

Risk Factors of Iron Deficiency Anemia among Pregnant Women Living in Rural Vietnam

ベトナム農村に住む妊産婦の鉄欠乏性貧血症の
リスクファクターに関する研究

Ritsuko Aikawa

This dissertation is submitted as part of the requirements for
the Degree of Doctor of Philosophy
Department of Health Science
Kagawa Nutrition University

January 18, 2006

DECLARATION

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief, this thesis contains no material previously published by any other person.

Signed: 相川 律子

Ritsuko Aikawa

Dated: December 1, 2005

Abstract

Introduction:

Iron deficiency anemia (IDA) is one of the most frequently observed nutritional deficiencies with the least effectively counter-measures in developing countries. WHO estimates that nearly half of the pregnant women in the world are suffering from anemia. In rural Vietnam, iron deficiency anemia among pregnant women is commonly observed because Vietnamese' staple food is rice and rice products and the amount of dietary iron absorbed is too small to meet the increased demand.

Objective:

This study aims to assess the prevalence of anemia in rural Vietnam and to determine its risk factors. By finding major risk factors, we can plan more effective approach for anemia reduction towards target population.

Design:

A cross-sectional survey.

Setting:

Vietnam, Nghe An province, 2003.

Study population:

Total number of the participants was 439. Of these participants, one participant was excluded from the study for mental disorder. Forty-seven did not participate in a parasite test and 68 did not complete at least one of the questions.

Methods:

The risk factors of IDA among pregnant women identified in past studies were assessed. First, presences of hookworm eggs in a stool sample and hemoglobin concentration in blood sample were measured. Second, the consumption of iron and Vitamin C rich foods and knowledge, attitude and practice of anemia prevention were assessed with self-administered questionnaire. All the data were coded into SPSS version 12.0 J for analysis. Computed descriptive statistics and comparison between anemic participants and non anemic participants were conducted. Multiple logistic regression analysis was used for the hemoglobin concentration. All the test were two sided, and a significant level of 5% as significant.

Ethical consideration:

This study is completely confidential and voluntary. Before the survey started, all the participants were explained the purpose of the study. They are also informed that they

do not have to write their names. Informed consent was then obtained from each participant.

Results:

The prevalence of anemia ($Hb < 11.0 \text{ g/dl}$) was 43.2% and severe anemia ($Hb < 8.0 \text{ g/dl}$) was 0.5%. Taking iron tablets ($p \leq 0.01$), a frequent consumption of eggs (more frequent than once a week) ($p \leq 0.05$) and higher educational level ($p \leq 0.05$) significantly and positively correlated in pregnant women with hemoglobin concentration in a multiple regression analysis. On the other hand, the women's gestational age ($p \leq 0.01$), the preference for traditional medicine ($p \leq 0.05$), hookworm infection ($p \leq 0.01$), and ascaris lumbricoides infection ($p \leq 0.01$) significantly and negatively correlated in pregnant women with hemoglobin concentration.

Conclusion:

Prevalence of anemia in rural Vietnam remained as high as 45.2%. The results showed that the cause of anemia is multifactorial, with the factors including the lack of iron intake, hookworm infection, and the preference of traditional medicine. The low frequency of egg consumption was identified as one of the risk factors. Although participants were encouraged to raise small animals as a household food security program, they were not generally for consumption within the household, but for sale. Experiences of recovery from anemia and understanding that iron tablets help the growth of the fetus were considered to increase compliance. For parasite control, besides mass use of antihelminthic therapy, sanitation control program and use of foot wear to protect feet from contact with contaminated soil should be emphasized as preventive strategies. Preference of traditional medicine was identified as one of the independent risk factors of IDA. More efforts are needed to study the effects of traditional medicine on Hb concentration in Vietnam. These results can help in the development of the multifactorial IDA educational program for pregnant women, additional emphasis needed to be directed to those who prefer to traditional medicine.

Introduction

Iron deficiency anemia (IDA) is one of the most frequently observed nutritional deficiencies among pregnant women around the world^[1]. The World Health Organization estimates that nearly half of the pregnant women in the world are suffering from anemia^[2]. IDA is known to be an important factor in maternal deaths^[3], the poor cognitive development of children, and for decreased work capacity of the mother^[4]. To control IDA, four approaches have been undertaken: dietary intervention, iron fortification, iron supplementation, and parasite control^[5]. The most effective IDA control is first to identify the at-risk group and then to combine several of these approaches^[6]. In practice, however, only a few countries have reported significant improvement of IDA at a national level^[7,8].

Risk factors for IDA among pregnant women identified in past studies included parasite infection^[1-4, 9], season^[10], food habits^[11,12], gestational age^[10], parity^[12], early age at the time of marriage^[12], and geographical location^[12]. In Vietnam^a,

^a The Vietnamese people established socialism in the North and continued the war of liberation in the South, which was won in 1975. Since then, recovering and developing the economy, stabilizing the sociopolitical situation in the South, Vietnam had to

the report of a joint government-donor-NGO working group indicated that the main cause of IDA in Vietnam is a lack of dietary iron intake, because the staple food of Vietnam is rice and rice products ^[13]. National anemia and nutrition risk factor survey showed that a lower consumption of meat in the household is significantly associated with a higher rate of anemia ^[14]. However, no studies have been reported from Vietnam that have analyzed the risk factors of IDA pointing detail.

