health workers) (23%).

Cost-effectiveness of iron supplementation

Mean of hemoglobin level of pregnant women increased from 114.5 to 117 and to 119.3 g/L between baseline, mid-term, and final evaluation (t = 4.5; P<0.001). After being adjusted for gestational age, the percentage of anemia in pregnant women was 25.4% for the baseline survey; 19.6% for mid-term evaluation; and 12.5% for final evaluation ($\chi 2 = 10.8$; P<0.001). The coverage rate of iron supplementation to pregnant women was remained at over 95% throughout the study period, and the good/very good compliance rate also increased by project time, from approximately 70% at the first two months of supplementation, to 74% after 4 months, and to approximately 80% by the end of the project. However, mean of hemoglobin level of women 15-34 years old was not changed statistically by project time, and the good/very good compliance rate in this group was also at much lower (58.5%; 80.7%, and 38%, respectively).

The average cost per women in whom anemia was prevented in this project was VND227958 (US$15.51). After 6 months of running the integrated model for EPI, iron and vitamin a supplementation, the cost for a targeted woman to receive monthly iron supplementation was at VND 369 (US$ 2.5 cent).

For children 6-23 months, 68% of children were found to be anemia at the baseline survey. After 6 months of intervention with 1 mL of iron syrup /week, the prevalence of iron deficiency anemia in children 6-23 months was reduced to 31.7% ($\chi 2 = 40.1$; $P<0.001$). The coverage rate of iron supplementation in children was remained high during the intervention period (89%, 82.8%, and 97% at 2 months, 4 months, and 6 months after starting the intervention).

The average cost per child in whom anemia was prevented after 6 project-months was VND69,470 or US$4.73. In average, to have a child fully supplemented with 4 does of iron syrup in the project month, cost is VND5865 or 40 cent in US$ equivalently. This cost was reduced to VND1406 or US$ 9.6 cent once the supplementation of iron syrup to children become a routine task and integrated fully with EPI.

Integrated model

A model of iron and vitamin A supplementation integrated with other community health activities at communal level was built and piloted in this study. Main features of this model are as bellows:

- Vitamin A supplementation program was integrated with the EPI program. Commune health workers (CHWs) are responsible for delivering vitamin A capsules to children at the supplementation post according to the monthly EPI schedule. Number of supplementation posts was varied from commune to commune, depending on specific geographical and demographic characteristics of commune. CHWs and village health workers (VHWs) monitor the subjects who come for this supplementation. In special cases, if a child could not be taken to the supplementation post, VHWs can take capsule to his or her home. For women in post-partum period, vitamin A capsules were delivered at commune health center when women came for delivery, or during EPI day.
- Iron supplementation prgram for pregnant women was delivered with the same strategy as vitamin A supplementation. In addition, it was integrated with the monthly antenatal care check-up activities at commune health center. The compliance among the recipients should also be monitored.
- The iron syrup supplementation for children was carried out as the vitamin A supplementation model. However, as this supplementation was organized weekly, then besides of organizing supplementation with the monthly EPI schedule, there were specific days for iron supplementation in another weeks in a month. CHWs and VHWs monitor the subjects coming for the supplementation. VHWs motivate mothers to take their

children to the supplementation post. Iron syrup could be delivered by VHWs to home of children who could not come to the post during the supplementation day.

- Iron supplementation program for 15-35 year-old women: This was organized integrated with the iron syrup supplementation model.
- VHWs, CHWs, and DHWs worked together to design their own schedule of delivering vitamin A capsules and iron tablets/iron syrup specifically to each commune. Monthly support of administrative cost was provided to each CHC to cover just office expenses for iron and vitamin A supplementation programs integrated with EPI at an average of VND 44000 (~ US$3.0) per month per CHC. District health center received an office management support of VND220000/month (~US$15) to cover all expenses incurred in management of the integrated program on district scale (including travel expenses).

Conclusion and recommendation:

- With the current system of vitamin A supplementation to children and women in Vietnam, the prevalence of vitamin a deficiency in children 6-35 months was at moderate level (~ 16.7%), and in lactating women was at severe level (~58%). Further inputs in terms of reorganizing the delivery system of vitamin A capsules towards integration with other commune health activities could bring the vitamin A deficiency in children 6-35 months and lactating women down significantly, however, the prevalence of vitamin A deficiency in children 6-35 months remained at moderate level (~10%), and in lactating women remained at severe level (~39%).
- Model of monthly supplementation of vitamin A integrated with EPI could bring the prevalence of vitamin A deficiency in children from moderate level (15%) down to a level of no significantly public health problem in the study area (1.5%), but could not bring the prevalence of vitamin A deficiency in breast milk of lactating mothers out of severe level (from 63% down to 31.9%; cut-off point for severe level of public health significance: >=25%), although coverage rates gained high, from 69% to 90% during the intervention period of one year.
- Cost of delivering monthly vitamin A supplementation to targeted children was approximately US$ 5 cent per dose, or 57 cents per child per year. In comparison, the cost for delivering vitamin A capsule 200000IU in the biannual campaigns was US$ 16 cent per dose, or approximately 31 cent per child per year. The strategy of launching vitamin A monthly supplementation therefore should be studied at a larger

scale (i.e., provincial system) to confirm the feasibility for public health intervention nation-wide.

- Anemia in children and in pregnant women in the study area was halved significantly in public health by the intervention of iron supplementation with weekly dose of 1 mL of iron syrup to children 6-23 months and of daily dose of 60mg iron + 0.4 mg folic to pregnant women from diagnosis of pregnancy to one month postpartum. With the community-based integrated model for delivering iron supplementation, the cost per monthly dose per pregnant woman or per child was kept low at 2.5 cent for pregnant women and 9.6 cent for children. Given anemia is severe public health problem in children and moderate problem in women's health, while iron supplementation showed a good biological response, high coverage rate, and high compliance rate, iron supplementation to the targeted children and pregnant women should be considered to introduce at larger scales in Vietnam as soon as possible. Integration of community health activities at communal level for delivering monthly vitamin A and iron supplementation required not only technical support but also financial support to cover further management cost at district (approximately US$15/month/district) and community health centers (US$ 3/month/CHC). Another condition for launching the integrated model is that the village health worker network must be formed and remained as seen in this study district.

1. Introduction

1.1 Rationale for conducting the research

As a country with annual income per capita of less than US$350 and prevalence of people living under the poverty line of up to 37%[2], physical malnutrition and micronutritient deficiency in children and women have become significant public health problems in Vietnam.

In order to address the problem of Vitamin A deficiency the Ministry of Health launched a national program in 1993 with the aim of eliminating VAD by the year 2000. This program included: 1) promotion of community awareness of the prevention and control of VAD; 2) encouragement of increased intake of vitamin A in daily diet; and, 3) biannual administration of high-dose vitamin A capsules to children and lactating mothers.

However, by 1998, the prevalence of low serum concentration nationally was still at 10.8 percent in children under 5 years of age (National Nutrition Survey 1998), and clinical vitamin A deficiency in lactating women (breast milk retinol <1,05μmol/l) was still very high, at 56.3 percent (National Nutrition Survey 1998).

In relation to iron deficiency, a nation-wide survey conducted in 1995 by NIN and UNICEF showed that 60.5 percent of children under two years of age and 41 percent of women of reproductive age suffered from anemia.

In order to address the problem of iron deficiency in Vietnam, the government of Vietnam launched a national program to control iron deficiency in the early 1990s. However, their efforts were limited to pilot communes, focusing only on pregnant women in the last trimester. Up until 1998, with the support of UNICEF, the program reached a total of 1,262 communes (out of a total of 10,600 communes in the country), representing approximately 12% of the communes in Vietnam.

The Ministry of Health, in recognition of these problems, recently expressed its desire to change their Vitamin A supplementation strategy from biannual to monthly. An exploration study was conducted in Bac Thai in 1995 by the National Institute of Nutrition with support from MI(1). In addition, they wished to take advantage of the opportunity created by shifting the vitamin A strategy to monthly to combine this activity with monthly iron supplementation. However, they lacked a protocol for, and information about, the feasibility and sustainability of a monthly combined vitamin A and Iron supplementation program.

Internationally, there was evidence for supporting introducing vitamin A supplementation combined with EPI to increase efficiency of controlling vitamin A deficiency in children and lactating mothers (2). In addition, a review of past programs revealed an almost total lack of attention in program design and implementation to the systematic collection of data on costs linked to iron and vitamin A supplementation (Howson, P.C, Kennedy, ET, and Horwitz, A. 1998).UNICEF/UNU/WHO/MI considered one of priority areas for research to prevent iron deficiency is "determine whether weekly supplementation of children and women of childbearing age is effective in large-scale operational programs where compliance is, by necessary, unsupervised" (3)

[2] World Bank – Poverty in Vietnam (2000)

Therefore, with financial and technical support from Micronutrients Initiative (MI) and in collaboration with NIN-Laboratory, RTCCD implemented a community-based intervention project to answer the question of the feasibility and cost-effectiveness of a monthly combined vitamin A and Iron supplementation program integrated with existing community health activities in Vietnam.

1.2 Specific research objectives:

- To design and implement a pilot monthly combined vitamin A and iron supplementation program that is integrated with other community health activities, that seeks to eliminate vitamin A deficiency and iron deficiency by strengthening the local infrastructure for health care delivery.
- To determine whether a monthly combined vitamin A and iron supplementation program that is integrated with routine health care services increases the vitamin a and iron status of the target group as measured by coverage rate and serum retinol, breast milk retinol and hemoglobin levels.
- To investigate the feasibility and sustainability of a monthly combined vitamin A and iron supplementation program
- To determine whether a monthly combined vitamin A and iron supplementation program increases community participation in community health activities, including micronutrient programs for women and children.
- To develop a protocol for a monthly combined vitamin A and iron supplementation program at district and commune levels.

2. Description of project site

One district of Phu Tho province, Tam Nong, was selected for the intervention study. Tam Nong is a mixture of lowland, midland, and montainous areas, 120 km north west of Hanoi. It has a total of 17,596 households with a population of 78,094 (Census 4/1999). It has 20 communes, of which, three communes are located in lowland areas, while the rest of the communes are in midland and mountainous areas. The percentage of households living under the poverty line was 23.6 percent in 1999 and the under 5 malnutrition prevalence in 1999 varied throughout the different communes, ranging from 20 percent to 60 percent based on weight/age indicator (District Health Center data, 1999).

Tam Nong district currently has a District Health Center that includes a District hospital and District preventive health team, which together manage all of the public health activities in the district. In each commune, there is a Commune Health Centre (CHC). According to government assessment criteria, three out of the twenty commune health centres in the district were classified as excellent and the rest were classified as good (with the exception of one rated average). Each CHC has at least three or four health staff: one assistant doctor, one midwive, and one to two nurses. In each commune, health staff of the CHC oversee activities of the Commune Health Centre and conduct community health activities with support from a village health worker (VHW) network. The VHW network in each commune consists of one village health worker per village.

Tam Nong district is a typical model of community health activities in Vietnam. In Tam Nong, EPI and family planning is routine work implemented to a monthly schedule. Vitamin A supplementation followed the national schedule of binannual mega doses. Iron supplementation program had not reached any communes in Tam Nong prior to the implementation of the project.

3. Research method

3.1. Research Design

The intervention is a community-based quasi-experimental study design. A participatory exercise was conducted with district health authorities to divide twenty communes into two groups of ten communes each (groups A & B – refer to map). The two groups are similar in terms of geographic and socio-economic conditions, as well as public healthcare infrastructure and management (see Table 3.1).

Table 3.1 *Comparison of population, socio-economic and healthcare infrastructure between two commune groups A & B*

Characteristics	*Group A*	*Group B*
Population	38695	40359
Crude birth rate (%)	1.39	1.43
Children Malnutrition rate (%)	29.5%	32.8%
Percentage of households below national poverty line (%)	26	23
Number of commune health staff per 1,000 population	1.2	1.1
Existing community health programs (before 6/2000)	EPI; FP; Vit A campaign twice a year	EPI; FP; Vit A campaign twice a year.
Annual EPI coverage rate during 1995-1999	85%	87%

3.2. Intervention strategy

The intervention strategies applied in each group are summarized as presented in Table 3.2.

Table 3.2 *Vitamin A and iron supplementation strategy in 20 communes of Tam Nong during study period 6/2000 – 5/2001*

Type of intervention		**Group A – 10 communes**	**Group B – 10 communes**
- Vitamin A			
Children 6- 35 months		Low-dose (50,000 IU) monthly x 12 months	Mega dose (200,000 IU) administered biannually
Post-partum women		1 mega dose (200,000 IU) within 1 month of delivery	1 megadose (200,000 IU) within 1 month of delivery
- Iron			
Children 6- 23 months		No intervention	Received 1mL of 25mg iron/week
Pregnant women		1 tablet of 60mg iron + 0.4 mg folic acid/day from diagnosis of pregnancy to one month post-partum	1 tablet of 60mg iron + 0.4 mg folic acid/day from diagnosis of pregnancy to one month post-partum
Reproductive age women (15 – 34)	Year 2000 (15/7 – 15/11/2000)	1 tablet of 60mg iron + 0.4 mg folic acid/week for 4 months	1 tablet of 60mg iron + 0.4 mg folic acid/week for 4 months
	Year 2001 (1/2 – 30/5/2001)	2 tablets/week x 4 months	1 tablet/week x 4 months

3.2.1 Vitamin A supplementation:

- Vitamin A low dose to children 6-35 months in the intervention group: Ten communes of the group A was used as the intervention group for monthly vitamin A low dose supplementation.
- National program of Vitamin A high dose to children 6-35 months in the control group: Ten other communes (group B) became the control group, in which the national schedule of bi-annual supplementation of mega-dose Vitamin A continued.
- Vitamin A high dose to post-partum women in both group A and B communes: They can use 1 tablet of vitamin A mega-dose during the first month after delivery.

Vitamin A tablets of 50,000IU were imported by RTCCD through UNICEF Hanoi and the Ministry of Health from the International Dispensary Association (IDA) 1030 AB, Amsterdam.
Vitamin A mega-dose of 200,000 IU were obtained from UNICEF via the national program for control of vitamin A deficiency

3.2.2 Iron supplementation

- To targeted children: Iron syrup supplementation with a dose of 1mL of 25 mg iron/week was applied to children 6-23 months in the ten group B communes (i.e. the control group for Vitamin A supplementation), leaving the group A communes as the control group (no iron syrup supplementation).
- To pregnant women: All pregnant women in both group A and group B communes were advised to take a dose of one iron tablet per day from the recognition of pregnancy until one month after delivery during the study period of July 2000 to May 2001.
- To women 15-34 years old: The national schedule of iron supplementation to women 15 –34 yrs old was applied. In this project, there are two strategies of iron supplementation was applied:
    - (1) for the year 2000, the duration of iron supplementation to the targeted group in all 20 communes of group A and B was from July 15 –November 15, with the dose of one tablet/week x 4 months/woman.
    - (2) for the year 2001, the duration of iron supplementation was from February-May. The dose of 2 tablet/week x 4months/woman was applied in 10 communes of the group A, while 10 communes of groups B remained the dose of 1 tablet/week x 4 months/woman.

