The Prevalence and Risk Factors of Anemia in Pregnant Women

PICHAI CHOTNOPPARATPATTARA, MD*,
SOMPOP LIMPONGSANURAK, MD*,
PONGSAK CHARNNGAM, MD*

Abstract

Objective : To determine the prevalence and risk factors of anemia in pregnant women.

Method : The pregnant women were screened with complete blood count, hemoglobin electrophoresis and serology tests for hepatitis B, syphilis and HIV. In cases of anemia, serum for iron and ferritin were investigated. Anemia was defined as a hemoglobin level less than 11.0 g/dl in the first and third trimester of pregnancy or less than 10.5 g/dl in the second trimester. Factors associated with anemia were analyzed by using student's *t*-test and chi-square. The statistically significant factors were tested with the use of multiple logistic regression.

Results : A total of 1,304 pregnant women were recruited. The prevalence of anemia was 19.2 per cent (251 cases). Classified in each trimester, the prevalence was 14.8 per cent, 20.5 per cent and 38.6 per cent in the first, second and third trimester, respectively. One hundred and sixty-one cases of anemia were available for serum iron and ferritin levels. Iron deficiency anemia, by means of serum ferritin, was detected in 32 cases (19.9%). An abnormal pattern of hemoglobin electrophoresis was detected in 367 cases (28.1%). Gestational age at first prenatal visit, abnormal hemoglobin electrophoresis and educational status were associated with anemia during pregnancy.

Conclusion : The prevalence of anemia in pregnant women who first attended the prenatal visit was 19.2 per cent. Factors associated with anemia during pregnancy were gestational age at first prenatal visit, abnormal hemoglobin electrophoresis and educational status.

Key word : Anemia, Pregnancy, Prevalence, Risk Factor

**CHOTNOPPARATPATTARA P,
LIMPONGSANURAK S, CHARNNGAM P
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* Department of Obstetrics and Gynecology, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand.

Anemia is common during pregnancy. Most studies have demonstrated that pregnant women with anemia causes adverse effects to their offspring[1-3]. Godfrey et al[4] suggested a correlation between maternal iron-deficiency anemia and low birth weight infants. Marti et al[5] demonstrated the association between maternal anemia at the end of the third trimester and increased risk of preterm birth. In addition, Brabin et al[6] found a strong association between severe anemia (hemoglobin level < 4.7 g/dl) and maternal mortality.

The prevalence of anemia among pregnant Thai women varied about 5.9-31.0 per cent[7-9]. Recently, health promotion has been the main issue of concern. Nutritional supplements and dietary concern has been the topic of discussion in Thailand. The prevalence of anemia have changed from the past when those studies were conducted. Furthermore, iron deficiency anemia which was expected to be high will decline with adequate dietary intake and nutrition supplement.

Thalassemia and hemoglobinopathy are more prevalent in South East Asia. These mothers may transmit the abnormal gene to their offspring causing adverse effects such as anemia in childhood or hydrops fetalis.

In Thailand, there are national policies to prevent and treat anemia in pregnancy such as iron supplementation and thalassemia screening program. However, there are insufficient data to indicate which group can be identified as being particularly at risk for anemia. It has been suggested that intervention should focus on some target groups. To evaluate the extent of this problem, the authors aimed to study the prevalence of anemia including iron-deficiency anemia and thalassemia. Risk factors associated with anemia in women who first attended the antenatal clinic were also identified.

MATERIAL AND METHOD

The pregnant women who first attended the prenatal clinic at King Chulalongkorn Memorial Hospital, Bangkok, from November 1, 1995 to January 31, 1996 were recruited in the present study.

The exclusion criteria were pregnant women who had previously attended the prenatal clinic of another health service.

At the first prenatal visit, blood was collected and obtained for complete blood count, hemoglobin electrophoresis, human immunodeficiency virus antibody (antiHIV), hepatitis B surface antigen (HBsAg), serology for syphilis (VDRL). In cases of anemia, blood for serum iron and ferritin were performed. Anemic mothers were treated with 200 mg elemental iron 3 times a day until delivery.

The subsequent visit was followed as a guideline for prenatal visits: every 4 weeks until 28 weeks gestation, every 2 weeks during 28-36 weeks gestation and subsequently, every week until delivery

Based on the Center for Diseases Control and prevention (CDC) criteria[10], anemia is defined as hemoglobin less than 11 g/dl in the first and third trimester and less than 10.5 g/dl in the second trimester. Iron deficiency is defined as serum ferritin less than 12 μg/L.

The data was presented as mean, standard deviation, percentage. Risk factors for anemia were analyzed with the use of the student's *t*-test and chi-square test. The factors that had significant difference were analyzed by using multiple logistic regression. The SPSS for window Statistical Package Program (release 10.0, SPSS Inc., Chicago, IL, USA) was used to analyze the result. The level considered significant was below 0.05.

RESULTS

A total of 1,304 pregnant women were recruited to the present study. The number of pregnant women who first attended the prenatal clinic during first, second and third trimester were 609, 594 and 101 cases, respectively. The mean age was 25 ± 5.5 years (range 13-44 years). Seven hundred and thirty-three cases (56.2%) were nulliparous. Thirty-three per cent of the women had one child. The others had two children or more. The baseline characteristics are shown in Table 1.

There were 51 cases (3.9%) of positive serology for HBsAg. Twenty cases (1.5%) had positive serology for anti HIV. Screening for syphilis showed 5 cases (0.4%) of positive-VDRL.

The mean of hemoglobin was 11.6 ± 1.2 g/dl (range 5.9-15.6 g/dl). The mean of hematocrit was 34.3 ± 3.4 per cent (range 17.6-43.2%). Fig. 1 shows the distribution of hemoglobin level in the pregnant women. Twenty six per cent of the pregnant women had a hemoglobin level less than 11 g/dl.