This study was undertaken to assess the prevalence of anemia among pregnant women in rural Vietnam and to determine its risk factors. By finding major risk factors,

develop a sense of national unity. The National Assembly decided to name the country the Socialist Republic of Vietnam, with Hanoi as the capital. In the period of 1954-1975, the economy in North Vietnam was centrally planned and based mainly on agriculture. There were only two socialist sectors in the economy, the state sector and the cooperative sector. From 1975 to 1980, after the unification of the North and the South, the centrally planned model was applied in the South, pursuant to the second five-year plan (1976-1980). In the period and 1981-1985, the contractual system was improved, with contractual quotas being given to working groups and individuals in agricultural co-operatives. In 1986-1991, Vietnam implemented institutional reform with a market orientation and endeavored to stabilize the economy. In the 6th Assembly, the Vietnamese Communist Party recognized the existence of the private sector and establishes a policy of eliminating subsidies. In the period 1991-1995, Vietnam accelerated economic reforms and built up “the multi-sector economy operating along market mechanism with state management and a socialist orientation”. The period since 1995 has been characterized by marked efforts at reform and development. The structure of gross output in 2002 is as follow: the agriculture-forestry- aquaculture sector (23%); industry and construction sector (38.5%); and service sector (38.5%).

we can plan more effective approach for anemia towards target population.

Methods

The study was carried out in July 2003. The study area included seven rural communes in the Yen Thanh district of Nghe An Province in Vietnam^b. This district has 37 communes altogether and is situated 350km south of Hanoi, the capital of Vietnam. The district has a border with Laos PDR and the summer (June- September) wind blows with high humidity in the Nghe An province ^c. Malaria is not endemic in this area. In 1998 the Vietnamese Ministry of Health implemented an iron supplementation program in 10 of 37 communes in Yen Thanh District. Through this program, iron (60mg) and folic acid (400µg) for daily use have been distributed to pregnant women. For the study six communes, we purposively selected two communes from 10 communes that were

^b The Socialist Republic of Vietnam is located in Southeast Asia bordering the People's Republic of China to the north, the People's Democratic Republic of Laos and the Kingdom of Cambodia to the west, and the Pacific Ocean to the east. With a coastline of thousands of kilometers from south to north, Vietnam has a land area of 330,000 square kilometers and a sea of one million square kilometers.

^c Vietnam lies in the hot region of the tropics. The climate is monsoon and subtropical in the North, which has four distinct seasons. The Nghe An province experiences two seasons, a rainy season and a dry season and characterized by the 'hot wind' influenced in summer caused by the Trung So mountain range in the west adjacent to Laos.

participating in an iron supplementation program. We then selected the four communes from a further 27 communes that were not participating in the iron supplementation program. These six communes were selected by the district health officers.

The study population in this survey was all of the pregnant women recorded in the target communes on June 30, 2003. To ensure that we included all of the pregnant women living in the selected villages to participate in the survey, we used the birth registrations of the commune health centers. The percentage of pregnant women who deliver at health centers was known to be high (74.3%) in the north central region of Vietnam. Women who had not yet come to the health center for their first check up were located by extensive publicity through the women's union network.

Approval for this survey was obtained from the Ethics Committee of the National Institute of Nutrition in Vietnam. Prior to the interview, participants were informed that their confidentiality would be maintained. They were also told that their participation would be voluntary and that they could withdraw from the study at any time. Their consent was then obtained for the study.

The study included questionnaires and key informant interviews, together with hemoglobin concentration and a stool sample was obtained for parasitic examination. The hemoglobin concentration in the blood of each participant was determined at the time of the survey using a portable β -hemoglobin photometer (Hemocue ®; HemoCue AB, Angelholm, Sweden) ^[15]. The WHO criterion for anemia in pregnant women was applied and a hemoglobin concentration of less than 11.0 g/dℓ was considered the baseline ^[2].

The risk factors for anemia among pregnant women identified in past studies were assessed. First, a trained technical officer of preventive medical center of Nghe An Province examined the presence of hookworm eggs in a stool sample after formalin/ether concentration ^[16]. The presence of hookworm was recorded as positive or negative, depending on whether if hookworm ova were detected. Secondly, the consumption of iron and Vitamin C rich foods was assessed with a self-administered food frequency questionnaire (FFQ). The questionnaire was developed based on information from the focus group discussions with the groups of pregnant women in the

survey communes (Annex3).

Thirdly, knowledge, attitudes, and practices of anemia were assessed. The questionnaire was modified from a similar study carried out in Nepal by UNICEF in 2001 and revised based on the results from key informant interviews. Key informant interviews were conducted with three obstetricians, four researchers who were responsible for IDA control, and one director of health service in the Yen Thanh district hospital.

Key informant interviews were conducted with three obstetricians in National/Provincial/District Hospitals, a Director of the Department of Preventive Medicine from the Ministry of Health, the Head of the Micronutrients Department from the National Institute of Nutrition, the WHO Program Coordinator of the Weekly Iron Supplementation Project, one UNICEF Program Officer of Health and Nutrition, the Director of Medical Training College in the Nge An Province, and the Director of Health Service of the Yen Thanh District. All the key informants were Vietnamese.

To accumulate the relevant data from the key informant interviews, we first

examined all the transcripts of the interviews and identified emergent themes that pertained to the central focus of this study. Then, we categorized all the data under the appropriate headings. Finally, we compared and discussed the issues raised in the discussions. The results of the questionnaire survey were transcribed and crosschecked with the data of the key informant interviews.

Statistical analysis

All data were coded and entered into SPSS version 12.0J for analysis.