Iron administration was in the form of syrup for children and tablets for women. Iron syrup was imported by RTCCD from UNICEF Copenhagen via UNICEF Hanoi and the Ministry of Health. Each 30 mL bottle contained 25 mg iron per mL. It was administered to children 6-23 months at the dose of 1mL per week (1mL being equivalent to 30 drops). The iron tablets were provided by UNICEF via the national program for iron deficiency anemia. Each tablet contained 60mg iron + 0.4 mg folic acid.

3.3. Study organization:

The study was managed by the Research and Training Centre for Community Development (RTCCD), an independent organization in Vietnam. The local collaboration partners include: (1) The laboratory of the National Institute of Nutrition (NIN) for measuring serum retinol, breast milk retinol, and hemoglobin; (2) The district health center of Tam Nong district, Phu Tho province, for implementing the project in the 20 communes of Tam Nong.

3.3.1. Baseline surveys and participatory assessment

- *Baseline survey for assessment of vitamin A deficiency in children 6-35 months and lactating women:* In April 2000, a sample of 100 children 6-35 months and 100 lactating women were selected in each of the commune group A and B, using random sampling technique, given a total of 400 study subjected selected. Serum and breast milk samples were collected from each study subjects to measure retinol levels
- *Baseline survey for iron deficiency in pregnant women and women 15-34 years old:* Also, in April 2000, a sample of 100 pregnant women and a sample of 100 women 15-34 years old were selected for each of the commune group A and B using random sampling technique. A total of 400 blood samples were collected for hemoglobin tests.
- *Baseline survey for iron deficiency anemia in children 6-23 months:* In September 2000, 100 children 6-23 months were selected from each of the commune group A and B using random sampling technique.
- *Baseline survey for Knowledge, Attitude, and Practice of mothers and women towards prevention of iron and vitamin A deficiency*

All pregnant women, women 15-35, lactating women who were selected for the biological testing and those mothers whose children were selected for serum retinol testing were selected for this purpose.

- *Participatory assessment for building a model of launching vitamin A and iron supplementation integrated with other routine community health program* conducted by a mix team consisted of 6 persons from RTCCD, district health team for building a model of launching iron supplementation vitamin A low dose monthly integrated with EPI in 10 communes and remaining other 10 communes as control one with biannual campaigns of vitamin A high dose supplementation. This assessment was conducted in May 2000. Models of delivering iron and vitamin A to targeted groups are presented in Figures 10,11 and 12 (Annex 1).

3.3.2. Mid-term evaluation survey (12/2000):

The mid-term evaluation was conducted in middle of December 2000, just after the national campaign of vitamin A supplementation. The sampling design in the baseline survey were applied for the mid-term evaluation, however, the sample sizes for each targeted group were adjusted with the given proportion of iron deficiency, vitamin A deficiency identified in the baseline survey for each specific group:

- Measuring vitamin A deficiency in children: 128 children for intervention communes; 132 children for control communes
- Measuring vitamin A deficiency in lactating women: 92 lactating women for intervention communes; 92 lactating women for control communes.
- Measuring anemia prevalence in pregnant women: 184 pregnant women in the both commune groups.
- Measuring anemia prevalence in women 15-34 year old: 227 women in the both commune groups.

There was no mid-term evaluation for iron syrup supplementation project as this intervention was started in September 2000.

3.3.3. Final evaluation (4/2001):

The final evaluation was conducted in April 2001, one month before the national campaign of vitamin A supplementation was launched. Random sampling technique was used for selecting study subjects, and the sample size for each specific group was taken approximately equal to that of the mid-term evaluation. Interviews on change of KABP on prevention of vitamin A and iron deficiency were conducted with all study women and mothers of children selected for biological tests.

3.3.4.. Project monitoring system

4 RTCCD full-time project officers, two for each commune group, visited every commune during the days of organizing vitamin A and iron supplementation, combined with EPI day or family planning days. They observed the actual management of community health system, conducted in-depth interviews on constrains that either community health works or beneficiary people reflected.

3.4. Measuring study indicators:

3.4.1. Impact:

The impact of intervention on vitamin A deficiency and anemia in the targeted groups was measured in the change gained in serum retinol, breast milk retinol, and hemoglobin levels at different times - before the intervention (baseline surveys), after 6 months of intervention (mid-term evaluation), and at the end of intervention (final evaluation).

- Measuring serum retinol level in children: The High Pressure Liquid Chromatography (HPLC) method was used to measure serum retinol. One ml intravenous blood was taken and put into EPPENDOFF tube with stopper, then labeled and encoded with the child's code. This specimen was kept cold in an icebox for several hours without being exposed to sunlight. After that, serum was separated from centrifuge and kept in another EPPENDOFF tube under a temperature of – 20oC until it was tested at the NIN's laboratory using the machine HPLC column LP 18 and wave-length of 235 nm with the international standard SIGMA.
- Measuring breast milk retinol: The HPLC method was used. One hour after a mother stopped breast feeding her child, 10 ml of milk was taken from her breast and put into a 12-ml tube tightly closed with rubber cap. This specimen was preserved in an ice-box without being exposed to the sunlight. It was kept in a temperature of – 20oC until it was tested in the NIN's laboratory using the machine HPLC column 18 with the international standard of SIGMA.
- Measuring serum hemoglobin levels in women and children: Finger blood was taken and put into a tube with 5 ml Dropkin. The mixture was evenly shaken and placed in a cool box. The results were read on the Corning machine with its wave-length of 540nm. The results were determined in comparison with the standard at the NIN's laboratory.

- The criteria for assessing vitamin A deficiency: The WHO 1996 criteria was used to assess vitamin A deficiency in individuals and in classifying the prevalence of the vitamin A deficiency as a public health problem.

Table 3.3 *Criteria for identifying low Vitamin A level in serum and in breast milk (WHO, 1996)*

Targeted group	*Vitamin A level (µmol/L)*
Children 6-35 months	Serum retinol ≤ 0.7
Lactating women	Breast milk retinol ≤ 1.05

Table 3.4 *Criteria for classifying the prevalence of the vitamin A deficiency as a public health problem (WHO 1996)(4)*

Indicator (cut-off)	*Prevalence cut-offs to define a public health problem and level of severity*		
	Mild	*Moderate*	*Severe*
Serum retinol ($\leq$0.7µmol/L)	$\geq$ 2 - <10%	$\geq$ 10 - < 20%	$\geq$ 20%
Breast milk retinol ($\leq$1.05µmol/L)	<10%	$\geq$ 10 - <25%	$\geq$ 25%

- The criteria for assessing iron deficiency anemia: The WHO 1998 criteria was used to assess anemia in individual and in classifying the prevalence of the iron deficiency anemia as a public health problem.

Table 3.5 *Criteria for identifying iron deficiency anemia (WHO/UNICEF/UNU, 1998)*

Targeted group	*Hemoglobin level (g/L)*
Children 6-35 months	< 110
Pregnant women	< 110
Women 15-34 years old	< 120

Table 3.6 *Criteria for classifying the prevalence of the iron deficiency anemia as a public health problem (WHO 1996)*

Level of severity	*Prevalence cut-offs to define a public health problem*
Mild	<20%
Low-moderate	20% - <40%
Severe	>40%

3.4.2. Measuring costs of project intervention

One fulltime researcher was responsible to record monthly all costs incurred when the project were introduced into the both groups of communes. The costs were recorded in details and broken down into the five components: (1) Supplements, (2) training costs, (3) social mobilization, (4) transportation and supervision, and (5) administration and per diem for district and local staff. It was recorded separately for costs of Vitamin A supplementation program and Iron supplementation program. As RTCCD provided budgets to run the project directly to district health center, and then from district health center to commune health center monthly, the financial recording system in fact got the dual checks monthly between RTCCD financial project officer and field coordinator with the district health team leaders, and between RTCCD financial project officer and field coordinator with a head of each commune health centers.

Costs of surveys, lab tests, and RTCCD research expenses were excluded from the costs for calculating costs-effectiveness of the interventions.

- *Costs of Vitamin A supplementation program:*
  - In intervention communes (group A):
    - The costs of supplements: This covered the costs of (1) vitamin A low doses (50,000IU) imported by RTCCD (including costs of medicine, imported fees via air flight, and all costs incurred to bring medicine to CHCs ready to use monthly, such as transportation and packaging into smaller doses for each commune monthly), and of (2) Vitamin A 200,000 IU for post partum women. This cost were calculated as if those communes did not received Vitamin A high doses from the national Vitamin A program and had to buy those medicine from the local market.

- Costs of training: It consists of all expenditure for organizing and implementing training activities to introduce the low dose Vitamin A intervention to communes, including training materials. The full costs of a training course organized by government staff in the context of the national program for control of vitamin A and iron deficiency was applied[3].
- Social mobilization: This covered all costs incurred in making community and local leaders awareness in vitamin A programs in these communes, such as costs for speakers at local meetings, mass organizations' meetings; costs of preparation materials for broadcasting on community mass media system; costs of materials on Vitamin A distributed to households.
- Transportation and supervision: Including all costs covering supervisions activities provided by district health team for the project activities.
- Administrative and per diem: this covered monthly recurrent costs for managing the project at village, communal and district levels.

o <u>In control communes (group B)</u>

- The costs of launching the campaigns of vitamin A supplementation in June and December 2000 at the ten communes of group B were recorded according to the district health center's report.

- *Costs of iron supplementation program:*
- The costs of supplementation irons tablet to targeted women groups in 20 communes, and the costs of supplementation iron syrups to children 6-23 months in 10 communes were also recorded in details and broken down into 5 components as above. In terms of the costs of supplement, it consists of the total costs of importing iron syrups (including costs of medicine, imported fees via air plane route), costs of iron tablets supplied by the national program for control of iron deficiency (using the average cost per a tablet). Costs of the other categories, such as training, social mobilization, transportation and supervision, and administration and per diem for district and local staff, are all calculated as the same principles as that applied in the Vitamin A program.

3.4.3. Costs-effectiveness analysis:

- *Vitamin A supplementation:*

o <u>At intervention communes:</u>

$$\text{Average cost per targeted person receiving a dose of Vitamin A in a month} = \frac{\text{Total costs for 12 project months}}{\text{Total vitamin A capsule distributed to targeted individuals during a year}}$$

$$\text{Average cost per targeted person escaped from Vitamin A deficiency} = \frac{\text{Total costs for 12 project months}}{\text{Total children and lactating women escaped from vitamin A deficiency in the study year}}$$

[3] For organizing a training course, the full costs of a training course cover: (1) training material design, fees for lecturer; lunch and tea break for all participants; traveling for lecturer and participant.

$$\text{Average cost for having one child 6-35 months escaped from vitamin A deficiency} = \frac{\text{Total costs for implementation of Vitamin A low dose supplementation during a year}}{\text{Total children 6-35 months escaped from vitamin A deficiency in the study year}}$$

$$\text{Average costs for a child received fully low doses of Vitamin A in a year} = \frac{\text{Total costs for supplementing Vitamin A low dose in a year in the study area}}{\text{(total Vitamin A doses distributed to targeted children/12)}}$$

At control communes:

$$\text{Average individual beneficiary cost} = \frac{\text{Total costs for two campaigns in a year}}{\text{Total number of targeted individuals during a year received a dose of 200000 IU by district health team report}}$$

$$\text{Average cost for having a targeted person escaped from vitamin A deficiency} = \frac{\text{Total costs for launching two campaigns the study year}}{\text{Total targeted persons escaped from vitamin A deficiency in the study year}}$$

Iron supplementation:

$$\text{Average cost per targeted person receiving one month dose of iron supplementation} = \frac{\text{Total costs for the whole duration of implementing the project}}{\text{(Total doses of iron supplementation distributed /total project months)}}$$

$$\text{Average cost per child 6-23 months received full doses per month} = \frac{\text{Total costs of implementing iron syrup supplementation program}}{\text{(Total doses of iron syrup distributed to targeted children during the study period/4)}}$$

$$\text{Average cost per targeted person escaped from anemia} = \frac{\text{Total costs of implementing project of iron supplementation during the study time}}{\text{Total of persons escaped from anemia during the study time}}$$

3.4.4. Measuring coverage rate of vitamin A and iron supplementation:

The following indicators were measure at various time of the study period: before implemented the project, during implementing the project, mid-term evaluation, and final evaluation

- The prevalence of children 6-35 months receiving vitamin A.

- The prevalence of lactating women receiving Vitamin A high dose
- The prevalence of pregnant women receiving iron tablets
- The prevalence of women 15-34 years old receiving iron tablets
- The prevalence of children 6-23 months receiving iron syrup.

. The method used to monitor prevalence rates is (1) A sample of communes was selected by RTCCD researcher to visit during the vitamin A-iron- EPI day. All persons in the targeted groups for Vitamin A and iron supplementation were counted. (2) For those communes not visited by RTCCD researchers, data came from commune health center reports.

3.4.5. Measuring women's compliance on administration of iron tablets:

For pregnant women and women 15-34 years old, the prevalence of women's compliance on drug administration was measured through household surveys. Surveyors counted number of iron tablets remained and interviewed about number of times missing administration during the last month.

3.5. Study duration:

The research was carried out from March 2000 until September 2001 with three phases: Preparation phase (march-May 2000), intervention phase (June 2000 – June 2001), and closing phase (July – December 2001) (Table 3.7)

Table 3.7 *Summary of project time- table.*

Main activities	*From*	*To*
Intervention:		
• Vitamin A low dose supplementation	Jun-00	May-01
• Iron tablet supplementation to pregnant women and women 15-34 yrs old	Jul-00	May-01
• Iron tablet supplementation to children 6-23 months	Nov-00	May-01
Measuring impacts:		
• Baseline survey on serum retinol, breast milk retinol, hemoglobin in women	Apr-00	
• Baseline surveyon hemoglobin in children 6-23 months	Sep-00	
• Mid-term evaluation on serum retinol, breast milk retinol, hemoglobin in women	Dec-00	
• Final evaluation on serum retinol, breast milk retinol, hemoglobin in women & children	Apr-01	
Analysis results	Jul-01	Oct-01
Policy oriented workshop	Dec-01	

3.6. Ethical issues

The study received an approval for implementation from the Ministry of Science, Technology, and Environment (MOSTE), and from the Ministry of Health and the National Program for control of vitamin A deficiency and iron deficiency in women and children. In addition, research protocol got approval from the committee for scientific research of the National Institute of Nutrition, Vietnam, before sending to MI for asking for funds.

