Asia-Pacific Journal of Public Health
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Asia Pac J Public Health 2011 23: 315
DOI: 10.1177/1010539511403133

The online version of this article can be found at:
http://aph.sagepub.com/content/23/3/315

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On behalf of:
Asia-Pacific Academic Consortium for Public Health

Asia-Pacific Journal of Public Health
23(3) 315–323

DOI: 10.1177/1010539511403133
http://aph.sagepub.com

Determinants of Adherence to Iron/Folate Supplementation During Pregnancy in Two Provinces in Cambodia

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Abstract

Iron supplementation can effectively control and prevent anemia in pregnancy. However, limited adherence is thought to be a major reason for the low effectiveness of iron supplementation programs. This research describes the factors influencing the adherence to iron/folate supplementation during pregnancy in Siem Reap and Kampong Cham provinces in Cambodia. Triangulation method, combining the quantitative and qualitative data collection methods, was performed for this study. A total of 177 women who gave birth during the year prior to the interview were selected for the quantitative survey. Ten women who gave birth during the year prior to the interview and 10 pregnant women were interviewed in-depth for the qualitative data. The χ^2 test and binary logistic regression were used for statistical analysis. The findings showed an adherence rate of 47%. The logistic regression revealed that the number of supplements received, number of prenatal visits, and access to antenatal care were determinants of adherence ($P < .05$). In conclusion, access to and follow-up of antenatal care were considered elements essential to improve iron/folate supplementation. Community-based interventions, such as nutrition education and distribution of supplements, should be prioritized in the interventions to improve adherence in Cambodia.

Keywords

adherence, anemia, Cambodia, iron/folate supplementation, pregnant women

Introduction

Anemia is one of the major public health problems affecting pregnant women in developing countries. It is estimated that more than half of pregnant women in the world suffer from anemia, a major cause of maternal morbidity and mortality.[1(p87),2] Experts suggest that 1000 mg of iron are needed for the mother and fetus during the pregnancy, a requirement that is practically

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impossible to meet with most diets in developing countries.[3(p58)] Because many women enter pregnancy with little iron store, the recommendation of daily oral iron supplements has been a routine practice in primary health care units.[4]

Many developing countries are now implementing iron supplementation programs, but only a few countries have reported significant improvement in anemia control and prevention.[5,6] Recurring problems identified are poor access to and utilization of prenatal care services, inadequate supply of iron tablets, poor counseling, lack of knowledge on anemia, and certain beliefs.[6-8] Galloway and McGuire[9] suggest that poor adherence is the main reason for the ineffectiveness of iron supplementation programs since adhering to other types of medical regimens is considered to be the major determinant of recovery from disease.

In Cambodia, anemia is a serious public health problem in pregnant women with a high prevalence of 57% in 2005.[10] Currently, iron/folate supplementation is the main strategy for anemia control and prevention. In the past, low utilization of antenatal care (ANC) and insufficient supplies of iron/folate tablets greatly affected the effectiveness of the program. The Cambodian Demographic Health Survey (CDHS) 2005 data reveal a remarkable improvement in the utilization of ANC with 69% of women receiving consultations compared with only 38% in 2000.[10] However, only 18% of pregnant women took the iron/folate supplements for 90 or more days, as recommended.[10] Why, when anemia could be effectively controlled and prevented by iron supplementation, does adherence rate remain so low? The aim of this research was to describe the adherence rate and factors influencing the use of iron/folate supplementation among Cambodian pregnant women.

Materials and Methods

The adherence to supplements was studied using the PRECEDE-PROCEED model developed by Green and Kreuter.[11] An emphasis was given to determine the associated factors related to the health behavior in terms of predisposing, reinforcing, enabling, and environmental factors. *Predisposing factors* are those antecedents that provide the rationale for the behavior, such as knowledge, attitude, perception, and demographic characteristics. For this study, knowledge of anemia and its prevention refers to the ability of women to describe causes, symptoms, and effects of anemia; benefits and instructions for taking supplements; and selection of iron-rich food. *Enabling factors* are those attributes that facilitate or impede an individual's behavior to be realized. Common examples are personal skills and needed resources. *Reinforcing factors* are those consequences of the behavior that provide incentive for performance, such as follow-up by health providers and support from family. *Environment factors* are social and physical elements that are interrelated but are not directly causing the behavior.