Computed descriptive statistics included proportions, means, and comparisons between anemic participants and non-anemic participants. Multiple logistic regression analysis was used for the hemoglobin concentration adjusted by gestational age. All tests were two-sided, and a significance level of 5% was regarded as significant. In order to calculate the required sample size, the prevalence of anemia among pregnant women was estimated to be 35%^[17] and the relative decrease of anemia prevalence used in the calculations was to be 20%. On the basis of this assumption, we estimated that a sample of 315 participants was required (80 % power, $p < 0.05$). To allow for dropouts in the

study, all of the pregnant women in six communes (n=420) were included.

Results

From the health centers' pregnancy records 307 pregnant women were identified and an additional 203 newly pregnant women identified through the women's union network also participated in the survey. A total of 71 from the first group declined to participate giving a total number of 439 participants. Of these participants, one was excluded from the study due to a mental disorder. From the full sample, 47 did not participate in the parasite test, and 68 did not complete at least one of the questions on the survey for risk factors of anemia. The final sample was therefore 438 for hemoglobin levels, 391 stool examinations for parasites and 342 for completing all tests and the full questionnaire. The overall participation rates were 86%. The mean gestational age of the participants at the time of the survey was 26.3 weeks (SD=10.7).

The average hemoglobin concentration was 11.1g/dℓ (SD=1.3, range 5.3-15.2 g/dℓ), just above the cut-off level for anemia. The prevalence of mild anemia (Hb <11.0g/dℓ) was 43.2% and severe anemia (Hb <8.0 g/dℓ) was 0.5%. Mean age of

participants was 25.8 (SD=4.5), and mean number of children was 1.1 (SD=1.1). The details of occupation and education level of the participants are shown in Table 1. The univariate analysis of hemoglobin concentrations and demographic variables showed that farmers were equally represented in the anemic and the non-anemic groups. However, the percentage of those who finished secondary school was lower among anemic participants (45.5%) than among the non-anemic participants (63.5%) ($P \leq 0.01$).

The distribution of risk factors for anemia between the anemic participants and non-anemic participants is shown in Table 2. Among the risk factors compared, that the use of iron tablets was lower in anemic participants (67.0%) than in non-anemic participants (76.0%) ($P \leq 0.05$). Also those who preferred traditional medicine^d were

^d Traditional medicine refers to health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain well-being. China, the Democratic People's Republic of Korea, the Republic of Korea and Vietnam have fully integrated traditional medicine into their health care systems, <http://www.who.int/mediacentre/factsheets/fs134/en/> hit on November 10, 2005.

represented more in the anemic participants group (36.7%) compared to the non-anemic participants (27.0%) ($P \leq 0.05$).

When the FFQ items were examined anemic participants were less likely to consume beans ($P \leq 0.05$). There was no difference between the anemic and non anemic participants in other parameters including frequency of meat, fish, egg, fruits and vegetable consumption, hook worm infection, unhygienic toilets, lack of advisement to take iron tablets, experiences of side effects from iron tablets, and receiving iron tablets before the first pregnancy.

The relationships between with risk factors for anemia and hemoglobin concentration are shown in Table 3. Among the variables examined, the high degree of correlation was observed for taking iron tablets($r=0.10$, $P \leq 0.05$), frequent consumption of beans ($r=0.128$, $P \leq 0.05$) and educational level ($r=0.23$, $P \leq 0.05$). Negative correlations were observed for hookworm infection ($r=-0.64$, $P \leq 0.001$), for week of gestation ($r=-0.157$, $P \leq 0.001$) and number of children ($r=-0.102$, $P \leq 0.05$). The variables: hygienic latrine use, side effects experienced, iron tablets received before

pregnancy, advice being given, and frequent meat, fish, egg, vegetable and fruits consumption, did not significantly correlate with hemoglobin concentration.

Table 4 shows the results of a multiple regression analysis. Taking iron tablets ($P \leq 0.01$), preferring western medicine ($P \leq 0.05$), consumption of eggs ($P \leq 0.05$) and educational level ($P \leq 0.05$) were significantly and positively correlated in pregnant women with hemoglobin concentration. Hookworm infection ($P \leq 0.01$), ascaris lumbricoides infection ($P \leq 0.05$) and the women's gestational age ($P \leq 0.01$) were significantly and negatively correlated in pregnant women with hemoglobin concentration.

Discussion

In this study, the current data indicated that prevalence of anemia (less than 11.0mg/dℓ) was 45.2%, indicating that IDA remains a major problem for pregnant women living in rural Vietnam. This results was similar to the national anemia survey of 1995[14]. The results showed that the cause of the anemia is multifactoral, with the factors including the lack of iron intake, hook worm infections, and preference of

traditional medicine.

No significant differences were found in parity ^[12] and geographic location ^[1.6].

In countries where fertility rate is high, closely spaced pregnancies deplete the iron stores of the women and lead to anemia. However, the total fertility rate in Vietnam has declined rapidly from 4.0 children per woman in 1987 to 2.3 in 1999 ^[18] according to the Population Census. This decrease is a result of a family planning campaigns in Vietnam, and improved health and economic conditions.

Low of iron intake resulted from low consumption of iron rich foods and iron tablets. Low frequency of egg consumption was identified as one of the risk factors for IDA in this survey. This may reflect the importance of adequate protein intake in the prevention of anemia^[19], although there were no differences in other protein foods consumption. The absorption of non-haem iron was higher in meat containing diets by 54 – 69% compared to the vegetarian diet^[20]. Although, participants were encouraged to raise small animals such as chickens, pigs and fish in their garden as a household food security program implemented by farmer's union, they were not generally for

consumption within the household but for sale. Seasonal variation of iron rich foods should also be considered as food availability differs with the seasons.