Inform consent was sent to every study subjects. People were free to refuse to participate in the study. Children and women who were found vitamin A deficiency or iron deficiency were explained on treatment and prevention methods which they should take part in. Cases of severe anemia were sent to hospital for treatment and RTCCD covered all hospital fees as well as transportation.

3.7. Data analysis

Survey data were managed by the information technology of RTCCD. Epi-Info 6 computer software (Vietnamese version) was used for data entry. Raw data from biological test results were sent from the NIN-lab to RTCCD for analysis.

The survey commands in STATA version 6 were used to analyze data from the household and biological samples survey with sampling weight and strata adjustments.

For calculating prevalence of anemia in pregnant women, technique of standardization by gestation age were used.

4. Results

4.1. Vitamin A supplementation

4.1.1. Coverage rates of vitamin A supplementation by commune groups

Table 4.1: *Coverage rate of vitamin A administered to children 6-35 months during the study period June 2000 – April 2001 in 20 communes of Tam Nong district, Phu Tho province.*

	Intervention communes (monthly low dose)		***Control communes (Bi-annual, high dose)***	
	N	%	N	%
Surveillance:				
• Check 1 (6/00)*	1865	95.6	136**	89.0
• Check 2 (7/00)	1679	92.1		
• Check 3 (11/00)	1660	89.5		
• Check 4 (3/01)	1539	87.2		
Final evaluation (4/01)	*127***	*98.4*	*108***	*97.2*

**The check-data came from RTCCD field visit reports combined with project reports prepared by heads of commune health centers.*
*** Data from the random survey conducted by RTCCD*

In the intervention communes with monthly low dose vitamin A supplementation integrated with other EPI and other community health programs, the coverage rate remained high in all project months, and was not different from the national campaigns of high dose vitamin A supplementation in the control communes.
However, in terms of vitamin A supplementation to women in post partum period, the coverage rate of women in post partum received a high dose of Vitamin A, in the communes with integrated model of launching vitamin a supplementation were remained high in every project months and significantly higher than that of the control communes (Table 4.2).

Table 4.2: *Coverage rate of Vitamin A administered to women in post-partum period in 20 communes of Tam Nong district, Phu Tho province, from June 2000-June 2001.*

Time	**Intervention communes (Integrated, project model)**		**Control communes (Government model)**	
	n	**%**	**n**	**%**
May, 2000*	15	17.2	16	18.8
July 2000**	46	87.2	NA	NA
Augst 2000**	39	69.4	NA	NA
September 2000**	45	90.2	NA	NA
May 2001***	32	86.5	42	50.0

* *From household baseline survey.*
** *From the project surveillance system; only for intervention communes.*
*** *From evaluation survey*

4.1.2. Change in prevalence of vitamin a deficiency

4.1.2.1.Serum retinol level sin children 6-35 months by project time

Table 4.3. shows level of serum retinol in children 6-35 months at the beginning, mid-term, and final project duration in the intervention and control commune groups during the study period April 2000-June 2001

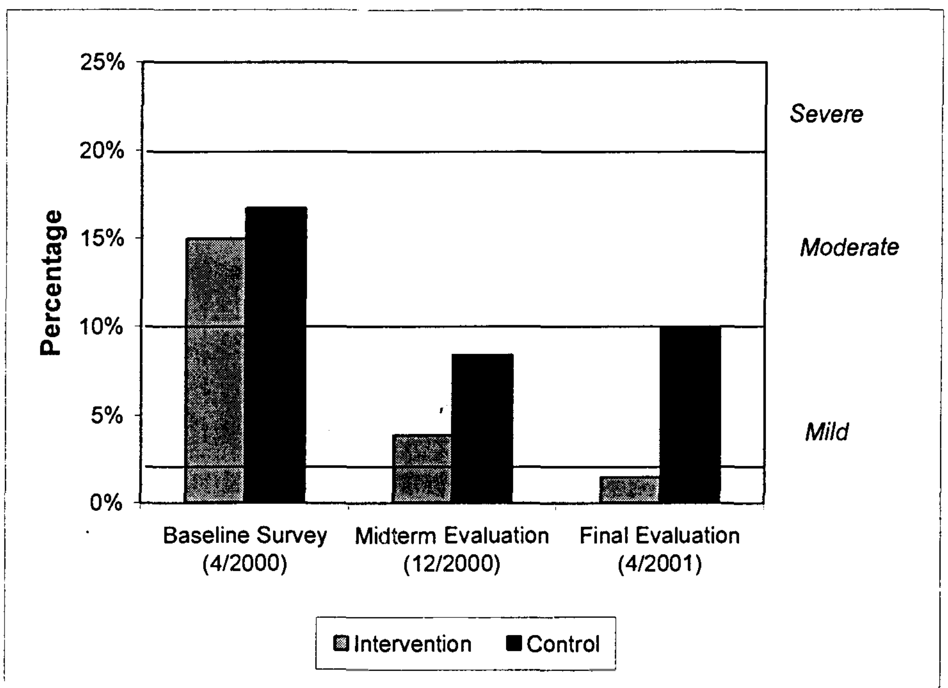
Table 4.3: *Serum retinol levels in children 6 - 35 months at different project time in communes with low dose, integrated model of vitamin A supplementation and communes with current government model of biannual, high dose vitamin A supplementation.*

		Baseline Survey (4/2000)	**Midterm Evaluation (12/2000)**	**Final Evaluation (4/2001)**	*Comparison within group (final-baseline)*
Intervention communes (N=10)	N	100	128	130	
	Mean (*μmol/ L*)	0.90	1.44	1.27	*t = 6.85*
	95% CI	[0.86-0.95]	[1.35-1.53]	[1.18-1.36]	*P<0.0001*
	Median (*μmol/ L*)	0.88	1.43	1.18	
	95% CI	[0.83-0.92]	[1.29-1.65]	[1.14-1.23]	
	% children with serum retinol < *0.7 μmol/ L*	15.0	3.9	1.5	χ^2 =14.9 P<0.001
	Public health severity of vitamin A deficiency	*Moderate*	*Mild*	*Not significant*	
Control communes (N=10)	N	102	131	132	
	Mean (*μmol/ L*)	0.87	1.05	1.09	*t = 3.97*
	95% CI	[0.83-0.92]	[0.98-1.12]	[1.00-1.18]	*P<0.0001*
	Median (*μmol/ L*)	0.86	0.95	1.04	
	95% CI	[0.79-0.90]	[0.89-0.99]	[0.97-1.07]	
	% children with serum retinol < *0.7 μmol/ L*	16.7	8.4	9.9	χ^2 =2.39 P= 0.12
	Public health severity of vitamin A deficiency	*Moderate*	*Mild*	*Mild*	
- Comparison between groups					
• Mean number of serum retinol					
o Mean difference (μmol/ L)		0.03	0.39	0.18	
▪ t		0.9266	6.7922	2.78	
▪ P>t		0.3553	<0.0001	0.0029	
• Proportion of retinol deficiency					
▪ Difference (%)		1.67	4.49	8.31	
▪ $\chi 2$		0.1052	2.2526	8.38	
▪ P		0.746	0.1333	0.003	

At the inception of the project, the serum retinol level was similar between the two commune groups. The percentage of children 6-35 months who suffered from vitamin A deficiency (serum retinol < *0.7 μmol/ L)* was 15% and 16.7 %, which reflected vitamin A deficiency was really a moderate (>10%) public health problem at in Tam Nong district, although they have routine vitamin A supplementation with biannual campaigns approach.

The intervention of monthly low dose vitamin A in the 10 intervention communes produced significantly higher levels of serum retinol in both the commune groups (Table 4.3). However, the intervention commune group had an increase at statistically higher than that of the control commune group. By the end of the intervention periods, vitamin A deficiency was no significantly public health problem (<2%) in the intervention group, and in the control one, it was at the upper limit of the mild problem level (Figure 1).

Figure 1 - *Comparision between the intervention and control groups on change of prevalence of Vitamin A deficiency in children 6 - 35 months by project time.*



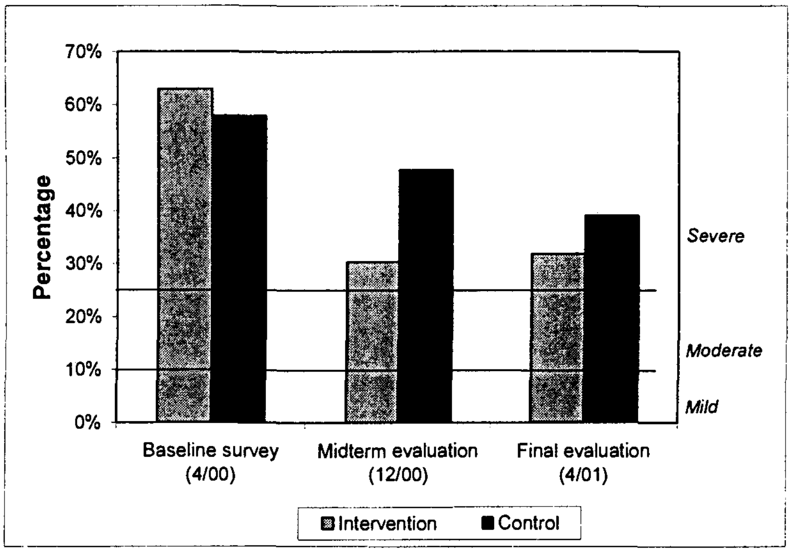
4.1.2.2.Breast milk retinol levels in lactating mothers by project time

Table 4.4: *Breast milk retinol level in lactating women of the two commune groups by various project time.*

Commune group		***Baseline survey (4/2000)***	***Midterm evaluation (12/2000)***	***Final evaluation (4/2001***	*Statistical test (final-baseline)*
	N	100	92	91	
Intervention communes (N=10)	***- Mean***	0.96	1.36	1.51	*t = 5.11*
	95% CI	[0.88-1.05]	[1.23-1.49]	[1.32-1.69]	*P<0.0001*
	- Median	*0.93*	*1.28*	*1.23*	
	95%CI	*[0.79-1.04]*	*[1.14-1.39]*	*[1.13-1.41]*	
	% breast milk retinol *< 1.05 µmol/ L*	63.0	30.4	31.9	χ^2 =15.7 P<0.001
	Public health severity of vitamin A deficiency	*Severe*	*Severe*	*Severe*	
	N	100	92	92	
Control communes (N=10)	**- Mean**	0.97	1.38	1.22	*t = 3.36*
	95% CI	[0.88-1.06]	[1.19-1.56]	[1.11-1.33]	*P<0.001*
	- Median	*0.97*	*1.09*	*1.15*	
	95% CI	*[0.84-1.07]*	*[0.9-1.2]*	*[1.05-1.29]*	
	% breastmilk retinol < *1.05 µmol/ L*	58.0	47.8	39.1	χ^2 =12.9 P<0.001
	Public health severity of vitamin A deficiency	*Severe*	*Severe*	*Severe*	
- Comparison between groups					
• Mean number of serum retinol					
o Mean difference (µmol/ L)		*0.01*	*0.01*	*0.29*	
▪ t		*-0.1684*	*-0.1607*	*2.6401*	
▪ P>t		*0.5668*	*0.5637*	*0.005*	
• Proportion of retinol deficiency					
▪ Difference (%)		*5.0*	*17.0*	*7.0*	
▪ χ2		*0.5231*	*5.8413*	*1.05*	
▪ P		*0.47*	*0.016*	*0.305*	

For lactating women, at the beginning of project inception, approximately 60% of lactating women in Tam Nong district suffered from vitamin A deficiency with breast milk retinol < 1.05 µmol/ L, equivalence to a severe level of vitamin A deficiency in lactating mothers terms of public health significance (Table 4.4). The presence of Vitamin A low dose project with integrated model made the change in levels of breast milk retinol in both the commune groups. There was statistically significant increase of retinol level in breast milk of mothers of the intervention communes (i.e., communes with the integrated model on vitamin A supplementation). The change was also in similar trend at the control communes, but at a lower rate. At the end of the project, both groups still were in severe level of vitamin A deficiency in breast milk of lactating mother (Figure 2).

Figure 2 - *Change of prevalence of vitamin A deficiency in lactating mothers in the intervention and control commune groups, 4/2000-2/2001*



4.1.3. Costs-effectiveness analysis for the 10 intervention communes

Table 4.5 shows the distribution of project cost by month and by activity. The project costs was high at the beginning of launching the project, reduced sharply then remained at a stable level after 6 project months (Table 4.5, part 1 & 2; Figure 3). Most of training cost incurred in the preparation phase, starting from March to June 2000. In calculation of cost distribution, we allocated the costs incurred in the preparation phase, including costs of training, social mobilization, supervision, as well as administration, to the project months from June to November. November 2000 was the time that the integrated model of EPI, Vit A and Iron supplementation was completed built and ran by commune health service network.

Table 4.5 *Costs of launching the low dose vitamin A supplementation integrated with other community health programs in 10 communes of Tam Nong district, Phu Tho province, from June 2000 –May 2001.*

Part 1- costs of the project from June to November 2000 by project components

Expenditure (VND) by project component	Jun	July	August	September	October	November
• Supplements	404,064	454,572	453,596	449,204	452,620	482,144
• Training cost	23,763,060	6,958,060	6,958,060	6,958,060	3,479,030	3,479,030
• Social mobilization	3,435,000	228,000	0	0	0	0
• Transportation and Supervision	4,850,000	1,770,000	220,000	400,000	220,000	220,000
• Administrative and per diem	4,396,000	2,343,000	1,620,000	789,500	400,000	400,000
Total	**36,848,124**	**11,753,632**	**9,251,656**	**8,596,764**	**4,551,650**	**4,581,174**

Table 4.5. *(continued)*
Part 2- Costs of the project from December 2000 to May 2001 by project components in 10 intervention communes

Expenditure (VND) by project component	December	January	February	March	April	May	Total
• Supplements	469,944	403,332	514,596	413,092	424,316	459,208	**5,380,688**
• Training cost	0	0	0	0	0	0	**51,595,300**
• Social mobilization	0	0	0	0	0	0	**3,663,000**
• Transportation and Supervision	400,000	400,000	400,000	400,000	400,000	400,000	**10,080,000**
• Administrative and per diem	420,000	220,000	220,000	220,000	220,000	220,000	**11,468,500**
Total	**1,289,944**	**1,023,332**	**1,134,596**	**1,033,092**	**1,044,316**	**1,079,208**	**82,187,488**

Figure 3- *Distribution of project costs by month*

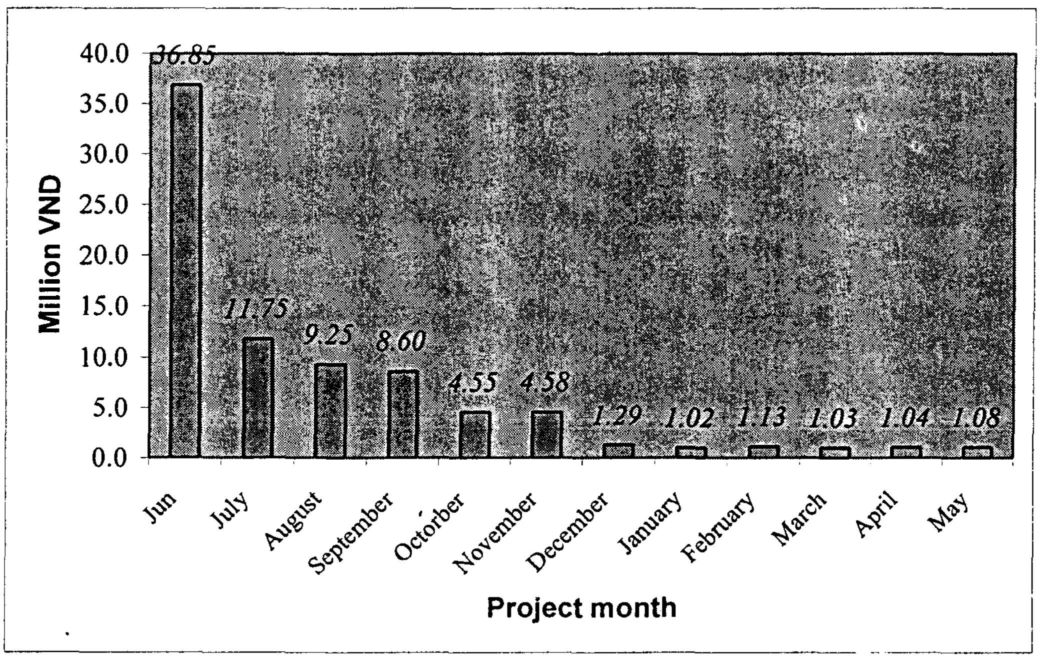


Figure 4a shows distribution of project cost by project component for the whole study duration June 2000-May 2001. Training accounted for 63%, followed by administration (14%), while medicine accounted for 7% of the total project costs.