Study Design, Subjects, and Setting

Triangulation method, combining the quantitative and qualitative data collection methods, was performed for this study. The quantitative method was the appropriate approach to identify the determinants of adherence to iron/folate supplements. In addition, the qualitative study provided information to understand the reasons of adherence and nonadherence. A total of 177 women who gave birth during the year prior to the interview were selected for the quantitative survey. Ten women who gave birth during the year prior to the interview and 10 pregnant women were interviewed in-depth for the qualitative data. The research was carried out in Siem Reap and Kampong Cham provinces in Cambodia in October and November 2007. The provinces were identified based on geography, poverty rate, and anemia prevalence. Siem Reap province is located in the northwest of Cambodia with approximately 800 000 residents and well known for its

potential in tourism and agriculture. The province is one of the poorest in the country, with a poverty rate higher than 75% in rural areas.[12] Kampong Cham province is located on the eastern part of the country that borders Vietnam and lies at a distance of 124 km from Phnom Penh. Most of the population, estimated at 1.6 million, live in rural areas and depend largely on agriculture for their livelihoods, with a poverty rate from 25% to 50%.[12] According to CDHS 2005, 41% and 60% of women were suffering from anemia in Siem Reap and Kampong Cham provinces, respectively.[10]

Sampling Method

In both the quantitative and qualitative studies, a multistage sampling method was used to select 4 districts, 8 communes, and 24 villages. At the village level, 177 women who gave birth during the year prior to the interview were selected by a simple random sampling method using the birth registration list. For estimation of the required sample size, we took account of the adherence rate to iron/folate supplementation in Cambodia (18%), with 95% confidence level, tolerable error (0.06), and 10% for the margin of nonavailability.[10] To ensure that most of the eligible women participated in the study, we used the birth registrations of the commune councils. On October 1, 2004, the Ministry of Interior supported by Plan International launched a mobile national civil registration campaign in Cambodia to establish and strengthen the civil registration system. The campaign has been a success, with the total number of registered Cambodians increasing from 5% to 92%.[13] The local authorities reported the rate of birth registrations to be approximately 85% in the study areas. Sampling was proportional to the number of listed births in each village (50%). The eligibility criteria stipulated that women must be aged ≥18 years, have given birth during the past year, have delivered at full-term (gestational age 37-42 weeks), and have agreed to participate in the study. Sampling size for the qualitative study was calculated based on the concept of redundancy and saturation. Ten women who gave birth during the year prior to the interview were randomly selected from among the participants of the quantitative study. The pregnant women were identified and randomly selected with the assistance of the local authorities. The sample was selected based on the criterion of being pregnant and having experiences of taking iron tablets. All women agreed to participate in the study.

Data Collection

A structured questionnaire was used to identify the factors associated with the adherence to iron/folate supplements, whereas the qualitative study used the technique of unstructured in-depth interviews. The survey questionnaire included predisposing, reinforcing, enabling, and environmental factors (Figure 1). A panel of experts at the Mahidol University, Bangkok, Thailand, was consulted to discuss the validity of all instruments. The survey questionnaire's reliability was examined through Cronbach's coefficient. The values of the main items varied from .72 to .81. All interviews were conducted by 3 Cambodian interviewers during home visits. All participants gave their informed consent, and the confidentiality of their responses was ensured. The study was approved by the Research and Ethics Committee at the Mahidol University, Bangkok, Thailand, in August 2007.

Data Analysis

All data were edited, coded, and then entered into SPSS version 14 program. The descriptive statistics were obtained, and association between factors and adherence to supplements was explored through χ^2 and odds ratios. Binary logistic regression analysis was also used to control

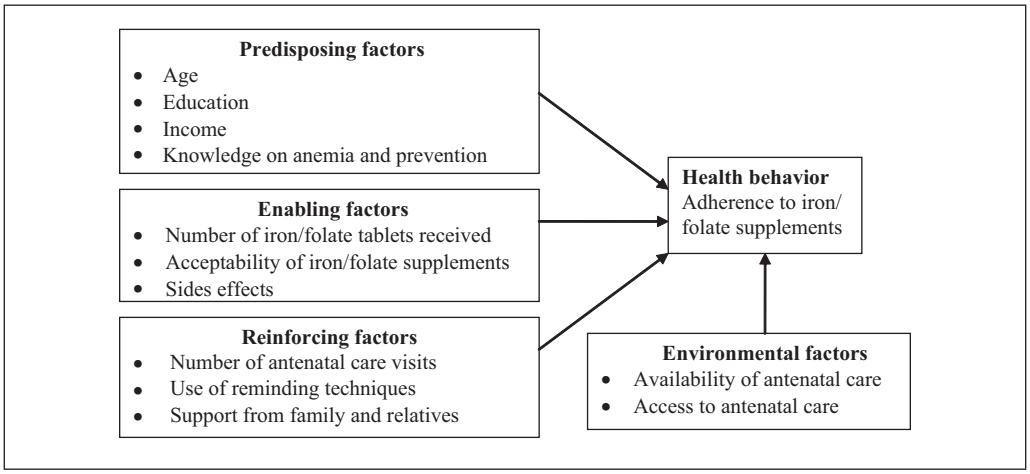

Figure 1. PRECEDE-PROCEED framework for adherence to iron/folate supplementation questionnaire development