The supply of iron tablets to women of childbearing age is one of the national nutrition policies in Vietnam ^[21]. Previous studies reported difficulties in compliance with taking iron tablets because of their side effects and the low awareness of anemia ^[22]. The results of focus group discussions with women of childbearing age in the study area showed that the lack of supply, their bad smell, the side effects, and the experience of recovery from anemia caused pregnant women to stop taking iron tablets. However, experience of recovery and understanding that iron tablets help the growth of the fetus were considered to increase compliance. The percentage of pregnant women who took iron tablets was 80% in communes with National Iron Supplementation Program and 61 % in communes without National Iron Supplementation Program. In communes without National Iron Supplementation Program, pregnant women bought iron tablets and took them. Therefore, it can be concluded that pregnant women in this area had a high compliance in taking iron tablets.

In this survey, we found that the presence of hookworm and ascaris lumbricoides ovas in stool samples was associated with a significantly increased risk of IDA. According to WHO guidelines, a de-worming tablet is recommended during the second and third trimesters of pregnancy ^[16]. Anthelmintic therapy for pregnant women has already been recommended in the “National Anemia and Nutrition, Risk Factor Survey, Vietnam” ^[14]. However, this recommendation is not often implemented due to a concern over its potential teratogenicity. Mass use of anthelmintic therapy among pregnant women is conducted only in Sri Lanka ^[23] and Nepal ^[11]. The development of a policy for anthelmintic therapy for pregnant women is urgently needed in Vietnam as it strongly contributes to IDA ^[14]. In addition to anthelmintic therapy, emphasis should also be given to other preventive strategies, including sanitation control programs and use of footwear to protect the feet from contact with contaminated soil.

Preference for traditional medicine was identified as one of the independent risk factors of IDA. There have been a few reports published about lead intoxication by

ingesting traditional medicine, which clinical symptoms in adults include anemia ^[24].

Therefore, more studies are needed in Vietnam to analyze the effects of taking traditional medicine on hemoglobin concentration.

Some limitations need to be considered when interpreting the results of the study. The rural area chosen for study is typical of rural Vietnam, but there may be differences with other provinces that are not known to the researchers. Geographic location is considered to be associated with IDA, as IDA prevalence is often higher in rural areas than in urban areas ^[1,2]. As the current survey was conducted entirely within a rural district, this difference was not assessed. Also, social services, such as education and health care, were evenly distributed throughout the study area. The overall equality in social development and opportunity limited the comparison of our participants' social backgrounds. The results of multiple regression analysis showed a small figure of R^2 . The reasons of small figure were increase of hemoglobin concentration may not linear and the data entered into the model as risk factors were not well categorized.

In conclusion, the results of this survey suggest that in addition to intake of iron

tablets and hookworm infection, low frequency of egg consumption and preference for traditional medicine are important risk factors of IDA among pregnant women living in the study area. These results can help in the development of a multifactoral IDA control educational programs for pregnant women, additional emphasis needs to be directed to those who prefer traditional medicine. Further studies are needed on the seasonal differences in risk factor prevalence in the study area.

Acknowledgement

All the three co-investigators significantly contributed in publishing this study. Dr. Khan of National Institute of Nutrition (NIN) is a co-investigator in Vietnam. Prof. Binns of Curtin University of Technology participated in the critical review of the study. Dr. Sasaki of National Institute of Health and Nutrition in Japan advised the statistical analysis.

This survey was financially assisted by the Japanese Cooperation Agency (JICA) from FY 2002 to FY 2004. Several experts and staff of JICA were involved in the process of developing this research. Dr. Jimba, Dr. Kanagawa, Dr. Horie and Ms. Tanaka, JICA experts on health sector, shared their knowledge on research methods and

experiences. Mr. Imai and Ms. Hayashi, JICA administrative officers, assisted me in the paper work involved in conducting this survey.

I also would like to acknowledge the assistance of people who worked in the field survey. I thank all participants of this survey and the staff of commune health centers, district health service of Yen Thanh district, preventive medical center of Nghe An province, Dr. Hoa, and Dr. Lan of NIN for their assistance in the field survey.

Lastly, I would like to thank Prof. Kamata for her warm encouragements to submit this thesis to the Kagawa Nutrition University. Without her continuous feedback, it is unlikely this thesis would ever have seen the light of the day.

References

- 1 Preziosi P, Prual A, Galan P, Daouda H, Boureima H & Hercberg S. Effect of iron supplementation on the iron status of pregnant women: consequences for newborns. *Am J Clin Nutr.* 1997; **66**(5): 1178-1182.
- 2 UNICEF/ UNU/ WHO. *Iron deficiency anaemia: assessment, prevention and control. A guide for programme managers*, Geneva:World Health Organization, 2001.
- 3 Allen HL & Casterline-Sabel J. *Prevalence and Causes of Nutritional Anemia*. In Nutritional Anemias edited by Ramakrishnan U. Florida:CRC press, 2000.
- 4 Beard J. One person's view of iron deficiency, development, and cognitive function. *Am J Clin Nutr.* 1995; **62**(4): 709-710.
- 5 Allen L & Gillespie S. *What Works? A Review of the Efficacy and Effectiveness of Nutrition Interventions*. In ACC/SCN Nutrition Policy Paper Series, 5, Vol. 19, 2001: 43-54.