Figure 4a - *Vitamin A low dose supplementation: Distribution of project cost component, 6/00 - 5/01*

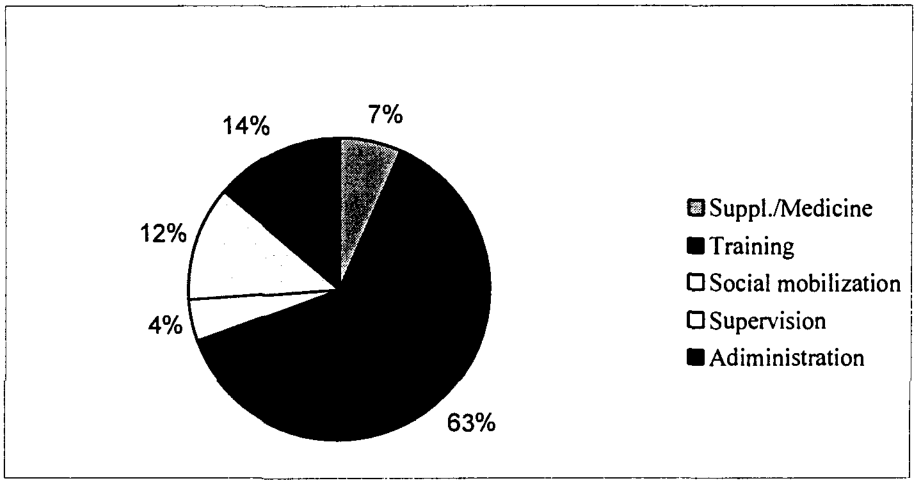


Table 4.6 shows an average cost per any targeted person to get a dose of vitamin A in a month. It was 4100 VND or $US 0.279 per child per project month (at exchange rate $US1 ~VND14,693 at June 2001).

Table 4.6 *Distribution of cost per child 6-35 months/ woman in post-partum period administered vitamin A using integrated model by project month in 10 intervention communes.*

		Jun	July	August	September	October	November
Total number of children 6 - 35 months of age in a month		*1,685*	*1,679*	*1,729*	*1,661*	*1,679*	*1,660*
Total number of post partum women in a month		*41*	*46*	*39*	*48*	*44*	*79*
Number of capsule vitamin A consumed at communes		2,013	1,991	1,925	1,911	1,939	2,001
Average Individual beneficiary cost /month	In VND	21,868	7,000 '	5,351	5,176	2,711	2,760
	In $US	1.50	0.48	0.37	0.36	0.19	0.19

Table 4.6 *(continued)-*

		December	January	February	March	April	May	Total
Total number of children 6 - 35 months of age in a month		1,615	1,511	1,560	1,539	1,626	1,559	**19,503**
Total number of post-partum women in a month		44	44	50	28	35	44	**542**
Number of capsule vitamin A consumed at commune		1,926	1,653	2,109	1,693	1,739	1,882	**22,782**
Average Individual beneficiary cost /month	In VND	778	658	705	659	629	673	**4100**
	In $US	0.053	0.045	0.048	0.045	0.043	0.046	**0.279**

Table 4.7 presents in details of all cost-effectiveness indicators. The costs per targeted person in whom vitamin A deficiency was prevented during the one year of intervention was VND 211,823 equivalent to $US14.42. The costs per a child 6-35 months receiving fully one-year-low doses of vitamin A was VND50,577 or $US3.44 equivalently. The average of full cost of delivery one tablet of vitamin A 50000 IU per child during study period was VND4,214 or US$0.29 equivalently

Table 4.7 *Other indicators for costs-effectiveness analysis for the vitamin A low dose supplementation to children using integrated model in 10 intervention communes in of Tam Nong, June 2000-May 2001.*

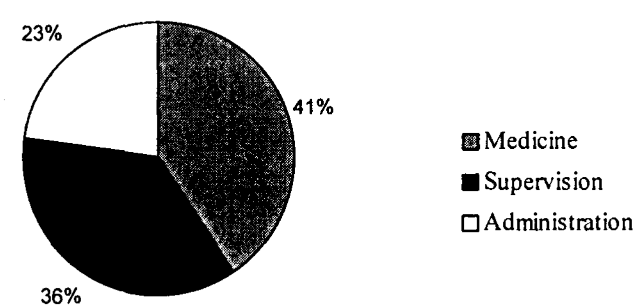
Indicator description	*Detail calculation*	*Output*
Total costs of launching vitamin A low dose supplementation in 10 intervention communes for the period June 2000– May 2001	In table 4.5	VND82,187,488 **(A)**
Average number of targeted children in 10 intervention communes were administered vitamin A during the intervention period	=19503/12 month (Table 4.6)	1625 (children) **(B)**
Total women delivered during the study period and received vitamin A low dose in 10 intervention communes	In Table 4.6	542 (mothers) **(C)**
Difference between prevalence of vitamin A deficiency in the targeted children at the baseline and the evaluation	= 15% - 1.5% (Table 3)	13.5% **(D)**
Difference between prevalence of vitamin A deficiency in the lactating mothers at the baseline and the evaluation	= 63.0% - 31.9% (Table 4)	31.1% **(E)**
Total children escaped from vitamin A deficiency during the intervention period	= B*D	219 (children) **(F)**
Total lactating mothers escaped from vitamin A deficiency during the intervention period	=C* E	169 (mothers) **(G)**
Costs per targeted person in whom vitamin A deficiency was prevented in one year of intervention	*= A/(F+G)*	VND *211,823* **(H)** ~ $US *14.42*
Costs per child 6-35 months receiving full doses of vitamin A low dose in a year	*= A/B*	VND *50,577* **(I)** ~ $US 3.44
Costs per child 6-35 months receiving a dose of vitamin A in a month	*= I/12*	VND 4,214 **(K)** ~ $US 0.29
Costs per any targeted person receiving a dose of vitamin A in a month at commune with integrated model	*= A/[(B*12)+C]*	VND *4100* **(L)** ~ $US 0.279

The mid-term evaluation report showed that the integrated model for EPI-Vitamin A- Iron supplementation was really worked as a routine system after 6 months of building the model(5). Therefore, we could consider the monthly project costs from December 2000 to May 2001 as the cost for maintaining the activity of monthly supplementation of vitamin A integrated with EPI. The average cost per month for the duration December 2000-May 2002 was approximately 1,1 million VND (Table 4.7b). It consisted of cost for medicine (0.45 million; 41%), costs for district health team to conduct supervision including transportation (0.40 million, 36%), and administrative and incentive to local health staff (0.25 million; approximately 23%);(Figure 4b). Once the vitamin A low dose supplementation become a routine public health program and is integrated with other community health activities at communal level, the cost for a child 6-35 months receiving full doses of vitamin A 50000 IU in a year was approximately VND 8424 or US$0.57 equivalently (Table 4.7b). The full cost of delivering vitamin A monthly at communal level using the integrated model to children and women was approximately VND702 or US$0.05.

Table 4.7b *Cost-effectiveness analysis for vitamin A supplementation in the intervention communes with integrated model, from December 2000 to May 2001.*

Indicator description	*Detail calculation*	*Output*
Total costs of launching vitamin A low dose supplementation in 10 intervention communes for the period Dec 2000– May 2001	In table 4.5	VND6,604,488 **(A)**
Average number of targeted children in 10 intervention communes were administered vitamin A during the intervention period	=9410/6 month (Table4. 6)	1568 (children) **(B)**
Total women delivered during Dec 2000-May 2001 and received vitamin A low dose in 10 intervention communes	In Table 6	245(mothers) **(C)**
Costs per child 6-35 months to receive one-year 50000 IU vitamin A capsules	= (A*2)/B	VND 8,424 **(I)** ~ $US 0.57
Costs per child 6-35 months to receive a 50000IU vitamin A capsule	= I/12	VND 702 **(K)** ~ $US 0.05
Costs per targeted person (including children and women) to receive a dose of vitamin A in a month at commune with integrated model	= A/[(B*6)+C]	VND 684 **(L)** ~ $US 0.05

Figure 4b- Distribution of cost component for maintaining monthly vitamin A supplementation, Dec2000 - May 2001



4.1.4. Costs-effectiveness analysis for the 10 control commune group

Table 4.8 and 4.9 showed costs-effectiveness indicators calculated for the control group that launched the biannual campaign of vitamin A high dose supplementation. It is noted that the numbers of children 6-35 months and of post-partum women were reported by district health center through the district routine health information system. The expenditure was also reported in total, not split down into the main categories as in the project financial report. The costs per any targeted person receiving a dose of vitamin A in a campaign was from VND 2,197 (equivalent to $US 0.15) in June and December 2000, down to 1,181 ($US 0.08) in June 2001 Table 4.8). Also, it should be noted that the campaign of June 2001 was launched by the district health center using the integrated model in the whole 20 communes as the project intervention was ceased in May 2001. That is why the number of targeted children and women received vitamin A in June 2001 was 2173 compared with 1780 in the previous campaigns in 2000.

Table 4.8 *Cost-effectiveness analysis of biannual campaign of vitamin A supplementation during the period June2000-June 2001*

	Jun-00	Dec-00	Jun-01	Total
Expenditure (VND)	3,910,000	3,910,000	2,567,180	10,387,180
Children in 6 - 35 months of age and post partern women	1,780	1,780	2173	5,733
VND	2,197	2,197	1,181	1,812
ndividual beneficiary cost in $U	0.15	0.15	0.08	0.12

**Exchange rate at 17/06/01: 1 $US = 14,693 VND*

In calculating cost-effectiveness of the biannual campaign of vitamin A high dose supplementation, we have to make some assumptions:

- That a full dose of prevention a child of 6-35 months from vitamin A deficiency in a year is 2 tablets of Vitamin A 200,000IU administered in two times at 6 months interval.
- Numbers of lactating mothers received vitamin A high dose at the campaigns in June and December in the control communes were equal to that in the intervention communes
- For lactating mothers, a full dose of preventing vitamin A deficiency in a year is one table of vitamin A 200,000 IU.

Table 4.9 shows the cost per targeted person from the control commune group in whom vitamin A deficiency was prevented in the year 2000 was VND 52,358 or $US 3.57 equivalently. The cost per child 6-35 months received vitamin A 200,000 IU twice a year was VND 4614 (or $US 0.31 equivalently).

Table 4.9 *Detail analysis of cost-effectiveness of the biannual campaign of vitamin A high dose supplementation in the 10 control communes during the year 2000.*

Indicator description	*Detail calculation*	*Output*
Total costs of launching vitamin A high dose supplementation campaigns in 10 intervention communes during the year 2000	=3910,000 * 2 (Table 8 part 1)	VND 7,820,000 **(A)**
Total lactating mothers received vitamin A high dose tablets in the two campaigns of June and December	=41+48	89 (mothers) **(B)**
Average number of targeted children in 10 control communes were administered vitamin A from the two campaigns in the year 2000	=1780 - B (Table 8 part 1)	1695 (children) **(C)**
Difference between prevalence of vitamin A deficiency in the targeted children at the baseline and the evaluation in the 10 control communes	= 16.7% - 8.4% (Table 3)	8.3% **(D)**
Difference between prevalence of vitamin A deficiency in the lactating mothers at the baseline and the evaluation in the 10 control communes	= 58.0% - 47.8% (Table 4)	10.2% **(E)**
Total children in whom vitamin A deficiency was prevented during the intervention period	= C*D	149.3 (children) **(F)**
Total lactating mothers escaped from vitamin A deficiency during the intervention period	=B* E	8.67 (mothers) **(G)**
Costs per targeted person in whom vitamin A deficiency was prevented in one year of intervention	= A/(F+G)	VND 52,358 (H) ~ $US 3.56
Costs per child 6-35 months to receive one-year high dose vitamin A in the year 2000	= A/C	VND 4,614 (I) ~ $US 0.31
Costs per child 6-35 months to receive a 200,000 IU vitamin A capsule in a campaign	= I/2	VND 2307 (K) ~ $US 0.16

4.2. Iron supplementation for women and children in Tam Nong district

4.2.1. Coverage rate of iron supplementation

4.2.1.1. Pregnant women

Tam nong was not covered by the National Program on prevention iron deficiency anemia in women and children. This is the first time the activity of iron supplementation provided to the targeted groups in Tam Nong. However, the baseline survey data showed that approximately 20% of mothers received iron tablets during her antenatal care period. When the project was implemented, the participation of pregnant women on this program was very high, with all most 100% of women received iron tablets during their antenatal care period (Table 4.10)

Table 4.10 *Prevalence of pregnant women ever used iron tablets during pregnancy in Tam nong district by various project time.*

Data collection time	n	%
- Baseline survey* (5/00)	191	19.9
- Check-up 1 (9/00)	200	99.0
- Check-up 2 (11/00)	200	96.0
- Final evaluation (5/01)	193	97.4

* *Baseline survey: before introducing the project to the district*

4.2.1.2. Women 15-34 years old

For women 15-34, baseline survey data showed few women received iron tablets before. When the project was introduced, the coverage rate of women received iron tablets remained at more than 90% during the whole period of study (Table 4.11.)

