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Risk factors for iron-deficiency anaemia among pregnant women living in rural Vietnam

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Abstract

Objective: To assess the prevalence of anaemia in rural Vietnam and to determine its risk factors.

Design: A cross-sectional survey.

Setting: Vietnam, Nghe An Province.

Study population: The total number of participants was 439. Of these participants, one was excluded from the study due to a mental disorder. Forty-seven did not participate in the test for parasites and 68 did not complete at least one of the questions.

Results: The prevalence of anaemia (haemoglobin (Hb) $< 11.0\,g\,dl^{-1}$) was 43.2% and of severe anaemia (Hb $< 8.0\,g\,dl^{-1}$) was 0.5%. Taking iron tablets, the consumption of eggs and the preference for Western medicine significantly and positively correlated with Hb concentration in the pregnant women in a multiple regression analysis. Pregnancy duration and hookworm infestation significantly and negatively correlated with Hb concentration in the pregnant women.

Conclusion: The prevalence of anaemia in rural Vietnam has remained as high as that found in the national anaemia survey in 2000. The results of the present study could aid in the development of an iron-deficiency anaemia programme among pregnant women in rural Vietnam that emphasises iron supplementation, parasite control and improved diet, including the consumption of eggs. The programme's focus should be on women who prefer traditional medicine to Western medicine.

Keywords
Iron-deficiency anaemia
Pregnancy
Parasite infestation
Vietnam

Iron-deficiency anaemia (IDA) is one of the most frequently observed nutritional deficiencies among pregnant women around the world[1]. The World Health Organization (WHO) estimates that nearly half of all pregnant women worldwide suffer from anaemia[2]. IDA is known to be an important factor in maternal death[3], the poor cognitive development of children and 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 national level[7,8].

Risk factors for IDA among pregnant women identified in past studies included parasite infestation[1–4,9], season[10], food habits[11,12], gestational age[10], parity[12], early age at the time of marriage[12] and geographic location[12]. In Vietnam, the report of a joint government–donor–non-governmental organisation working group indicated that the main cause of IDA is a lack of dietary iron intake, because the staple food in Vietnam is rice and rice products[13]. Another report showed that a lower consumption of meat in the household is significantly associated with a higher rate of anaemia[14]. However, no studies have been reported from Vietnam that analysed the risk factors for IDA in detail.

The present study was undertaken to assess the prevalence of anaemia among pregnant women in rural Vietnam and to determine its risk factors. By finding major risk factors, we can plan a more effective approach for anaemia targeted towards the at-risk population.

Methods

The study was carried out in July 2003 and included six rural communes in Yen Thanh District of Nghe An Province in Vietnam. This district has 37 communes altogether and is situated 350 km 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 Nghe An Province. Malaria is not endemic in this area. In 1998 the Vietnamese Ministry of Health implemented an iron supplementation programme in 10 of the 37 communes in Yen Thanh District. Through this programme, iron (60 mg) and folic acid (400 μg) for daily use have been distributed to pregnant women. For the six

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communes of the present study, we purposely selected two communes from the 10 communes that were participating in the iron supplementation programme. We then selected four communes from the 27 communes that were not participating in the iron supplementation programme. 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 30 June 2003. To ensure that we included all pregnant women living in the villages selected to participate in the survey, we used the birth registrations of the commune health centres. The percentage of pregnant women who deliver at health centres is known to be high (74.3%) in the north central region of Vietnam. Women who had not yet come to the health centre 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 determination of haemoglobin (Hb) concentrations and examination of stool samples for parasitic infestation. The Hb concentration in the blood of each participant was determined at the time of the survey using a portable β-haemoglobin photometer (Hemocue®; HemoCue AB, Angelholm, Sweden)[15]. The WHO criterion for anaemia in pregnant women was applied, with Hb $< 11.0\,\mathrm{g\,dl^{-1}}$ considered the baseline[2].