- 6 Trowbridge F & Martorell R. Summary and recommendations. *Journal of Nutrition*. 2002; **132**: 875S- 879S.
- 7 Hallberg L, Bengtsson G, Garby L, Lennartsson J, Rossander A & Tibblin E. An analysis of factors. Leading to a reduction in iron deficiency in Swedish women. *Bulletin of the World Health Organization*. 1979; (57): 947-954.
- 8 Winichagoon P. Prevention and control of anemia: Thailand experiences. *J Nutr*. 2002; **132**(4 Suppl): 862S-866S.
- 9 Dicko A, Mantel C, Thera MA *et al*. Risk factors for malaria infection and anemia for pregnant women in the Sahel area of Bandiagara, Mali. *Acta Trop*. 2003; **89**(1): 17-23.
- 10 Marchant T, Armstrong Schellenberg JR, Edgar T *et al*. Anaemia during pregnancy in southern Tanzania. *Ann Trop Med Parasitol*. 2002; **96**(5): 477-487.
- 11 Bondevik GT, Eskeland B, Ulvik RJ *et al*. Anaemia in pregnancy: possible causes and risk factors in Nepali women. *Eur J Clin Nutr*. 2000; **54**(1): 3-8.
- 12 Musaiger AO. Iron deficiency anemia among children and pregnant women in the Arab Gulf countries: the need for action. *Nutrition Health*. 2002; **16**: 161-171.
- 13 Department of Culture and Information. *Joint Report of the Government-Donor-NGO Working Group. Vietnam development report 2000. Attacking poverty*. Hanoi: Department of Culture and Information, 1999.
- 14 National Institute of Nutrition. *Report of the national anemia and nutrition risk factor survey*, Hanoi:National Institute of Nutrition, 1995.
- 15 Johns WL & Lewis SM. Primary health screening by haemoglobinometry in a tropical community. *Bulletin of the World Health Organization*. 1989; (67): 627-633.
- 16 Pawlowski ZS, Schad GA & Stott GJ. *Hookworm infection and anemia. Approaches to prevention and control*. Geneva: World Health Organization, 2002.
- 17 Khoi HH. *Report on Vietnam national anemia survey, 2000*. Hanoi: National Institute of Nutrition, 2001.

- 18 World Bank, Sida, AusAID, Royal Netherlands Embassy, Ministry of Health of Vietnam. *Vietnam growing healthy: a review of Vietnam's health sector*. Hanoi: Vietnam Development Information Center. 2001.
- 19 清水盈行, 内野治人, 宫崎保: 栄養性貧血, 第一出版株式会社, 東京, 1982.
- 20 Kristensen MB, Hels O, Morberg C, Marving J, Bugel S & Tetens I. Pork meat increases iron absorption from a 5-day fully controlled diet when compared to a vegetarian diet with similar vitamin C and phytic acid content. *Br J Nutr*. 2005; **94**(1): 78-83.
- 21 Hoang TQ. *National Nutrition Strategy 2001-2010*. Hanoi: Medical Publishing House. 2001.
- 22 Earl R & Wateki CE. *Iron deficient anemia, recommendation guidelines for the prevention, detection and management among U.S. children and women of childbearing age*, Washington D C: National Academy Press, 1993.
- 23 Atukorala TM, de Silva LD, Dechering WH, Dassenaieke TS & Perera RS. Evaluation of effectiveness of iron-folate supplementation and anthelmintic therapy against anemia in pregnancy--a study in the plantation sector of Sri Lanka. *Am J Clin Nutr*. 1994; **60**(2): 286-292.
- 24 Spriewald BM, Rascu A, Schaller KH, Angerer J, Kalden JR & Harrer T. Lead induced anaemia due to traditional Indian medicine: a case report. *Occup Environ Med*. 1999; **56** (4): 282-3.

Table1. Comparison of backgrounds between anemic participants and non-anemic participants (%)

	Anemic (n=189)	Non anemic (n=249)	Total (n=438)	p-value ¹
Occupation ²				
Farmer	95.2	90.0	92.2	n.s.
Teacher	3.7	7.6	5.9	
Business owner	0.5	0.8	0.7	
Education				
Illiterate	1.1	0.0	0.5	P<0.001 ³
Primary	53.4	36.5	43.8	(df=1)
Secondary	39.2	47.8	44.1	
High school	2.1	8.4	5.7	
Above high school	4.2	7.2	5.9	
Kitchen garden				
Pig	95.1	96.6	95.9	n.s
Chicken	89.9	90.8	90.4	n.s
Vegetable	83.3	80.4	81.7	n.s.
Sweet potatoes	67.5	65.5	66.4	n.s
Fruits tree	50.7	56.2	53.7	n.s
Fish pond	38.9	34.5	36.5	n.s

¹ P value for χ^2 analysis.

² Occupation was missing for one anemic and four non-anemic participants

³ χ^2 analysis between participants who completed secondary school and did not complete.