Table 4.11 *Prevalence of women 15-34 years old in Tam Nong received iron tables during antenatal period by various project time*

Data collection time	n	%
- Baseline survey (5/00)	175	1.7
- Check-up 1 (8/00)*	400	98.0
- Check-up 2 (11/00)*	357	95.8
- Final evaluation (5/01)		
+ 10 communes with the dose of 1 tablet per week	98	95.9
+ 10 communes with the dose of 2 tablets per week**	94	92.6

* *From July 2000 – November 2001: the dose of 1 tablet per week was applied in all 20 communes*

** *From February 2001-June 2001: two strategies applied: 10 communes remained the dose of 1 tablet per week; the other 10 communes applied the dose of 2 tablets per week for women 15-34 years old.*

4.2.1.3. Children 6-23 months

Table 4.12 *Prevalence of children 6-23 months in 10 intervention communes received doses of iron syrup by different project time*

Data collection time	*n*	*%*
Check-up 1 (1/2000)	892	89.0
Check-up 2 (3/2001)	864	82.8
Final Evaluation (5/01)	137	97.1

For children in the 10 intervention communes where the dose of 1mL of iron syrup per week was applied to children 6-23 months, data from the project monitoring system shows an increase of the coverage rate, from approximately 83 % in March to 97% in May 2001.

4.2.2. Change of prevalence of anemia

4.2.2.1.Pregnant women:

Table 4.13 shows the change in hemoglobin level of pregnant women through the baseline survey, mid-term and final project evaluation. In the final evaluation, there was two result columns: hemoglobin level measured by NIN with HPLC, and hemoglobin level measured by RTCCD researchers with HemoCue. There was an increase of hemoglobin level during the intervention period and reached to a significantly statistical change that halved the prevalence of anemia (12.5%) compared with the baseline (25.4%) after adjusting to gestation age (Table 4.13). The results from HemoCue shows a much lower prevalence of anemia. However, we did not have HemoCue results for the baseline survey so the results is mostly to serve for the purpose of piloting HemoCue in prevalence survey on anemia in Vietnam compared with standard HPLC method in terms of feasibility, costs and sensitivity.

Table 4.13 *Hemoglobin levels and prevalence of anemia in pregnant women before and after launching the iron supplementation program in 20 communes of Tam Nong district, from July 2000 to June 20001*

	Baseline Survey (4/2000)	***Mid-term Evaluation (12/2000)***	***Final Evaluation (4/2001)***[4]	
			NIN	***HemoCue***
N	201	184	200	159
Mean (g/L)	114.5	117	119.3	128.5
95% CI	[113.1-116.0]	[115.3-118.7]	[117.8-120.9]	[126.3-130.6]
Median (g/L)	113.4	117.3	119.2	128
95% CI	[112.6-115.8]	[115.4-119.2]	[117.0-121.4]	[126.0-131.4]
% anemia				
*- Not standardized for gestation age**	32.3	26.1	19.0	7.6
*- Standardized for gestation age***	25.4	19.6	12.5	5.7
Severity level of public health problem after standardization	Low-moderate	Mild	Mild	Mild

** Cut-off point for anemia in pregnant women: Hb,110 g/L (WHO,1998);*
***Cut-off points for anemia in pregnant women at different gestation age: first trimester: Hb < 110gL; Second trimester: Hb < 105g/L; Third trimester: HB < 110g/L (Beaton,G.H & McCabe 1999)*
(Statistical difference between baseline and evaluation (NIN tests):

- Comparison of mean (g/L): t = 4.5; P<0.001
- Comparison of proportions of anemia:
    - Not standardized: $\chi 2 = 9.3$; P<0.001
    - Standardized: $\chi 2 = 10.8$; P<0.001)

4.2.2.2.Women 15-34 years old

Hemoglobin level for women 15-34 years old in the 10 communes applied 1 tablet /week strategy was no change during the intervention, measured by NIN-lab. In the 10 communes that applied 2 tablets/week strategy, there was a reduction in prevalence of anemia (15.6%

[4] NIN and RTCCD would like to test whether the HemoCue method is appropriate in prevalence survey on anemia in Vietnam, especially in terms of costs for hemoglobin survey

compared with 20.8% at baseline) but 95% confidence interval of median and mean of hemoglobin level showed the increase was not gained statistically significant (Table 4.14)

Table 4.14 *Hb levels in women 15-34 before and after intervention with weekly dose strategy from July 2000-June 2001**

		Baseline survey (4/00)	Mid term evaluation (12/00)	Final evaluation (4/01)	
				NIN	HemoCue
10 communes with a dose of 1tablet /week (7/00 - 6/01)	- n	100	111	107	62
	- mean (g/L)	126.6	129.5	125.1	136.9
	- 95% CI	[124.2-129.1]	[127.3-131.6]	[122.4-127.9]	[132.9-141.0]
	- Median	129.2	129.3	127.9	139.5
	- 95% CI	[124.6 - 132.2]	[128.4 -132.9]	[124.8 - 130.0]	[133.8-143.5]
	- % anemia	25	21.6	29.9	12.9
Severity level of public health problem		Low-moderate	Low-moderate	Low-moderate	Mild
10 communes with a dose of 1 tablet/week from 7/00 - 11/00 and 2 tablets/week from 2/01 - 6/01	- n	101	113	96	101
	- mean (g/L)	128.3	128.8	130.5	140.2
	- 95% CI	[126.1-130.4]	[127.0-130.7]	[128.4-132.5]	[138.1-142.4]
	- Median	129.8	129	131.1	140
	- 95% CI	[125.9 - 132.5]	[125.1 - 131.0]	[127.9 - 134.4]	[139.0-142.8]
	- % anemia	20.8	15.9	15.6	2.97
Severity level of public health problem		Low-moderate	Mild	Mild	

**The study period from 7/2000 - 6/2001was divided into two phases:*

- *Phase I: from 7/2000 – 11/2000. all 20 communes applied a strategy of 1 tablet/week*
- *Phase II: from 2/2001 – 6/2001, 10 communes continued with 1tablet/week, while the other 10 communes applied a strategy of 2 tablets/week.*

(Statistical difference between baseline and evaluation (NIN tests):

- 10 communes applied the strategy of 1 tablet/week dose:
    - Comparison of mean (g/L): t = -0.5; P=0.7
    - Comparison of proportions of anemia: $\chi 2 = 1.02$; P>0.5
- 10 communes applied the strategy of 2 tablet/week dose in 2001:
    - Comparison of mean (g/L): t = -0.5; P=0.7
    - Comparison of proportions of anemia: $\chi 2 = 1.02$; P>0.5)

4.2.2.3.Children 6-23 months

The baseline survey showed anemia in children was severe problem in Tam Nong (68%-Table 4.15). After 6 months of intervention with 1 mL of iron syrup /week, the prevalence of iron deficiency anemia in children 6-23 months in 10 communes was halved (31.7%).

Table 4.15 *Hb levels in children 6-23 months before and after intervention with iron syrup weekly doses in 10 communes from November 2000 – May 2001*

	Baseline Survey (9/2000)	Final Evaluation (4/2001)	
		NIN	HemoCue
N	203	120	96
Mean (g/L)	105	113.2	119.6
95% CI	[103.4 - 106.6]	[111.5 - 114.9]	[117.4-121.9]
Median (g/L)	106.3	113.3	119.5
95% CI	[103.6 - 107.4}	[111.8 - 115.8]	[116.9-122.0]
% anemia	68.0	31.7	13.5
Severity level of public health problem	Severe	Low-moderate	Mild

**Cut-off point for anemia in children 6-35 months: Hb < 110 g/L (WHO/UNICEF/UNU 1998)*

Statistical difference between baseline and evaluation (NIN tests):

- Comparison of mean (g/L): t = 6.32; P<0.001
- Comparison of proportions of anemia: $\chi 2$ = 40.1; P<0.001

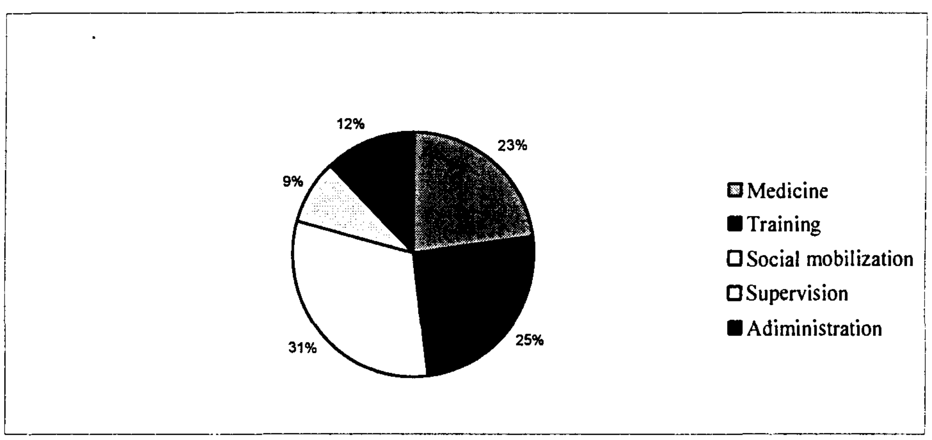
4.2.3. Costs –effectiveness analysis

4.2.3.1.Project costs of iron supplementation to pregnant women and women 15-34 years old

As doses of iron tablet supplementation to pregnant women and women 15-34 years old are different, and this is the first time such project of iron supplementation was introduced to this district, many activities had been done before the supplementation of medicine actually happened. Therefore, the cost of the project was accounted from the preparation period, March to June 2000. Activities during this period were training, social mobilization, set up the network of providing iron tablets to hamlet levels.

For the period from March 2000 to May 2001, total costs of the project of launching supplementation of iron tablets to pregnant women and women 15-34 years old was VND 135,635,269 (Table 4.16). Of which, cost of medicine accounted for 22.8% (30,960,969/135,635,269) and the social mobilization accounted highest portion, 31.3% (42,460,500/135,635,269) (Figure 5).

Figure 5 - *Distribution of project cost components for iron tablet supplementation to women in 20 communes*



The distribution of project costs by project months shows that for the duration of 15 project months, the first 7 project months had the monthly cost was approximately from 12.0 millions to 17.4 millions (approximately 13.9 millions in average), while the next 8 project months had the monthly cost was at average of 4.78 millions, from 1.9 to 7.2 millions (Table 4.16). Figure 6 shows the trend of project costs by months. It was noted that in December, there was midterm evaluation; from November 15 to the end of January, 2001 there was a recess of the iron tablet supplementation to women program. Therefore, the project costs in November, December and January became lowest compared with other project months.

Table 4.16 *Distribution of costs of launching iron tablets supplementation to pregnant women and women 15-34 years old in 20 communes by project months, from March 2000 to May 2001 (VND)*

Expenditure (VND)	March	April	May	Jun	July	August	September
Supplements	0	0	0	0	1,688,661	3,286,296	3,249,012
Training cost	9,984,800	7,800,000	0	0	6,040,000	0	7,530,000
Social mobilization	0	2,100,000	14,000,000	3,435,000	228,000	9,011,000	5,445,000
Transportation and supervision	1,050,000	720,000	0	4,850,000	1,770,000	0	400,000
Administrative and perdiem	2,858,000	2,285,800	516,500	4,396,000	2,343,000	1,620,000	789,500
Total	**13,892,800**	**12,905,800**	**14,516,500**	**12,681,000**	**12,069,661**	**13,917,296**	**17,413,512**

Table 4.16 *(continued)*

	October	November	December	January	February	March	April	May	Total
Supplements	3,255,642	2,036,619	891,033	828,165	2,346,396	4,714,281	3,917,394	4,747,470	**30,960,969**
Training cost	0	0	0	2,700,000	0	0	0	0	**34,054,800**
Social mobilization	0	411,500	400,000	0	4,258,500	1,812,500	1,359,000	0	**42,460,500**
Transportation and supervision	400,000	400,400	400,000	400,000	400,000	400,000	400,000	0	**11,590,400**
Administrative and perdiem	220,000	219,800	220,000	220,000	220,000	220,000	220,000	220,000	**16,568,600**
Total	**3,875,642**	**3,068,319**	**1,911,033**	**4,148,165**	**7,224,896**	**7,146,781**	**5,896,394**	**4,967,470**	**135,635,269**

Figure 6- *Iron tablet supplementation to pregnant women and women 15-34 in 20 communes of Tam Nong district from March 2000 to May 2001: Distribution of project costs by month.*

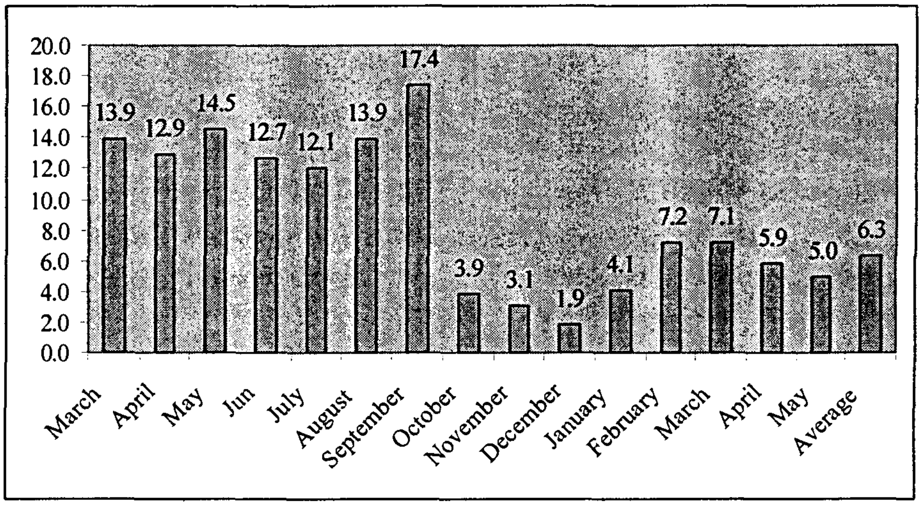


Table 4.17 shows the number of pregnant women and women 15-34 years old received iron tablets by project months. For women 15-34 years old, the supplement of iron tablets was launched from July 15 to November 15 (for the year 2000), then there was two months of recess (December 2000 and January 2001). The supplement was started for the year 2001 in February and lasted until May. That is why in December and January, there was only pregnant women received iron tables, and number of iron tablets transferred to communes were also at the lowest. Another note is about number of iron tables transferred to communes in July and November. They were lower that that of other months. The explanation for that is the supplementation of iron tablet for women 15-34 was started from July 15^{th} to November 15^{th}.