The risk factors for anaemia among pregnant women identified in past studies were assessed. First, a trained technical officer of the preventive medical centre of Nghe An Province evaluated the presence of hookworm eggs in each stool sample after formalin/ether concentration[16]. The presence of hookworm was recorded as positive or negative, depending on whether hookworm ova were detected. Second, the consumption of iron- and vitamin C-rich foods was assessed with a self-administered food-frequency questionnaire (FFQ). The FFQ was developed based on information from focus group discussions with the groups of pregnant women in the survey communes. Third, knowledge, attitudes and practices of anaemia were assessed by a questionnaire that was modified from a similar study carried out in Nepal by the United Nations Children's Fund (UNICEF) in 2001 and revised based on the results from key informant interviews. Key informant interviews were conducted with three obstetricians in national/provincial/district hospitals, four researchers who were responsible for IDA control (Director of the Department of Preventive Medicine from the Ministry of Health; Head of the Micronutrients Department from the National Institute of Nutrition; WHO Program Coordinator of the Weekly Iron Supplementation Project; UNICEF Program Officer of Health and Nutrition) and two directors of health services (Director of the Medical Training College in Nghe An Province; Director of Health Service of Yen Thanh District). All of the key informants were Vietnamese.

To accumulate the relevant data from the key informant interviews, we first examined all transcripts of the interviews and identified emergent themes that pertained to the central focus of this study. Then, we categorised all of 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 cross-checked with the data of the key informant interviews.

Statistical analysis

All data were coded and entered into SPSS version 12.0J (SPPS Inc., Chicago, IL, USA) for analysis. Computed descriptive statistics included proportions, means and comparisons between anaemic participants and non-anaemic participants. Multiple logistic regression analysis was used for Hb concentration adjusted by pregnancy duration. 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 anaemia among pregnant women was estimated to be 35%[17] and the relative decrease of anaemia prevalence used in the calculations was 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 drop-outs in the study, all of the pregnant women in the six communes ($n = 420$) were included.

Results

Three hundred and seven pregnant women identified from the health centres' pregnancy records and an additional 203 newly pregnant women identified through the women's union network were invited to participate in the survey. A total of 71 from the first group declined participation, 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 test for parasites and 68 did not complete at least one of the questions on the survey for risk factors of anaemia. The final sample was therefore 438 for Hb levels, 391 stool examinations for parasites and 342 for completing all tests and the full questionnaire. The overall participation rate was 86%. The mean pregnancy duration of the participants at the time of the survey was 26.3 (standard deviation (SD) 10.7) weeks' gestation.

The average Hb concentration was $11.1\,\mathrm{g\,dl^{-1}}$ (SD 1.3, range $5.3–15.2\,\mathrm{g\,dl^{-1}}$), just above the cut-off level for anaemia. The prevalence of mild anaemia (Hb

$<11.0\,g\,dl^{-1}$) was 43.2% and of severe anaemia (Hb $<8.0\,g\,dl^{-1}$) was 0.5%. Mean age of the participants was 25.8 (SD 4.5) years, 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 Hb concentrations and demographic variables showed that farmers were equally represented in the anaemic and non-anaemic groups. However, the percentage of those who finished secondary school was lower among anaemic participants (45.5%) than among the non-anaemic participants (63.5%) ($P < 0.001$).

The distribution of risk factors for anaemia between the anaemic and non-anaemic participants is shown in Table 2. Among the risk factors compared, the use of iron tablets was lower in anaemic participants (67.0%) than in non-anaemic participants (76.0%) ($P < 0.05$). Also, those who preferred traditional medicine were represented more in the group of anaemic participants (36.7%) than in the non-anaemic group (27.0%) ($P < 0.05$).

When the FFQ items were examined, anaemic participants were less likely to consume beans ($P < 0.05$). There was no difference between the anaemic and non-anaemic participants in other parameters including consumption frequency of meat, fish, eggs, fruits and vegetables, hookworm infestation, unhygienic toilets, lack of advice to take iron tablets, experience of side-effects from iron tablets and receiving iron tablets before pregnancy.

The relationships between risk factors for anaemia and Hb concentration are shown in Table 3. Among the variables examined, a significant positive correlation was observed for taking iron tablets ($r = 0.101$, $P < 0.05$), frequent consumption of beans ($r = 0.128$, $P < 0.01$) and educational level ($r = 0.150$, $P < 0.01$). Significant negative correlations were observed for hookworm infestation ($r = -0.175$, $P < 0.001$), weeks of pregnancy duration ($r = -0.157$, $P < 0.001$) and number of children ($r = -0.102$, $P < 0.05$). The variables hygienic latrine use, side-effects experienced, iron tablets received before pregnancy, advice for iron tablets being given and frequent consumption of meat, fish, eggs, vegetable and fruits did not correlate significantly with Hb concentration.