Table 2. Comparison of risk factors for anemia between anemic participants and non-anemic participants

	Anemic		Non anemic		p-value ¹
	n	%	n	%	
Taking iron tablets	188	67.0	246	76.0	P<0.05
Traditional treatment preferred	188	36.7	244	27.0	P<0.05
Education level ²	189	45.5	249	63.4	P<0.001
Hygiene latrine ³	187	15.0	246	15.9	n.s.
Hookworm infected	168	25.6	223	18.0	n.s.
Ascaris infected	168	96.4	223	96.0	n.s.
Trichuriasis infected	168	30.4	223	30.9	n.s.
Experiences of side effects	186	40.1	245	43.5	n.s.
Iron tablets received before first pregnancy ⁴	186	42.1	246	48.9	n.s.
Advice for taking iron tablets being told	179	79.3	238	79.0	n.s.
Knowing lack of iron causes anemia	114	86.8	265	84.2	n.s.
I have seen IEC materials for IDA prevention	189	50.3	243	50.6	n.s.
Consumption of meat and meat products ⁵	188	73.5	249	73.4	n.s.
Consumption of fish and sea foods ⁵	189	91.0	249	88.8	n.s.
Consumption of eggs ⁵	187	47.6	248	53.2	n.s.
Consumption of beans ⁵	188	11.2	246	19.1	P<0.05
Consumption of vegetables ⁶	189	91.0	248	89.9	n.s.
Consumption of fruits ⁵	189	68.3	248	66.9	n.s.

¹ P value for χ^2 analysis.

² Percentage of participants completed secondary schools.

³ Hygiene latrines are two room latrine or toilet with water. No hygienic latrines are no latrine, hole in the ground or one room latrine.

⁴ The data includes either receiving iron tablet at health center or being delivered by nutrition collaborators at home.

⁵ Percentage of participants who consumed more frequent than every week.

⁶ Percentage of participants who consumed more frequent than everyday.

Table 3. Percentage of participants with risk factors for anemia and their coefficients with hemoglobin level

	n	%	Peason correlation coefficient	p-value
Taking iron tablets	434	72.0	0.101	P<0.05
Side effects experienced	431	42.1	0.064	n.s.
Iron tablets received before pregnancy	438	46.3	0.041	n.s.
Consumption of beans ¹	438	15.9	0.128	P<0.01
Consumption of meat and meat products ¹	438	73.5	-0.025	n.s.
Consumption of sea foods ¹	438	89.5	0.006	n.s.
Consumption of eggs ¹	438	50.7	0.071	n.s.
Western medicine preferred	438	68.8	0.082	n.s.
Hookworm infected	391	21.5	-0.175	P<0.001
Ascaris infected	391	96.4	-0.023	n.s.
Trichuriasis infected	391	30.4	0.00	n.s.
Hygiene latrine (Two rooms latrine or toilet with water)	433	15.4	-0.046	n.s.
Advice for taking iron tablets being told	417	79.1	-0.006	n.s.
Education level	438	55.6	0.15	P<0.01

¹ Consumption frequency greater than every week.

Table 4. Multiple regression analysis of risk factor of low hemoglobin level (n=323)

R^2	0.156	p-value
Taking iron tablets (0: no, 1: yes)	0.37	P<0.05
Preferred treatment (0: traditional, 1: western)	0.339	P<0.05
Consumption of egg (0: less frequent than every week, 1: more frequent than every week)	0.28	P<0.05
Education level (0: did not complete secondary school, 1: completed secondary school)	0.23	P<0.05
Weeks of gestation	-0.021	P<0.001
Ascaris infected (0: not infected, 1: infected)	-0.203	P<0.05
Hookworm infected (0: not infected, 1: infected)	-0.64	P<0.001

Partial regression coefficient, multiple linear regressions with backward elimination procedure.

Number of children, in the kitchen garden having chicken, vegetables, pigs (0: yes, 1: no), receiving iron tablets before pregnancy (0: no, 1: yes), having seen any educational materials on anemia prevention (0: no, 1:yes), mothers occupation (0: not farmer, 1: farmer), type of latrine (0: no hygienic, 1: hygienic), advice for taking iron tablets being told (0:no, 1:yes), side effects (0: not experienced, 1: experienced), consumption of meat (0: no, 1:yes), consumption of fish and seafood (0: no, 1:yes), consumption of beans (0: no, 1:yes) were also entered in the first models and did not remain in the final models.

Only risk factors which partial regression coefficients were significant ($p<0.05$) were included in the final models.

Abbreviation: R^2 =determination coefficient.

Annex 1 Study approval from committee of the National Institute of Nutrition in Vietnam

ETHICAL CLEARANCE

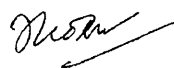
The Committee of the Medical Research Ethics of National Institute of Nutrition, with regards of the protection of human rights and welfare in medical research, has carefully received the proposal entitled:

“Health promotion approach for IDA among pregnant women in rural VIETNAM”

Name of principal investigator: **RITSUKO AIKAWA**
Name of institution: **JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**

Above mentioned proposal was approved
Ha Noi,

For the **Chairman of the Committee of
The Medical Research Ethics OF NIN**



*Dr. Pham Van Huan
Head, Dept. Science, NIN.*

01/12/03

Annex2 Questionnaire for pregnant women

**Study on Iron Deficiency
Among Pregnant Women**

Mother's name:	Months of pregnancy
----------------	---------------------

Commune		Hamlet	
Code No			
Helminth	Hookworm	Ascaris	Trichuri
Hb level	1 st	2nd	
Data Entry name:			
Supervisor's name:			