Table 4.17 *Distribution of targeted women received iron tablets by project months*

	March 00	April 00	May 00	June 00	July 00	August 00	Sept. 00
No. of women 15-34 received iron tablets	0	0	0	0	13,988	14,163	14,158
No. of Pregnant women received iron tablets	0	0	0	0	826	844	868
No. of iron tablets transfered to commune	0	0	0	0	43,299	84,264	83,308

Table 4.17. *(continued)*

	Oct. 00	Nov. 00	Dec. 00	Jan. 01	Feb. 01	March 01	April 01	May 01	Total
No. of women 15-34 received iron tablets	14,126	14,029	Recess	Recess	13,747	13,799	13,609	13,631	**125,250**
No. of Pregnant women received iron tablets	834	797	688	640	602	631	619	675	**8,024**
No. of iron tablets transferred to commune	83,478	52,221	22,847	21,235	60,164	120,879	100,446	121,730	**793,871**

Table 4.16 and 4.17 showed for the duration from October 2000 to May 2001, the project remained the cost at a level of maintaining the supplementation of iron to pregnant women and women 15-34 years old as the routine work. Putting December 2000 and January 2001 aside (as it is recess for iron supplementation to women 15-34), then we could calculate monthly average-delivery cost per targeted woman receiving monthly dose of iron supplementation (Table 4.18b). It was about VND369 or $US 2.5 cent equivalently.

4.2.3.2. Details of costs-effectiveness analysis for project of iron tablet *supplementation to pregnant women and women 15-34 yrs:*

There are several assumptions for estimating cost-effectiveness of the project:

- A full dose of iron supplementation in a month for women 15-34 is 1 tablet/week/x 4 weeks;
- A full dose of iron supplementation in a year for women 15-34 is 1tablet/week x 4 months continuously.
- A full dose of iron supplementation in a month for pregnant women is 1 tablet/day x 30 days.
- A full dose of iron supplementation to a pregnant woman is 1 tablet/day x 5.5 months (i.e., an average time since pregnancy was recognized until delivery)

With these assumptions, the iron supplementation to women 15-34 in this project was considered as a program for two years, each year had 4 project months (from July 15th – November 15 for the year 2000 and from February –May for the year 2001). Similarly, the supplementation of iron tablets to pregnant women in 11 months (July 200-May 2001) is equivalent to the supplementation to 2 cohorts of pregnant women (i.e., each cohort received iron supplementation for 5.5 months). The actual number of pregnant women go through the project of iron supplementation was therefore equal to two times of the project-monthly average number of pregnant women received iron supplementation.

Table 4.18a presents the cost-effectiveness estimation process in detail. The cost per targeted woman in whom anemia was prevented during the project period is approximately VND 227,958 or $US 15.51 equivalently.

Table 4.18*a Costs-effectiveness analysis for project of iron tablet supplementation to pregnant women and women 15-34 years old in 20 communes, from 3/2000-5/2001*

Indicator description	*Detail calculation*	*Output*
Total costs of launching iron tablet supplementation in 20 communes, March 2000–May 2001	In table 4.16	VND135,635,269 **(A)**
Project-monthly average number of pregnant women in 20 communes received doses of iron tablets from July 2000 to May 2001	=8024/(11 project months)	729 (pregnant women) **(B)**
Project-monthly average number of women 15-34 yrs old received doses of iron tablets from July 2000 to May 2001	=125,250/(8 project months)	15656 (women) **(C)**
Difference between prevalence of anemia in the pregnant women group at the baseline and the evaluation	= 25.4% - 12.5% (Table 4.13)	12.9% **(D)**
Difference between prevalence of anemia in the women 15-34 yrs old at the baseline and the evaluation *(only for 10 communes applied the dose of 2 tables per week)*	= 20.8% - 15.6% (Table 4.14)	5.2% **(E)**
Total pregnant women in whom anemia was prevented during the intervention period	= (B*2)*D	188(prg. women) **(F)**
Total women 15-34 yrs old in who anemia was prevented during the study period in 10 communes	=(C/2)* E	407 (women) **(G)**
Costs per women in whom anemia was prevented through the iron supplementation project	*= A/(F+G)*	VND ***227,958*** **(H)** ~ $US***15.51****

* Exchange rate at 17/6/2001: $US 1= VND14,693.

Table 4.18b. *Delivery cost for maintaining iron supplementation to targeted women groups as a routine work at community level*

Indicator description	*Detail calculation*	*Output*
Total costs of launching iron tablet supplementation in 20 communes in 6 months, from October 2000 to May 2001*	In table 4.16	VND32,179,502 **(A)**
Total of pregnant women and women 15-34 to receive iron supplementation in 6 months	In table 4.17	87099 (women) **(B)**
Project-monthly delivery cost per targeted woman to receive monthly iron supplementation	=A/B	~VND369 **(C)** **~ $US 0.025**

** not including project costs and outputs of December 2000 and January 2001*

4.2.3.3.Children 6-23 months

Table 4.19 shows the distribution of costs for iron syrup supplementation to children 6-23 months in 10 communes of group B by project component. The costs of training, social mobilization, supervision, and administrative cost were incurred in the beginning of the supplementation (November 2000), not every project month, except in March there was cost supervision and administrative but they were mainly for preparation of final evaluation. The total project cost was VND22,022,024. Of which, training got the highest shared costs (41%; VND9,100,000/ 22,022,024), following by medicine accounted 39 % (VND8,586,080/ 22,022,024) (Figure 7)

Table 4.19 *Distribution of costs of launching iron syrup supplementation to children 6-23months in 10 communes by project months, from November 2000 to May 2001*

	Nov.00	Dec.00	Jan.01	Feb.02	Mar. 03	Apr.04	May 05	Total
Expenditure (VND)								
Supplements/ Medicine	708,640	1,186,560	1,153,600	1,186,560	1,648,000	1,829,280	873,440	**8,586,080**
Training cost	9,100,000	0	0	0	0	0	0	**9,100,000**
Social mobilization	411,500	0	0	0	0	0	0	**411,500**
Transportation and supervision	1,400,000	0	0	0	167,111	0	0	**1,567,111**
Administrative cost	1,844,000	0	0	0	513,333	0	0	**2,357,333**
Total	**13,464,140**	**1,186,560**	**1,153,600**	**1,186,560**	**2,328,444**	**1,829,280**	**873,440**	**22,022,024**

Figure 7- *Iron syrupe supplementation to children 6-23 months: distribution of project cost component*

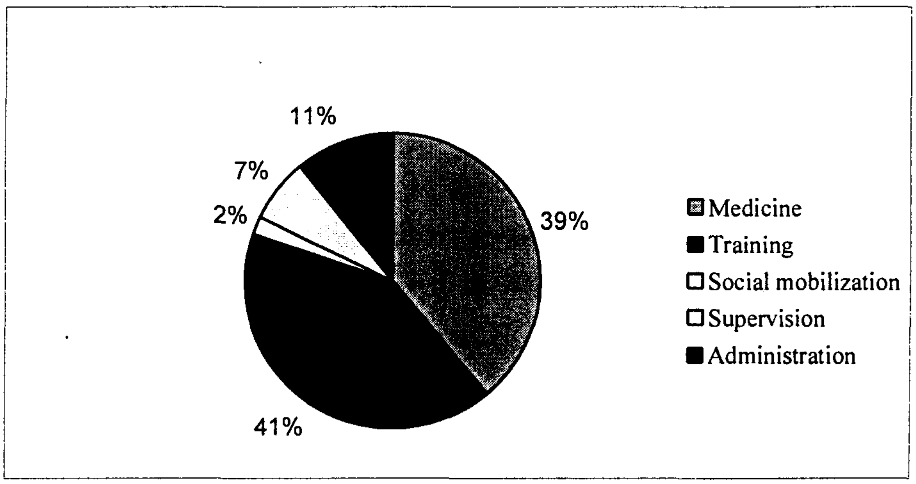


Table 4.19 and Figure 8 show the monthly distribution of project costs. We can see the cost of maintaining the activity of iron supplementation to children 6-23 months in this 10 communes was at approximately VND 1million , and almost all of the cost was for medicine.

Figure 8 - *Iron syrup supplementation to children 6-23 months: Distribution of project costs by month in million VND*

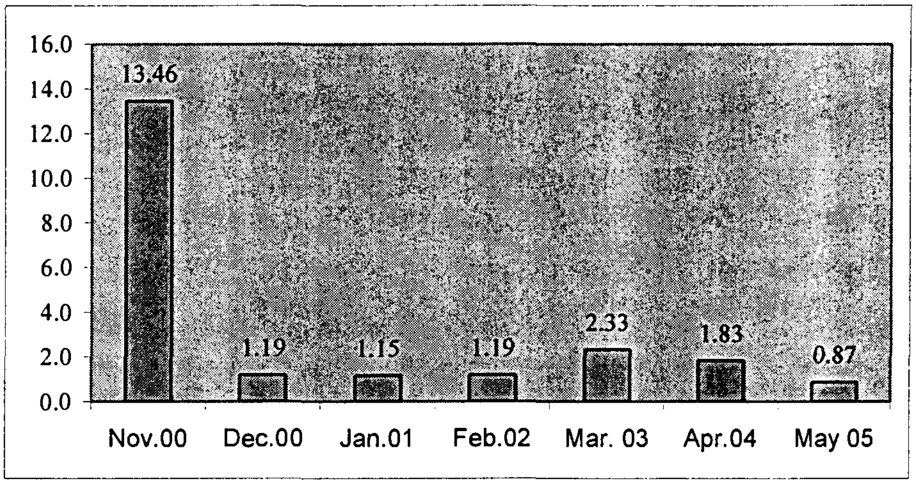


Table 4.20 shows the number of children served by the project by month. In average, to have a child fully got 4 doses of iron syrup in a project month, the cost was VND 5,865 or $US 0.40 equivalent. This cost will be reduced once the supplementation of iron syrup to children become a routine work and integrated with EPI. This study showed that the project cost distribution by month from December 2000 to May 2001 covered mostly by drug cost component. The cost of iron syrup for a child in a month was only VND 1406 or $US0.096 equivalently (Table 4.21a).

Table 4.20 *Distribution of cost-effectiveness of the project by month*

	Nov.00	Dec.00	Jan.01	Feb.02	Mar. 03	Apr.04	May 05	Total
Total project cost	13,464,140	1,186,560	1,153,600	1,186,560	2,328,444	1,829,280	873,440	**22,022,024**
Nunber of children 6-23 months of age	892	892	871	858	864	865	866	***6,108***
Average cost/month/child in VND	***30,189***	***1,330***	***1,324***	***1,383***	***2,695***	***2,115***	***2,017***	***5,865***
Average cost/month/child in $ US	***2.05***	***0.09***	***0.09***	***0.09***	***0.18***	***0.14***	***0.14***	***0.40***

Table 4.21a *Estimation of delivery cost for a child 6-23 months to receive monthly dose of iron syrup*

Indicator description	*Detail calculation*	*Output*
Total costs of launching iron syrup supplementation in 10 communes in the months December 00, January, February, April and May 2001	In table 4.18	VND**6229440** **(A)**
Total children 6-23 months received monthly dose of iron syrup	=892+871+858+865+866 (Table 4.20)	**4352**(children) **(B)**
Delivery cost per child receiving monthly doses of iron syrup	= A/B	VND**1431** Or ~US$**0.097**

Table 4.21b show the cost for a child in whom anemia was prevented during the project period. In average, it costs VND 69,470 or $US4.73 per case of anemia.

Table 4.21b. Costs-effectiveness analysis for project of iron syrup supplementation to children 6-23 months old in 10 communes, from 11/2000-5/2001

Indicator description	*Detail calculation*	*Output*
Total costs of launching iron syrup supplementation in 10 communes, Nov 2000– May 2001	In table 4.18	VND22,022,024 (A)
Project-monthly average number of children in 10 communes received doses of iron syrup from Nov 2000 to May 2001	=6108/7 (Table 4.19)	873 (children) (B)
Difference between prevalence of anemia in the children 6-23 months old at the baseline and the evaluation	= 68.0% - 31.7% (Table 4.15)	36.3% (C)
Total children in whom anemia was prevented during the intervention period	= B*C	317 (children) (D)
Costs per child in whom anemia was prevented by the iron syrup supplementation project	*= A/D*	VND *69,470* ~ $US4.73*

* *Exchange rate at 17/6/2001: $US 1= VND14,693.*

4.3. Women's Compliance on taking doses of iron supplementation

This study measured compliance rates of pregnant women and women 15-34 years old in the iron supplementation program at three points: after 2 month launched the supplementation (check 1, August/Sept 2000), after 4 months (check 2- Oct/Nov 2000) and at the end of the project (check 3, April/May 2001).

4.3.1. Compliance rate in the pregnant women group

For pregnant women, by the end of the project, approximately 39% of them had very good compliance, with exactly one tablet per day for 30 days per month. The percentage of pregnant women administering more than the daily dose recommended or missing less than 5 tablets in a month varied a little, from 37.5% in the check, to 34% in the check 2, and to approximately 39% at the evaluation. The percentage of pregnant women with poor compliance (missing from more than 10 tablets to missing all 30 tablets in a month) was decreased by project time, from 16.5% at the check 1, 15.5% at the check 2, down to less than 7% at the end of the project (Table 4.22).

Table 4.22 *Compliance rates on iron administration by project time in pregnant women in 20 communes in Tam Nong, July 2000-May 2001*

Level of compliance	Check-up 1 8-9/00		Check-up 2 10-11/00		Final evaluation 4-5/01	
	n	%	n	%	n	%
Very good *	63	31.5	79	39.5	74	39.4
Good**	75	37.5	68	34.0	74	39.4
Average***	18	9.0	17	8.5	18	9.6
Poor compliance ****	33	16.5	32	16.0	13	6.9
- Could not check medicine box	*11*	*5.5*	*4*	*2.0*	*9*	*4.8*
Total	**200**	**100**	**200**	**100**	**188**	**100**

**1 tablet/day for the last 30 days.*

*** Missing administration or over administratio of more or less than 5 daily doses out of 30 daily doses*

****Missing administration from 5-10 tablets during the last 30 days.*

*****Missing from 10 daily doses to all 30 daily doses.*

4.3.2. Compliance rates in women 15-34 years old group

The good compliance reached to approximately 81% after 4 months of project implementation, then reduced to 38% at the end of the project (Table 4.23). There was also an increase of percentage of taking more than 4 doses for the last four weeks, from 3.1% in October 2000, to 31% in May 2001. Poor compliance rate was also increased from 3.8% in September 2000 to 9.5% at the end of the project.