for possible confounders. In this study, women were categorized as "adherent" if they took 65% or more of the supplements, equivalent to taking supplements at least 4 days a week during 3-month period.[7] For the qualitative research, the method of content analysis for the data processing and analysis was applied using categories and subcategories.

Results

Sample Characteristics

A total of 173 participants remained after removing 4 uncompleted questionnaires. The questionnaires filled by one interviewer during the first day of data collection in Kampong Cham province contained unclear item responses on food intake per day. Table 1 presents the general characteristics per group of adherents and nonadherents. The interviewees were aged 20 to 46 years (mean ± SD = 29 ± 6.8 years). More than half of the participants did not have any education or did not complete primary schooling. Also, parity varied, ranging from 1 to 10 with a mean of 2.8 children. Most women living in Kampong Cham province were classified as adherent. The group of nonadherents had lower education (76%) compared with the group of adherents (37%). Regarding age and family income, the two groups had similar patterns.

Adherence to Iron/Folate Supplementation

Among the 173 women interviewed, 113 (65%) took iron/folate supplements and 81 (47%) adhered to the supplementation (at least 4 days per week during 3 months period). Among the women who took the supplementation, the total duration varied, ranging from 5 days to 8 months with a mean of 142 days (SD = 67.3).

Factors Affecting the Adherence to Iron/Folate Supplements

The univariate analysis of crude odds ratios for the adherence to iron/folate supplementation was performed among 12 variables (Table 2). Seven factors showed statistically significant association with adherence ($P < .05$). The *predisposing factors* considered to be significantly associated with

Table 1. Frequency, Percentage, Mean, and Standard Deviation by General Characteristics (n = 173)

	n (%)		
Variable	Nonadherence (n = 92)	Adherence (n = 81)	Total (n = 173)
Place of residence (province)			
Siem Reap	72 (78.3)	27 (33.3)	99 (57.2)
Kampong Cham	20 (21.7)	54 (66.7)	74 (42.8)
Age (years)			
20-29	56 (60.9)	53 (65.5)	109 (63.0)
30-39	26 (28.3)	21 (25.9)	47 (27.2)
40-46	10 (10.9)	7 (8.6)	17 (9.8)
Minimum, maximum	20, 46	20, 45	20, 46
Mean ± *SD*	29.5 ± 7.2	28.5 ± 6.4	29.0 ± 6.8
Education			
No formal schooling	70 (76.1)	30 (37.1)	100 (57.8)
Primary school	20 (21.7)	41 (50.6)	61 (35.3)
Secondary school	2 (2.2)	10 (12.3)	12 (6.9)
Income (US$/month)			
<20	63 (68.5)	48 (59.3)	111 (64.2)
≥20	29 (31.5)	33 (40.7)	62 (35.8)
Minimum, maximum	2.5, 300	2.5, 300	2.5, 300
Mean ± *SD*	18.0 ± 27.1	33.9 ± 56.9	25.5 ± 44.2

adherence were education and knowledge of anemia and its prevention ($P < .05$). Our results show that the majority of the participants (87%) had very little knowledge of anemia and its prevention. Only 17% of respondents recognized some signs of anemia, such as being tired and weak. The number of tablets received was the only *enabling factor* considered to have significant effects on adherence ($P < .05$). The majority of the participants (89%) received 30 tablets per supply from the health centers. More than 60% of the women were satisfied with the size, color, packaging, and instructions. Only 24 of the women interviewed (21%) had side effects after taking the supplements. The *reinforcing factors* considered to be significantly associated with adherence were number of ANC visits, use of reminding technique, and support from family ($P < .05$). Among the 113 women who received ANC services, the number of visits range from 1 to 10 with a mean of 5.4 visits. The majority of the women who took the supplements (85%) used reminding techniques such as "put the tablets at the same place" and "take the tablets during the meals." A total of 33% of women reported that they had little support from their families. The access to ANC (distance) was identified as an important *environmental factor* of taking iron/folate supplements. In contrast, availability of ANC (costs) did not show effect on adherence ($P > .05$).