Table 4 shows the results of a multiple regression analysis. Taking iron tablets ($P < 0.05$), preferring Western medicine ($P < 0.05$), consumption of eggs ($P < 0.05$) and educational level ($P < 0.05$) were significantly and positively correlated with Hb concentration in the pregnant women. Hookworm ($P < 0.001$) and *Ascaris lumbricoides* infestation ($P < 0.05$) and pregnancy duration ($P < 0.001$) were significantly and negatively correlated with Hb concentration in the pregnant women.

Discussion

The present study indicates that the prevalence of anaemia (Hb $<11.0\,g\,dl^{-1}$) was 43.2%, indicating that IDA remains a major problem for pregnant women living in rural Vietnam. This result is similar to the prevalence found in the national anaemia survey of 1995[14]. The study also shows that the cause of anaemia is multifactorial, with risk factors including lack of iron intake, hookworm infestation and preference for traditional medicine.

Previous studies have found parity[12] to be an important factor in iron deficiency, but this was not the case in the present study. In countries where the fertility rate is high, closely spaced pregnancies deplete women's iron stores and lead to anaemia. However, according to the population census[18], the total fertility rate has declined

Table 1 Comparison of backgrounds between anaemic and non-anaemic participants (%)

	Anaemic ($n = 189$)	Non-anaemic ($n = 249$)	Total ($n = 438$)	*P*-value*
Occupation†				
Farmer	95.2	90.0	92.2	NS
Teacher	3.7	7.6	5.9	NS
Business owner	0.5	0.8	0.7	NS
Education				
Illiterate	1.1	0.0	0.5	$P < 0.001$ (df = 1)‡
Primary	53.4	36.5	43.8	
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	NS
Chicken	89.9	90.8	90.4	NS
Vegetable	83.3	80.4	81.7	NS
Sweet potatoes	67.5	65.5	66.4	NS
Fruit tree	50.7	56.2	53.7	NS
Fish pond	38.9	34.5	36.5	NS

NS – not significant.
* *P*-value from chi-square analysis.
† Occupation was missing for one anaemic and four non-anaemic participants.
‡ Chi-square analysis between participants who did and did not complete secondary school.

Table 2 Comparison of risk factors for anaemia between anaemic and non-anaemic participants

	Anaemic		Non-anaemic		
	n	%	*n*	%	*P*-value*
Taking iron tablets	188	67.0	246	76.0	<0.05
Traditional treatment preferred	188	36.7	244	27.0	<0.05
Education level†	189	45.5	249	63.4	<0.001
Hygienic latrine‡	187	15.0	246	15.9	NS
Hookworm infestation	168	25.6	223	18.0	NS
Ascaris infestation	168	96.4	223	96.0	NS
Trichuris infestation	168	30.4	223	30.9	NS
Experience of side-effects	186	40.1	245	43.5	NS
Iron tablets received before pregnancy§	186	42.1	246	48.9	NS
Advice for taking iron tablets being told	179	79.3	238	79.0	NS
Knowing lack of iron causes anaemia	114	86.8	265	84.2	NS
Has seen educational materials for IDA prevention	189	50.3	243	50.6	NS
Consumption of meat and meat products¶	188	73.5	249	73.4	NS
Consumption of fish and seafood¶	189	91.0	249	88.8	NS
Consumption of eggs¶	187	47.6	248	53.2	NS
Consumption of beans¶	188	11.2	246	19.1	<0.05
Consumption of vegetables‖	189	91.0	248	89.9	NS
Consumption of fruits¶	189	68.3	248	66.9	NS

IDA – iron-deficiency anaemia; NS – not significant.
* *P*-value from chi-square analysis.
† Percentage of participants who completed secondary school.
‡ Hygienic latrines are two-room latrine or toilet with water. Unhygienic latrines are no latrine, hole in the ground or one-room latrine.
§ The data include either receiving iron tablets at a health centre or being delivered by nutrition collaborators at home.
¶ Percentage of participants with consumption frequency of more than every week.
‖ Percentage of participants with consumption frequency of more than every day.