Table 4.23 *Compliance rates on iron administration by project time in women 15-34 years old in 20 communes of Tam Nong district, July 2000 - May 2001*

Level of compliance	Check-up 1 8-9/00	Check-up 2 10-11/00	Final evaluation 5/01
	n (%)	n (%)	n (%)
Good*	234 (58.5)	288 (80.7)	68 (38.0)
Average (missing one dose)	30 (7.5)	28 (7.8)	31 (17.3)
Poor compliance (missing >= 2 doses)	15(3.8%)	27(7.5)	17 (9.5)
More than 4 doses for the last 4 weeks	81 (20.3)	11 (3.1)	56 (31.3)
Could not check medicine box	*40 (10.0)*	*3 (0.8)*	*7 (3.9)*
Total	**400 (100)**	**357 (100)**	**179 (100)**

**following exactly the guideline: one dose per week during the last 4 weeks.*

5. Discussion and Recommendations

This research is to explore the feasibility and cost-effectiveness of the integration approach on monthly low dose of vitamin A supplementation and on daily and weekly doses of iron to different targeted groups in a setting where the primary health care network is available and functioning well with monthly EPI activities of more than 90% coverage rate in children under 3 year old during the last 5 years (Table 3.1). This intervention study in nature is to bring the "good things" – knowledge, medicine, and integrated management model, to health staff and community people that fit to the need of children and women's healthcare in these communes - therefore was highly supported by local government as well as community people.

The research was launched at the time Ministry of Health of Vietnam is focusing on strengthening rural health care system. It got strong support from Ministry of Health and its related institutions, especially from NIN.

In addition, there are three further points to bear in mind when assessing results from this research.

First, the intervention was carried out in one district with two groups: intervention and control. Both the groups are under the management of district health center. There was certainly interference from the intervention to the control communes caused by district health team through monthly CHC staff meeting at district health center, through the usual field trips for monitoring and supervisions community health programs, and through the mass media system managed by district government.

Second, in this study, the results of the tests on serum retinol, breast milk retinol, and hemoglobin conducted by NIN-Lab was really not checked by an international, reference lab specialized in this field, although NIN-Lab is the leading one and had carried out several internationally collaboration research projects in Vitamin A and anemia(6).

Third, data on costs of national campaign on vitamin A high dose supplementation in the control communes was estimated as the costs of maintaining a routine activity, while the costs of vitamin A low dose and iron supplementation covered all expenses for establishing a totally new program.

Nonetheless, the following findings were the contribution from this research.

5.1. Bi-annual campaigns of vitamin A 200000IU supplementation

Biannual campaign of vitamin A high dose supplementation could bring the vitamin A deficiency in children 6-35 months and lactating women down significantly more than what Vietnam gained so far.

With a routine supplementation of vitamin A high dose with biannual campaign strategy, vitamin A deficiency in Vietnam remains a public health problem at moderate level in children 6-35 months (Table 4.3) and at very severe level in lactating mothers: approximately 60% of lactating mothers had breast milk retinol level under 1.05 $\mu mol/L$ (Table 4.3).

An interesting that the control communes in this study enjoyed a significant increase of serum retinol after 1year of follow –up. This increase happened in both the targeted groups: children 6-35 months (mean: 0.87$\mu mol/L$ at the baseline, 1.05 at the mid-term, 1.09 $\mu mol/L$ at the final evaluation; t=6.85; P<0.001), and lactating mothers (0.97 $\mu mol/L$ to 1.38 and 1.22 $\mu mol/$

L respectively; t = 3.36; P<0.0001). The prevalence of vitamin A deficiency in children reduced from 16.7% down to 8.4% and then 9.9% correspondently (Table 4.3). Similarly, the prevalence of vitamin A deficiency in lactating women from 58% down to 39.1% ($\chi 2$ =12.9; P<0.001), and the coverage rate of vitamin A high dose in postpartum women increased from 18.8% to 50% (Table 4.2).
This reduction could be explained by (1) the interference caused by the transferring community health management experience from the intervention communes to the control communes; and (2) the co-effect of vitamin A and iron in the control communes when iron supplementation was launched in these communes in the last 7 months of the study duration.

In terms of the deviation in vitamin A campaign implementation in the control group, it was reflected by an increase of the coverage rate of vitamin A supplementation. It was also observed during the fieldwork that the district health team disseminated information they learnt in project management in the intervention communes to the control communes through monthly staff meetings. Key information disseminated were adjustment in organizing the EPI day to integrated with other community health activities; job description of village health workers; educational materials to health staff as well as to community people on prevention of vitamin A deficiency in children. Those inputs probably were they key factors to result in the increase of coverage rate of vitamin A supplementation in both children group and lactating women group (from 89% to 97% for the children - Table 4.1, and from 18% to 50% for lactating women- Table 4.2).

The biologically interactive between iron and vitamin A co-supplementation was possibly factor explaining partly the increase of retinol in control communes. First, iron supplementation was delivered in those communes since November 15, before the second campaign of vitamin A supplementation (12/2000). In a longitudinal study in Mexican preschoolers with the sample size of 219 children assigned randomly to 4 groups, Munoz, Rosado et al. reported that supplementation iron significantly increased retinol (7). In our study, the serum retinol in control groups increased significantly in the midterm evaluation (95% CI of mean; 0.98-1.12) compared with that of the baseline survey (4/2000) (95% CI: 0.83-0.92) (Table 4.3).

This community-based evidence gave an implication for further research to test our community health management model in a more extension scale, say provincial level, to provide policy lessons for the national vitamin A supplementation and iron supplementation program in Vietnam. The hypothesis is, it does not matter whether to monthly dose of vitamin A supplementation was launched nationally or not, just revising the current management of community health project implementation at community level toward integration model within local health authorities' capacity, Vietnam could reduce substantially the burden of vitamin A deficiency in children.

5.2. Monthly supplementation of vitamin A 50000IU to children

Monthly supplementation of vitamin A low dose to targeted children, plus with high coverage rate of lactating mothers receiving vitamin A capsule of 200000 IU, could bring the vitamin A deficiency in children from medium level down to a level of no significantly public health problem in the study area

The results from the 10 intervention communes showed the percentage of children with serum retinol level below 0.7 *μmol/ L* at the end of the project was 1.5%, a level of no significantly public health problem according to WHO criteria. It is statistically lower than that of the control group (1.5% vs 9.9%; $\chi 2$ = 8.38;P = 0.003; Table 4.3.). This effect is partly contributed from the high percentage of lactating mothers receiving vitamin A capsule of 200000 IU (98.4%; Table 4.1).

5.3. Delivery cost of monthly vitamin A low dose supplementation

Full cost of delivering monthly vitamin A supplementation to targeted children is about 5 cent per dose or at 57 cents per child per year

In this research, it took approximately 6 months for building an integrated model for delivering monthly vitamin A supplementation together with EPI activities and family planning. Once the model has run well, the total cost per child per year receiving monthly dose of 50000 IU vitamin A was approximately 57 cents (Table 4.7b). No studies so far reported costs of launching monthly vitamin A low dose integrated with vitamin A. Internationally, the full cost of delivering the capsules of 200000 IU to children 6 months to 5 years of age at six month intervals are estimated from 4 cents per dose (8) to about 50 cent per year (9). Howson et al made a review of costs of micronutrient control program (Table 2.2) (10) showed the cost ranged from 55 to 81 cent per person per year (US$ projection 1994$). In Vietnam, there is no studies on costs of the biannual campaign of vitamin A supplementations were reported. This study used the data reported by the district health center that showed the cost per dose of 200000IU in the control communes was at US$16 cents, or 31 cent per year (Table 4.9).
Further research in Vietnam on provincial level in terms of monthly low dose of vitamin A supplementation integrated with EPI and other community health program is needed.

5.4. Vitamin A 200000IU to mothers in postpartum period

Supplementation of vitamin A high dose to women in postpartum period was not enough to lowdown breast milk retinol in lactating women to under the cut-off point of severe problem

This research found that lacking vitamin A in breast milk is severe public health problem in the study area. The baseline survey showed at both commune groups, the coverage rate of vitamin A supplementation in postpartum'women was low at <19%, and approximately 60% of breast milk samples had retinol lower than 1.05 *μmol/ L.* After one year of intervention, this prevalence were halved at the intervention communes (31.9%), but still much higher than cut-off points for severe problems in public health (>25%), although the coverage rate increased from 69% to 90%. Studies are needed in this area to find strategy of improving retinol in lactating women.
Because the dose of vitamin A supplementation to women in post-partum period was applied every communes (1 tablet of 200000IU), the higher level of increase of breast milk retinol in intervention commune group compared with the control commune group during the study period could be explained by the effect of the integrated model on delivering vitamin A applied in the intervention communes (mean: 1.52 μmol/ L versus 1.22μmol/ L in the control; t = 2.64; P= 0.005- Table 4.4). This finding once again confirm the benefit of organizing integrated model in delivering community health programs at grass-roots level presented in the section 5.1 above.

5.5. Iron supplementation to pregnant women

Iron supplementation to pregnant women received very high compliance rate and could reduce the burden of anemia to mild in rural community.

This study found prevalence of anemia in pregnant women in this district before the intervention was at moderate level, about 25.4% after adjusting with gestation age. Other documents reported an estimation for Vietnam at about 53% (11). This difference could be explained by two possible reasons. First, data on anemia in pregnant women reported by NIN or Ministry of Health was not standardized by gestation age. In our study, the prevalence of anemia before standardization was 32.3%. Second, the prevalence of anemia in pregnant women reported by the Government came from the NIN survey 1995, and rural health has been changing remarkably in the last 5 years. Third, baseline survey found that although national program on iron supplementation was not introduced into this district, still there were about 20% of pregnant women administering iron tablets during pregnancy (Table 4.10).

The intervention of iron supplementation to pregnant women in these communes after one year halved the prevalence of anemia (12.5%- Table 4.13), bring those communes from moderate anemia down to mild anemia one year after. This situation is certainly sustainable if the project is prolonged because we found that, the compliance rate in pregnant women was remained high throughout the study period: From approximately 70% at the beginning of the project implementation, to 74% after 4 months, then increased to approximately 80% by the end of the project. In addition, the poor compliance rate reduced from 16.5% to 6.9% correspondingly (Table 4.22). The high compliance rate found in this study was interesting, as in internationally, it was reported that large-scale iron supplementation programs for pregnant women always fail (12). The model of iron tablets delivery in this study might contribute to a high compliance rate in these communes. A study of efficiency of this model at a larger scale, i.e., province level, is needed.

5.6. Iron supplementation to women 15-34 years is a challenge

Mean number of hemoglobin in women 15-34 supplemented with 1 iron tablet/week in consecutive 4 months was not changed statistically in the both communes groups (Table 4.14). There are two factors that possibly explain for that.

First, in the women 15-34 years old group, the compliance rate was not remained high: The percentage of good compliance ranged from 58.5% in August 2000 check-up, to 80.7% in November, then reduced to 38% in the final evaluation. Correspondently, the mean number of hemoglobin moved from 126.6 g/L to 129.5 g/L then dropped to 125.1 g/L in the 10 communes using 1 tablet/week -dose strategy throughout the study (Table 4.14). While the high compliance rate was remained for the pregnant women group in the same communes, the poor compliance rate for this group could be explained mainly by women's non-compliance with iron tablet consumption.

Second, the dose of 1 tablet/week for consecutive 4 weeks may not enough to impact to hemoglobin status. After the first round of 4 months of supplementation (July-November 2000), we decided to increase the dose to 2 tablets/week x 4 consecutive months in 10 communes (Feb-May 2002) and left 10 other communes remained with 1 tablet/week dose as the control. The increase of hemoglobin level was observed in the intervention commune group (from 129g/L in December, to 131.1g/L in April), but it was not enough statistical significance, although the prevalence of moderate anemia had been changed to mild anemia in those 10 intervention communes.

Suggestions from this research on iron supplementation to women 15-34 include (1) a need of investigating various strategies on dose of iron supplementation. The hypothesis is that a dose of 2 tablets per week in more than 4 consecutive months would make change statistically of hemoglobin, any dose of lower than that would have not significantly public impact on anemia in women. (2) Attention should be focused adequately on women's non-compliance with iron tablet consumption. Training and providing necessary information to this group must be considered as equal as to delivery of iron tablet in prevention of iron anemia in women.

5.7. Supplementation of iron syrup to children 6-23 months

Anemia is a serious public health problem in rural Vietnam. 1 mL of iron syrup per week halved prevalence of anemia in children 6-23 months after 6 months of intervention, but anemia in children is still at severe in those study communes

This research confirmed a situation of severe anemia in rural children in Vietnam: 68% of children were classified as anemia at the time of before launching the intervention. 95% confidence interval for both mean and median numbers of hemoglobin in children 6-23 months was below the WHO/UNICEF/UNU's cut-off points for anemia (Table 4.15).
High anemia in children 6-23 months of those communes was not special, because the program of prevention of iron anemia was not implemented in the district before this study commenced. In a nation - wide survey in 1995 by NIN and UNICEF, a prevalence of anemia at 60.5% of children under two years of age was reported.
The decrease of anemia from 68% to 31.7% was gained after 6 months of intervention with iron syrup 1ml/week, brought the anemia problem in children from severe down to moderate. A high coverage rate remained throughout the intervention duration, from 82.8 % to 97% (Table 4.12). The good response from intervention indicated that iron deficiency is a key factor caused anemia in children in Vietnam, and the high compliance rate in this study provided the evidence that the model of iron-vitamin A supplementation integrated with EPI is effective.

5.8. Cost of maintaining a routine iron supplementation to women and children

Project cost for having a child escaped from anemia was about US$4.73, and for any targeted women escaped from anemia was US$15.5. However, cost of maintaining a routine iron supplementation to women and children was much cheaper: less than 10 cent per monthly doses.

This study showed the delivery cost per a monthly dose of iron to a woman was at VND 369 or US 2.5 cents equivalently (Table 4.18b), and at VND1431 or US 9.7 cent per monthly dose of iron syrup to children 6-23 months (Table 4.21a). As the evidence for the effectiveness of iron supplementation to pregnant women and children are clear, iron supplementation to pregnant women and children 6-23 months seems to be considered a good strategy in primary prevention of anemia in women and children's health in rural Vietnam. However, the project cost for having any targeted women escaped from anemia was estimated about US15.51, and for a child was US$4.73. This cost may be reduced when the program is launched at larger area and for a longer period. However, it would be worth to consider the program cost in a poor country, whether they can afford for the same time to launch iron supplementation to children as well as to targeted women. Currently, the national program on control of iron deficiency anemia in Vietnam covered less than 15% of all communes. The main limitation for extending the program is short of budget. This study provided evidence for health policy makers to chose whether they launch iron tablet/syrup supplementation program to all three targeted groups or priority given to any of them (children 6-23 months, pregnant women, and women 15-34 years old). This research findings support to the option of selective supplementation of iron to children and pregnant women, because their evidence of effectives as well as high compliance rate.

5.9. The model for delivering micronutrient supplementation to the targeted groups

Integration of community health activities at communal level for delivering monthly vitamin A and iron supplementation required not only technical support but also financial support to cover further management cost at district (approximately US$ 15/month/district) and community health center (US$3 /month/CHC). Another condition for launching the integrated model is that the village health worker network must be form and remained.