The technique of binary logistic regression was used to control potential confounders. Seven factors that had significant effects on the adherence were entered into logistic regression analysis. Three predictors remained statistically significant: number of tablets received, number of ANC visits, and access to ANC services (Table 2).

Twenty in-depth interviews were held in Siem Reap province (10 interviews) and in Kampong Cham province (10 interviews). The respective data show that most of the interviewees received ANC from a midwife during the pregnancy. The main reason mentioned for consulting at the health center was to receive iron/folate supplements. All women living in isolated areas complained about the lack of transport and costs for traveling to reach ANC services. When asked about the reasons of nonadherence, the participants reported lack of information, difficulty of access to ANC, and insufficient support from their families. Economic constraints relating to transport and health services costs were often mentioned during the interviews. As shown in the quantitative data, the

Table 2. Factors Associated With Adherence to Iron/Folate Supplements

		Univariate Analysis		Binary Logistic Regression[a]	
Variable	n (%)	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Predisposing factors	(n = 173)				
Age (years)					
<30	109 (63.0)		.650		
≥30	64 (37.0)				
Education					
No schooling	100 (57.8)	2.32 (1.60-3.37)	<.001[b]		.453
Primary and above	73 (42.2)	1.00			
Income (US$/month)					
<20	111 (64.2)		.207		
≥20	62 (35.8)				
Level of knowledge					
Low	151 (87.3)	2.53 (1.16-5.54)	.002[b]		.656
High	22 (12.7)	1.00			
Enabling factors	(n = 113)				
Acceptability					
Satisfied	108 (95.6)		.67		
Not satisfied	5 (4.4)				
No. of tablets received					
<30	12 (10.6)	3.82 (2.44-5.99)	<.001[b]	18.30(3.70-91.30)	<.001[b]
≥30	101 (89.4)	1.00		1.00	
Side effects					
Yes	24 (21.2)		.684		
No	89 (78.8)				
Reinforcing factors	(*n* = 113)				
No. of ANC visits					
<4	20 (17.7)	3.61 (2.18-5.9)	<.001[b]	8.10(2.65-24.75)	.002[b]
≥4	93 (82.3)	1.00		1.00	
Reminding technique use					
Yes	96 (85.0)	1.00			
No	17 (15.0)	3.57 (1.23-10.32)	.014[b]		.964
Support from family					
Low	57 (32.9)	3.33 (2.48-4.47)	<.001[b]		.551
High	116 (67.1)	1.00			
Environmental factors	(*n* = 113)				
Availability of ANC					
Expensive	6 (5.3)		.226		
Not expensive	107 (94.7)				
Access to ANC					
Difficult	22 (19.5)	3.65 (2.18-6.11)	<.001[b]	9.16 (3.22-26.04)	<.001[b]
Easy	91 (80.5)	1.00		1.00	

Abbreviations: OR, odds ratio; CI, confidence interval; ANC, antenatal care.
[a]Binary logistic regression analysis: log likelihood = 72.471, R^2 = .61.
[b]Statistical significance at $P < .05$.

vast majority of interviewees had very little knowledge of anemia and its prevention. Benefits and importance of taking the supplements were often unknown. In contrast, women knew very well the instructions for taking the supplements. The vast majority of the respondents told us that they were still working until the delivery and did not have any particular help during their pregnancies. According to the women interviewed, support received from the family comes after the delivery. At the end of the interviews, the participants recommended that transport to health center and health services costs should be reviewed in isolated areas. Thus, the respondents were receptive to village health volunteers distributing iron tablets.

Discussion

Our results show that the number of tablets received, access to, and follow-up of prenatal care were the most important predictors of adherence to iron/folate supplementation. Our findings also reveal that 47% of the women interviewed adhered to the supplementation. This is higher than the 18% found by CDHS 2005.[10] The difference in the geographic locations and definition of adherence used between the surveys could explain the findings.