Table 3 Percentage of participants with risk factors for anaemia and correlation of risk factors with haemoglobin level

	n	%	Pearson correlation coefficient	*P*-value
Taking iron tablets	434	72.0	0.101	<0.05
Side-effects experienced	431	42.1	0.064	NS
Iron tablets received before pregnancy	438	46.3	0.041	NS
Consumption of beans*	438	15.9	0.128	<0.01
Consumption of meat and meat products*	438	73.5	−0.025	NS
Consumption of fish and seafood*	438	89.5	0.006	NS
Consumption of eggs*	438	50.7	0.071	NS
Western medicine preferred	438	68.8	0.082	NS
Hookworm infestation	391	21.5	−0.175	<0.001
Ascaris infestation	391	96.4	−0.023	NS
Trichuris infestation	391	30.4	0.000	NS
Hygienic latrine (two-room latrine or toilet with water)	433	15.4	−0.046	NS
Advice for taking iron tablets being told	417	79.1	−0.006	NS
Education level	438	55.6	0.150	<0.01

NS – not significant.
* Consumption frequency of more than once a week.

Table 4 Multiple regression analysis of risk factors for low haemoglobin level ($n = 323$)

	Partial regression coefficient	*P* value
Taking iron tablets (0 = no, 1 = yes)	0.370	<0.05
Preferred treatment (0 = traditional, 1 = Western)	0.339	<0.05
Consumption of eggs (0 = less frequent than every week, 1 = more frequent than every week)	0.280	<0.05
Education level (0 = did not complete secondary school, 1 = completed secondary school)	0.230	<0.05
Week of gestation	−0.021	<0.001
Ascaris infestation (0 = not infected, 1 = infected)	−0.203	<0.05
Hookworm infestation (0 = not infected, 1 = infected)	−0.64	<0.001
R^2 (explained variance)	0.156	

Multiple linear regressions with backwards elimination procedure.
Number of children, having chicken, vegetables, pigs (0 = yes, 1 = no) in the kitchen garden, receiving iron tablets before pregnancy (0 = no, 1 = yes), having seen educational materials on anaemia prevention (0 = no, 1 = yes), mother's occupation (0 = not farmer, 1 = farmer), type of latrine (0 = non-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) and 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 for which partial regression coefficients were significant ($P < 0.05$) were included in the final models.

rapidly in Vietnam from 4.0 children per woman in 1987 to 2.3 in 1999. This decrease is the result of family planning campaigns in Vietnam, and improved health and economic conditions.

In the present population, low 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. This may reflect the importance of an adequate protein intake in the prevention of anaemia, although there were no differences in consumption of other protein foods. Although participants are encouraged to raise small animals such as chickens, pigs and fish in their garden as part of a household food security programme implemented by the farmer's union, generally they are not 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[19]. Previous studies have reported difficulties in compliance with taking iron tablets because of their side-effects and the low awareness of anaemia[20]. The results of focus group discussions with women of childbearing age in the study area showed that the lack of supply, their bad smell, side-effects and the experience of recovery from anaemia caused pregnant women to stop taking iron tablets. However, experience of recovery and understanding that iron tablets help the growth of the foetus were considered

to increase compliance. The percentage of pregnant women taking iron tablets was 80% in communes participating in the national iron supplementation programme and 61% in communes not in the programme. In communes not in the national iron supplementation programme, 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 *A. lumbricoides* ova 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]. Anthelminthic therapy for pregnant women has already been recommended in the report of the National Anemia and Nutrition and Risk Factor Survey[14]. However, this recommendation is not often implemented owing to concerns over its potential teratogenicity. Mass use of anthelminthic therapy among pregnant women is conducted only in Sri Lanka[21] and Nepal[11]. The development of a policy for anthelminthic therapy for pregnant women is urgently needed in Vietnam as it strongly contributes to IDA[14]. In addition to anthelminthic therapy, emphasis should also be given to other preventive strategies, including sanitation control programmes 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 for IDA in the present study. Thus, emphasis should be given to the counselling of pregnant women who prefer traditional medicine to ensure that adequate iron status is achieved.

Some limitations need to be considered when interpreting the results of our study. The rural area chosen for the 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 small R^2 values. Reasons for this might be that the increase of Hb concentration is not linear and the data entered into the model as risk factors were not well categorised.

In conclusion, the results of the present survey suggest that, in addition to intake of iron tablets and hookworm infestation, low frequency of egg consumption and preference for traditional medicine are important risk factors of IDA among pregnant women living in rural Vietnam. These results could help in the development of a multifactoral IDA control programme. In educational programmes 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.

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