Delivering low dose vitamin A and iron supplementation to targeted groups requests an integrated model for launching all community health activities on monthly regular schedule. Village health workers and CHC staff as well as district health officers all need to be trained on how they work together to work out a feasible plan for delivering micronutrient supplementation integrated with EPI and other community health activities in their own area. Tam Nong model should be built to become a training model for other communes. In average, it takes about 6 months to make the delivery of vitamin A and iron supplementation to be fully integrated into the commune health system. Cost for maintaining the integrated model is considered to be very effective compared with the benefits gained from the increase of coverage rates of service utilization. Before having the integrated model, the coverage of vitamin A supplementation in postpartum women in Tam Nong was 17.2% in the intervention group, and 18.8% in the control. With the integrated model, the coverage increased to 87.2% and remained high at 86.5% after one year. The adaptation of this model in the control communes resulted an increase of the coverage to 50%, compared with, the median coverage of 30% among 44 countries adopted policy for postpartum supplementation as of 1998 (13). The high coverage of low dose vitamin A and iron supplementation in the targeted groups of children was also gained easily in communes run health programs with integrated model in this study.

References

1. Khan NC, Hoa HV, Huong CT, Nhan BT. MOnthly supplementation of vitamin A capsule to children at Dong Hy district, Bac Thai province. In: National Institute of Nutrition, editor. 20 years of prevention and control of micronutrient deficiencies in Vietnam- Research and Development 1980-2000. Hanoi: Medical Publishing House; 2001. p. 204-7.

2. Mclaren DS, Frigg M. Sight and life manual on vitamin A deficiency disorders (VADD). 2nded. Basel, Swizerland: 2001.

3. UNICEF. Prevention iron deficiency in women and children- Techinical consensus on key issues ;UNICEF/UNU/WHO/MI Techinical Workshop. New York: International Nutrition Foundation (INF) and Micronutrient Initiative (MI); 1998.

4. Beaton, George H and McCabe, George P. Efficacy of intermittent iron supplementation in the control of iron deficiency anaemia in developing country- An analysis of experience. 1999. Ottawa, Canada, Micronutrient Initiative.

5. Dung, Van Thi Mai. Determining effectiveness of the monthly combined vitamin A and iron supplementation integrated with the existing health activities in Tam Nong district, Phu tho province: Analysis of the preliminary research findings and mid-term project report . 1-70. 2-1-2001. RTCCD.

6. Thu, Bui dai, Schultink, Werner, Dillon, Drupadi, Gross, Rainer, Leswara, Nelly D, and Khoi, Ha Huy. Effect of daily and weekly micronutrient supplementation on micronutrient deficiencies and growth in young Vietnamese children. Am J Clin Nutr 69, 80-86. 1999.

7. Munoz, Elsa C, Rosado, Jorge L, Lopez, Patricia, Furr, Harold C, and Allen, Lindasay H. Iron and zinc supplementation improves indicators of vitamin A status of Mexican preschoolers. Am J Clin Nutr 71, 789-794. 2000.

8. Sommer, Alfred. Vitamin A deficiency disorders: Origins of the problem and approaches to its control. information@biotech-info.net , 1-7. 5-17-2001.

9. USAID. Global Health. Internet . 5-25-2002.

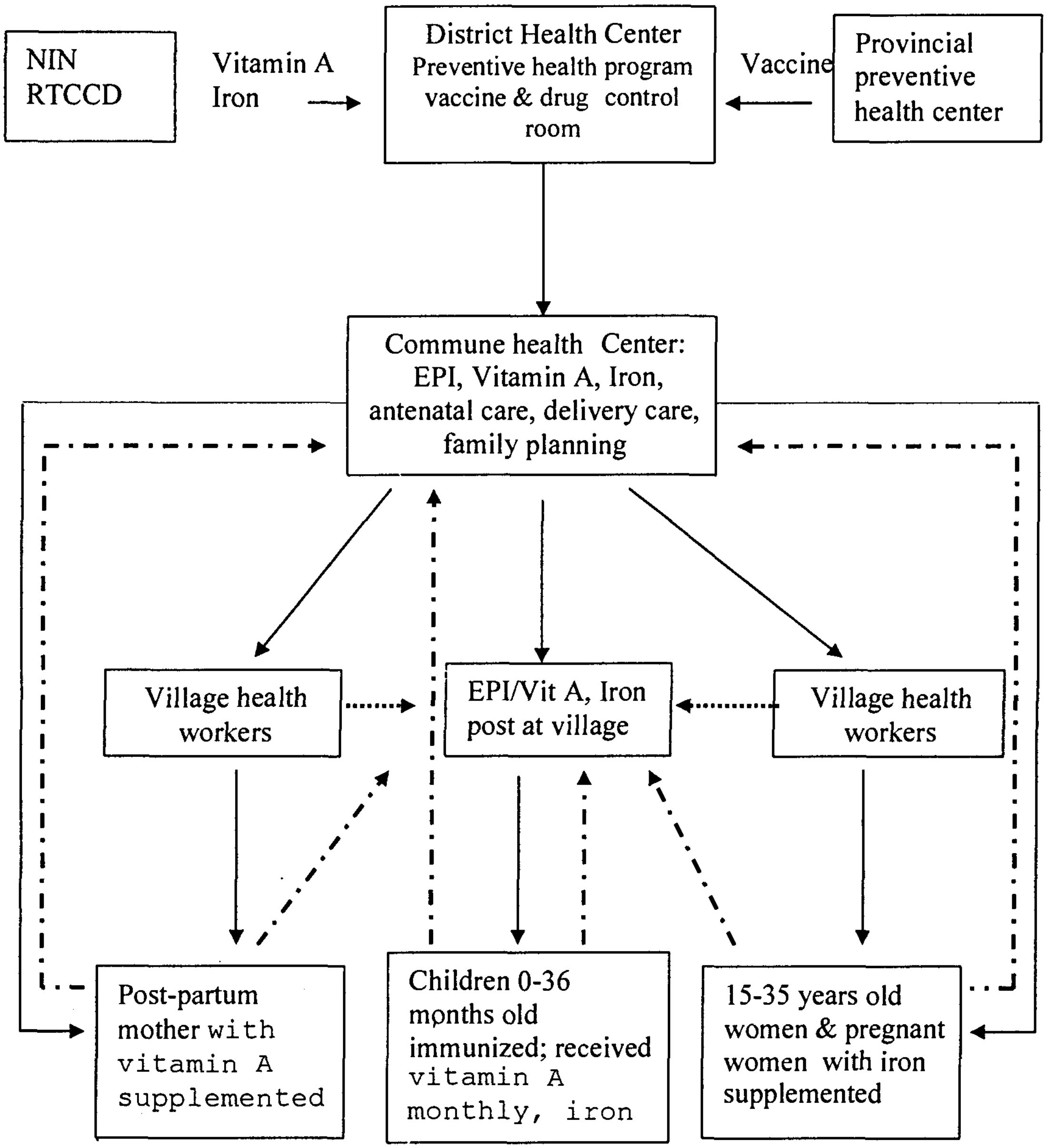
10. Howson CP, Kenedy ET, Horwitz A. Prevention of micronutrient deficiencies- tools for policymakers and public health workers. Washington, D.C.: National Academy Press; 1998.

11. Wolrd bank, Sida, AusAID, Royal Netherlands Embassy, and Ministry of Health Vietnam. Vietnam: Growing healthy: A review of Vietnam's health sector. 1-202. 2001.

12. Elder, Leslie K. Issues in programming for maternal anemia. -31. 2000. Arlington, VA, John snow, Inc. MotherCare.

13. Mason, John B, Lotfi, Mahshid, Dalmiya, Nita, Sethuraman, Kavita, and Deitchler, Megan. The Micronutrient Report: Current Progress and Trends in the control fo Vitamin A, Iodine, and Iron Deficiencies. RA645.V56M52 2001, 1-65. 2001. Ottawa, ON, Canada KIG 3H9, The Micronutrient Initiative (MI).

Annex 1- *Diagram of delivering vitamin A capsules and iron syrup/iron tablets to the targeted groups integrated with EPI at communal level*



Notes:

→ Management

⋯→ Assistance for implementation

–·–→ Received medicine Vaccine, iron tablets/syrup, vitamin A capsules)

Annex 2- *Distribution of in hemoglobin concentration and prevalence of anemia in children 6-23 months by specific age group (in month) at baseline and final project evaluation*

Age group *(in month)*	Baseline Survey (9/2000)				Final Evaluation (4/2001)			
	N	*Mean [95%CI]*	*Median*	*% anemia**	*n*	*Mean [95%CI]*	*Median*	*% anemia**
6-11,9	69	100.0 [97.2-102.7]	100.9	84.1	40	111.6 [108.5-114.6]	111.0	42.5
12-17,9	71	104.9 [102.2-107.6]	106.3	70.4	36	111.4 [107.7-115.1]	112.0	38.9
18-23,9	63	110.7 [108.1-113.3]	110.1	47.6	44	116.1 [114.0-118.2]	117.0	15.9
Total	203	105.0 [103.4-106.6]	106.3	68.0	120	113.2 [111.5-114.9]	113.3	31.7

** Anemia cut-off point: Hb < 110 g/L*

Annex 3- *Distribution of hemoglobin concentration and prevalence of anemia in children 6-23 months by nutritional status at baseline and final project evaluation*

Nutrition Indicator	Baseline (9/2000)				Final Evaluation (4/2001)			
	N	*Mean [95%CI]*	*Median*	*% anemia**	*n*	*Mean [95%CI]*	*Median*	*% anemia**
SDD waz	87	104.9 [102.7-107.1]	105.5	70.1	33	111.9 [108.8-114.9]	113	36.4
SDD whz	20	108.8 [104.7-112.9]	108.4	55.0	10	114.2 [108.5-119.8]	116	30.0
SDD haz	71	103.7 [100.7-106.6]	103.6	67.6	22	112.6 [108.9-116.3]	113	31.8

** Anemia cut-off point: Hb < 110 g/L*

Annex 4- *By age group: Distribution of hemoglobin concentration and prevalence of anemia in pregnant women at baseline, mid-term, and final evaluation*

Age (in year)	***Baseline Survey 4/2000***				***Midterm Evaluation 12/2000***				***Final Evaluation 4/2001***			
	n	Mean [95% CI]	*Median*	% anemia	N	Mean [95% CI]	*Median*	% anemia	n	Mean [95% CI]	*Median*	% anemia
< 25	99	116.4 [114.2-118.6]	*115.4*	29.3	85	117.7 [115.1-120.3]	*117.3*	27.1	95	118.1 [115.6-120.5]	*117.0*	27.4
25-29	76	113.5 [111.4-115.6]	*113.0*	31.6	63	116.6 [113.8-119.4]	*117.3*	25.4	62	122.3 [119.5-125.1]	*121.8*	9.7
30+	26	110.7 [105.5-116.0]	*110.3*	46.2	36	116.1 [112.2-120.0]	*116.6*	25.0	36	117.7 [114.5-120.8]	*119.2*	16.7
- Total	**201**	**114.5 [113.1-116.0]**	*113.4*	**32.3**	**184**	**117.0 [115.3-118.7]**	*117.3*	**26.1**	194*	**119.3 [117.7-120.9]**	***119.2***	**19.6**

WHO cut-off point for anemia in pregnant women Hb < 110 g/L
**6 cases missing age*

Annex 5- *By age group: Distribution of hemoglobin concentration and prevalence of anemia in women of 15-34 years old in Tam nong district at baseline, mid-term, and final evaluations*

Age group	Baseline Survey 4/2000				Midterm Evaluation 12/2000				Final Evaluation 4/2001			
	N	*Mean [95% CI]*	*Median*	*% anemia*	*N*	*Mean [95% CI]*	*Median*	*% anemia*	*n*	*Mean [95% CI]*	*Median*	*% anemia*
<20	51	127.3 [124.1-130.4]	129.8	21.6	56	128.5 [126.1-130.9]	129.0	14.3	51	127.4 [123.8-131.0]	129.0	25.5
20-24	50	128.2 [124.8-131.6]	129.8	20.0	55	129.8 [126.7-133.0]	131.0	20.0	50	129.9 [126.1-133.7]	131.0	20.0
25-29	50	128.0 [124.8-131.2]	127.7	22.0	58	130.0 [127.1-133.0]	129.2	19.0	49	126.2 [122.7-129.7]	128.0	22.5
30+	50	126.4 [122.8-130.0]	128.7	28.0	55	128.2 [125.1-131.2]	129.0	21.8	52	127.2 [123.5-130.9]	129.0	25.0
Total	**201**	**127.5 [125.8 - 129.1]**	**129.8**	**22.9**	**224**	**129.1 [127.7-130.6]**	**129.0**	**18.8**	**202***	**127.5 [125.7-129.4]**	**130.0**	**23.3**

- WHO criteria for cut-off point of anemia: hemoglobin < 120 g/L
**1 cases missing age*

Erick Boy

From: HERBWEIN@aol.com
Sent: Thursday, March 28, 2002 12:50 PM
To: Erick Boy
Subject: Re: Latin American forum for cereal flour producers: iron fortification update
Follow Up Flag: Follow up
Due By: Wednesday, April 03, 2002 9:30 PM
Flag Status: Flagged

Erick:

Gracias por aquello de Excelentisimo...

Dame unas cuantas horitas - acabo de regresar como tu sabes de Holanda - para contestarte con sugerencias y algo relativo a disponibilidad (tiempo) etc.

Como te comente cuando nos vimos en Ottawa estoy bien metido en el proyecto del ADB en Asia y hay bastante quehacer. Despues, en Junio, Julio y Agosto estare bien ocupado con el Institute of Food Technologists, El Premio de Tec ... en Mexico y Venkatesh quiere organizar un taller sobre alimenentos complementarios en Agosto en Canada.

Te escribo pronto ... prometo.

Un abrazo,

Herbert

Herbert Weinstein, Ph.D.
1600 N. Oak Street
Suite 725
Arlington, VA 22209
Tel. 703 812 8513
Fax 703 812 9693

Countries with Wheat Flour Fortification Standards

Country	Iron Standard (ppm)	Year of Issue
Bolivia	30	1998
Canada	29 – 43	
Chile	30	1960s
Proposed Central American Regional Standard (INCAP Proposal)	55 – 65	1997 (proposed)
Costa Rica	28.7 – 36.4	
Dominican Republic	29.3	
Ecuador	58.7	
Indonesia	30+	1999 pending
WHO MENA Rec. Std.*	30 as FeSO4 60 as Elemental	1998 Beirut workshop
Mexico	24 - 39.8	1999
Nigeria	28.9 – 36.7	
Oman	30+	1998
Peru	30 (specifies ferrous sulfate)	1998
Saudi Arabia	36.3	1996
UK	16.5	
USA	44.1	
Venezuela	20 (blend of fumarate and reduced iron)	1994

* Includes 1.5 ppm Folic Acid