In general, demographic characteristics are not good predictors of adherence, and our results confirm this statement.[14,15] The age and income variables did not have effect on adherence on iron/folate supplementation. Both quantitative and qualitative data suggested that education and knowledge were important factors influencing the use of ANC services and taking supplementation. The study of Jasti et al[7] found that education beyond high school was positively associated with the adherence, but higher education and better knowledge of the benefits of supplements increased concern about pregnancy outcome. As expected, knowledge of anemia and its prevention was identified as an important factor for taking iron/folate supplements. During the in-depth interviews, the participants explained that they never heard about anemia during their ANC visits or from other sources. Similar findings were found by Galloway et al[6] in the Mother Care project implemented in 8 developing countries. In general, the level of knowledge about anemia and its prevention among pregnant women was very low. The authors recommended that health providers must be trained to effectively counsel women about anemia during pregnancy. In this study, the number of tablets received was the only enabling factor predicting adherence. Although it is a policy in Cambodia to give 60 tablets of iron at the first ANC visit during the first trimester and then 30 tablets at every subsequent visit, none of the participants received more than 30 tablets per visit. The qualitative data reveal that the health staff working at the health center refused to provide more than 30 tablets because they were concerned about the exhaustion of stock. Studies showed that inadequate and sporadic supplies of iron tablets, as well as the failure to distribute them, emerge as barriers to adherence.[6,8] Our findings suggest that the distribution system of iron/folate tablets was an element essential in the process of adherence, which should be reviewed. Interestingly, experiencing side effects was not a risk factor for not taking the supplements. The results show that the majority of women persisted with taking iron, finding that side effects subsided after the first few days. In Bangladesh, a study confirmed that side effects of iron tablets had very limited influence on compliance and recommended that efforts to reduce side effects may not be a successful strategy for improving adherence.[16] Past studies did not report that the acceptability of supplements could have significant effects on the adherence.[6,8,17] Similarly, our results confirm this statement. Most of the women interviewed were satisfied with the size, color, packaging, and instructions of iron/folate tablets. Our results suggest that the side effects and acceptability of supplements should not be prioritized in the interventions to improve adherence to iron/folate supplementation in Cambodia.

Concerning the reinforcing factors, the best predictor identified was the number of ANC visits. In both qualitative and quantitative studies, the only channel reported by the participants to get

the supplements was the local health center. During the in-depth interviews, the women who received ANC services explained that the main reason for going back to the health center was to get a new supply for the supplementation. In Vietnam, Ritsuko et al[8] confirmed that the number of ANC visits and supply had effects on adherence. The authors suggested that frequent supplies through ANC visits or community-based interventions could greatly improve the adherence. In Thailand, Winichagoon commented that using village health volunteers to encourage continuation of ANC consultations by midwives could be an appropriate iron supplementation strategy.[18]

As expected, the environmental risk factor "access to ANC" was an important predictor of adherence. Our results show that the majority of the women living far from the health center did not use ANC services. According to survey conducted in Cambodia, ANC attendance was decreasing according to the distance to the health center: 69% of the women living in a village close to the health center visited the health center for consultation compared with 27% living in the most remote village.[19] There was also evidence that access to ANC was affecting the number of ANC visits among the women consulting for prenatal care. In contrast to the accessibility, the price of ANC services was not mentioned as a constraint to consult at the health center. During the interviews, the participants explained that economic constraints were more related to the transport costs to reach the health center than the costs of ANC services.

Some limitations need to be considered when interpreting the results of this research. First, our findings may not be generally applicable to women who did not register their children at the commune councils. Second, recall error regarding iron/folate supplementation may have posed a problem for women who gave birth during the year prior to the interview. Finally, as the interviewers included members of the health staff, the team was in a position of power to be judgmental and influence the truthfulness of the respondents. Respondents may know what the interviewer is looking for and give the "correct" answer instead of what they actually practiced or believed.

Conclusion

The findings of this research are significant for 3 reasons. First, the results showed that the access to and follow-up of ANC were elements essential to improve iron/folate supplementation. Constraints such as bad roads, lack of transportation, and cost of traveling are still considered the most important challenges to increase the access and utilization of health services in Cambodia. It is recommended that the group of pregnant women living far from the health center needs to be targeted in the actual context. Community-based interventions such as nutrition education and distribution of supplements by village health volunteers should be considered. Second, our results suggested that the distribution system of iron/folate tablets should be reviewed in the health centers. Finally, our findings revealed a very low level of awareness about anemia and its prevention. The pregnant woman who consults should receive adequate information from health providers. She should be aware of the benefits and importance of taking the supplementation. More thorough and in-depth studies are recommended for designing and refining iron supplementation program strategies and messages for communication materials.

Acknowledgments

The authors thank the research team, Nak Apivath Sahakum (NAS), and Neary Khmer staff for their work and commitments during the data collection. The authors also gratefully acknowledge the time and effort devoted by the participants.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interests with respect to the authorship and/or publication of this article.

Funding

The author(s) received no financial support for the research and/or authorship of this article.

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