July 8th - 17th, 2003

Yen Tanh, Nhge An, Vietnam

National Institute of Nutrition

Department of Mother and Child
Health

48 Tang Bat Ho Str. Hanoi, Vietnam

Tel: 84-4-971-9280

Fax: 84-4-971-7885

Institute for International Cooperation

Japan International Cooperation Agency

10-5 Ichigaya Honmura-cho

Shinjuku, Tokyo, 162-8433, Japan

Tel: 03-3269-3022 Fax: 03-3269-2054

A. Social & Economic Background

1	Age:		
2	Education: 1.[illiterate] 2.[Primary] 3. [Secondary] 4. [High]		
3	Religion	1. Buddhist 2. Christian 3. Nothing 9. Other _____ (Be specific)	
4	Mother's occupation	1. Farmer 2. Handcraft 3. Business owner 4. Teacher	
5	No of children:		
6	No of children under 5 yrs old:		
7	What is your husband occupation	1. Farmer 2. Handcraft 3. Business owner 4. Worker 5. Teacher 6. Soldier	
8	Do your husband always stay at home	1. Yes 2. No	

9	What type of latrine do you have in your home? <i>(If none, please mark 1)</i>	0. Do not have any latrines 1. "Hole-in-the-ground" latrine(no water) 2. 1-room latrine (no water) 3. 2-room latrine (no water) 4. "Toilet-seat" latrine (with water) 99. Don't know 9. Other _____(Be specific)	
10	How many months are your household lack of rice & other starchy foods (last year)	_____ Months	
11	Which do you have in your garden for foods in your household?	1. Green Vegetables 2. Fruit Trees 3. Roots 4. Fish Pond 5. Pig 6. Chicken 9. Others _____(Be specific)	

B. KAP Study on Iron Supplementation

1	How many months of pregnancy were you, when you went to check up first time	_____ months	
---	--	---------------------	--

2	Which was the first place you went for check-up, consultation or receiving medicine If response is not “1”, continue If response is “1” go to question 4	1. Commune Health Centre 2. Traditional Birth Attendance 3. Traditional Healer 4. District Hospital 5. Polyclinic 6. Did not consult anybody 999. Can't remember 9. Other_____ (<i>Be specific</i>)	
3	Why didn't you go the CHC (Multiple choice)	1. Not necessary 2. Busy 3. Home is far from CHC 4. No support from family member to go to the CHC 5. No proper check-up in the CHC 6. CHC always closed 9. Others_____ (<i>Be specific</i>)	
4	Which was treatment of disease do you prefer to receive	1. Drug 2. Herbs 9. Others_____ (<i>Be specific</i>)	
5	What is the role of iron in our body (Multiple choice)	1. Good for health 2. Increases blood 3. Protects against diseases 4. Improve blood 9. Others_____ (<i>Be specific</i>) 99. Don't know	

6	What are iron rich foods (Multiple choice)	1. Meat products 2. Beans & pulses 3. Vegetables 4. Fruits 5. Liver 6. Milk products 7. Cereals 8. Egg 10. Fish 9. Other_____ (Be specific) 99. Don't know	
7	Have you heard of anaemia If "Yes" , continue (8) If "No" go to question 14	1 Yes 2 No	
8	What are the causes of anaemia during pregnancy (Multiple choice)	1. Lack of iron rich foods 2. Parasitic infestation 3. Requirement increased 99. Don't know 9. Other_____ (Be specific)	
9	What are the symptoms of anaemia during pregnancy (Multiple choice)	1. Lathergy 2. Tiredness 3. Loss of appetite 4. Paleness 5. Headache 6. Dizziness 7. Weakness 8. Oedema 99. Don't know 9. Other_____ (Be specific)	

10	What are the consequences of anaemia during pregnancy (Multiple choice)	1. Small baby 2. Difficulty during delivery 3. Impairs mental development of the baby 4. Stillbirth 5. Child death (during delivery) 6. Maternal death during delivery 7. Unhealthy child/mother 99. Don't know 9. Other _____(Be specific)	
11	How can anaemia be prevented during pregnancy (Multiple choice)	1. Need to take iron supplement (tablet) 2. Need to eat more food 3. Need to take de-worming medicine 4. Need to take medicine which gives energy 5. Need to take vitamin 99. Don't know 9. Other _____(Be specific)	
12	Where did you learn about anaemia (Multiple choice)	1. Women's Union 2. Traditional Birth Attendance 3. Radio/TV 4. School 5. Health Worker in Hamlet 6. Health Worker in CHC 7. Nutrition Collaborator 9. Other _____(Be specific) 99. Don't know 999. Can't remember	

13	Does taking iron tablets during pregnancy have any negative impact on the mother or baby (to be born)'s health	1. Yes _____ (<i>Be specific</i>) 2. No 99. Do not know	
14	Have you ever seen any IEC materials regarding anaemia in your commune If the response is "yes", continue, If "no" go to question 17	1. Yes 2. No	
15	If "Yes" what material did you see (Multiple choice)	1. Newspaper 2. Poster 3. Booklet 4. Leaflet 5. Flipchart 9. Other _____ (<i>Be specific</i>)	
16	If "Yes" where did you see (Multiple choice)	1. Commune Health Centre 2. Meeting Room in Commune 3. Meeting Room in Hamlet 4. School 5. Road 6. Home 7. Pharmacy 8. Market 9. Others _____ (<i>Be specific</i>)	

17	What were you told about the benefits of taking iron tablets during pregnancy (Multiple choice)	1. Blood increases after taking iron tablet 2. Prevents anaemia 3.Prevents maternal or child death during delivery 99. Nothing 999. Cant remember 9. Others_____ (<i>Be specific</i>)	
18	Were you told explanations in taking iron tablets	1. Yes 2. No 999. Can't remember	
19	If "Yes" what were you told (Multiple choice) If the response is (3), continue If response is not (3), go to 21	1. Dose per day 2. Time to take iron tablets 3. Side-effect 999. Can't remember 9.Others_____ (<i>Be specific</i>)	
20	If you were told side effect, what was it (Multiple choice)	1. Likely vomiting 2. Vomiting 3. Black stool 4. Constipation 5. Tiredness 6. Headache 7. Burning sensation during urination 999. Can't remember 9. Others_____ (<i>Be specific</i>)	
21	Do you take iron tablets If "Yes", continue If "No" go to 34 If "Can't remember" go to 35	1. Yes 2. No	

22	Do you have any problems while taking iron tablets	1. Yes 2. No	
23	If “Yes” what did you have (Multiple choice)	1. Likely vomiting 2. Vomiting 3. Black stool 4. Constipation 5. Tiredness 6. Headache 7. Burning sensation during urination 999. Can’t remember 9. Others _____ (<i>Be specific</i>)	
24	Could you accept the taste and smell of the iron tablets	1. Yes 2. No	
25	If “didn’t accept” why (Multiple choice)	1. Felt like vomiting 2. Bad smell 3. Bitter taste 9. Others _____ (<i>Be specific</i>)	
26	How often have you received iron tablets	1. Each time of Check-up at CHC 2. Every month at CHC 3. Every month Nutrition collaborators deliver home 999. Can’t remember	
27	From when should pregnancy start taking iron tablets If the response is “99” Go to 30	_____ Months of pregnancy 99. Don’t know	

28	Did you start at the right time	1. Yes 2. No 999. Can't remember	
29	If "No", when did you start taking iron tablets	_____ Months of pregnancy 999. Can't remember	
30	<Repeat> When did you start taking iron tablets	_____ Months of pregnancy	
31	If you don't start taking iron tablets at the right time, Why	1. I didn't not know the pregnancy 2. Iron tablets were not given 3. Unaware about it/Nobody advised 4. I didn't go to CHC because of the second delivery 5. No support from family member to go to the CHC 6. I didn't go to CHC because CHC was far from house 7. CHC always closed 9. Others _____ (<i>Be specific</i>)	
32	How often do you take iron tablets during last pregnancy If the response is "1" Go to 34	1. Every day 2. 2-3 times per week 3. Once a week 4. 2-3 time per month 999. Can't remember 9.Others _____ (<i>Be specific</i>)	

33	Why do you have difficulties to take iron tablets every day	1. It is not necessary 2. I forget to take iron tablets every day 3. I don't have enough number of tablets 4. Iron tablets are broken or bad smell 9. Others _____ (<i>Be specific</i>)	
34	Did you take iron tablets with tea or boiled water?	1. Tea 2. Boiled Water 9. Others _____ (<i>Be specific</i>)	
35	Before you were pregnant, did you ever receive iron tablets If yes, continue If not yes, go to question 37	1. Yes 2. No 999. Can't remember	
36	If Yes, Where did you receive iron tablets	1. Commune Health Center 2. High school 3. Village health worker distribute to home 4. Mother bought to me 999. Can't remember 9. Other _____ (<i>Be specific</i>)	
37	Have you ever purchase iron tablets at pharmacy	1. Yes 2. No 999. Can't remember	
38	Have you ever heard about iron fortified fish source	1. Yes 2. No 999. Can't remember	

39	With whom do you consult about foods during pregnancy? (Multiple choice)	1. Mother 2. Sister 3. Mother in law 4. Husband 5. Neighbours 6. Friends 7. Nutrition Collaborator 8. Village health worker 10. Nurse/doctor in CHC 9. Others _____ (<i>Be specific</i>)	
40	Where would be the best place to display Health (IEC) materials to see for women	1. Commune Health Centre 2. Cultural post room of commune 3. Village hall 4. Walls within community 99. Don't know 9. Others _____ (<i>Be specific</i>)	

Thank you very much

C. Dietary Pattern

Please remember all year around, how often do you eat following foods?

If it is the food in season, let interviewer note

	Item	2-3 /day	Every day	Every Week	2-3time/ month	Some Times	Rarely	Note
1	Meat							
2	Liver							
3	Kidney							
4	Heart							
5	Milk/ milk product							
6	Fish and seafood							
7	Seafood in pond/river							
8	Bean & pulses							
9	Green Vegetables							
10	Legumes							
11	Sweet potatoes							
12	Fruits							
13	Egg							
14	Fish source							

15) Which cooking method of vegetable do you use most frequently?

1. Raw 2. Boil 3. Stir fried { }

16) Which animal meat do you eat most frequently?

1. Beef 2. Pork 3. Chicken 4. Other specify, _____ { }

17) Which do you drink daily?

1. Tea 2. boiled water 3. Milk 4. Soyamilk 5. Fruits juice 6. Cola
7. unboiled water { }

Annex 3 List of Questions for Focus Group Discussion among Pregnant Women

1. What is your name?
2. Did you have any difficulties during your last pregnancy?
3. Do you know anemia? To improve anemia, what should we do?
4. Do you take iron tablets?
5. If yes, did you improve your health condition by taking iron tablets?
6. If you had side effects, what did you do? Did you stop or continue?
7. If you continue, how did you overcome?
8. Did you share your experiences of taking iron tablets or overcoming side effects with your friends?
9. How do you receive information on health and nutrition?
10. What does a nutrition collaborator do to you? How often a nutrition collaborator visit you?
11. To improve your health status, can you spend 500VND per month?
12. Who decide what you can buy medicine, yourself or your husband?
13. Did you receive work reduction for pregnant women during your last pregnancy by people's committee?