Categorized by trimester, the number of pregnant women who first attended the prenatal clinic and the prevalence of anemia are shown in Table 2. The overall prevalence of anemia in the present study was 19.2 per cent which was highest in the third trimester.

Hemoglobin electrophoresis, performed in 1,303 cases, showed an abnormal pattern in 28.2 per

Table 1. Baseline characteristics of 1,304 pregnant women.

Characteristics	Number of cases	%
Profession		
Office employee	793	60.8
Government employee	13	1.0
Business owner	93	7.1
Housewife	405	31.1
Income (baht/month)†		
< 5,000	366	28.9
5,000-9,999	713	56.3
10,000-19,999	145	11.4
> 20,000	43	3.4
Education		
Illiterate	18	1.4
Primary school	749	57.4
Secondary school	402	30.8
College school	101	7.8
Bachelor at least	34	2.6

† Data available in 1,267 pregnant.

cent. Approximately, 41 per cent of anemic mothers had abnormal pattern of hemoglobin electrophoresis, whereas only 25 per cent of non-anemic mothers had an abnormal pattern. The majority of abnormal hemoglobin electrophoresis were heterozygous hemoglobin E (25.7%), heterozygous β thalassemia (1.1%). The other abnormalities were double heterozygous β thalassemia-hemoglobin E, hemoglobin constant spring, hemoglobin H, hemoglobin A Bart's and hemoglobin S.

Among 251 anemic mothers, 161 cases were available for serum iron and ferritin levels. The mean levels of serum iron and serum ferritin were 98.1 ± 47.4 μg/dl and 77.5 ± 128.4 μg/L, respectively. Thirty-two cases (19.9%) had a serum ferritin level below 12 μg/L. Serum iron levels lower than 60 μg/dl were detected in 31 cases (19.3%).

Table 3 shows the relationships between anemic status and age, parity, educational status, gesta-

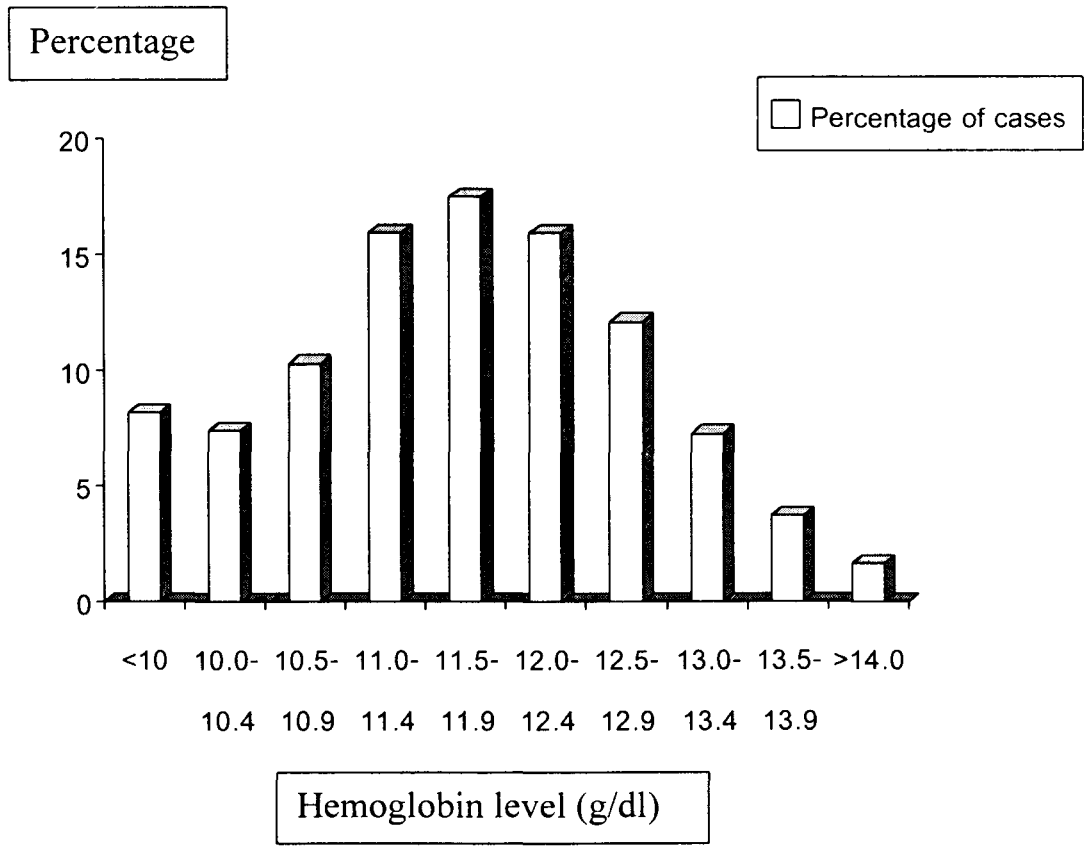

Fig. 1. The distribution of hemoglobin values.

Table 2. The prevalence of anemia in each trimester.

Trimester	No. of pregnant women (cases)	No. of anemic mothers (cases)	Prevalence (%)
First	609	90	14.8
Second	594	122	20.5
Third	101	39	38.6
Total	1,304	251	19.2

Table 3. The relationship between anemic status and the risk factors.

Factors	Pregnant women with anemia†	%	Pregnant women without anemia†	%	P-value
Age (mean ± SD)	24.2 ± 5.6		25.2 ± 5.5		0.007*
Parity					0.07
Nulliparous	142	10.9	591	45.3	
One child	75	5.8	360	27.6	
Two or more	34	2.6	102	7.9	
Education					< 0.001*
Illiteracy	9	0.7	9	0.7	
Primary school	164	12.6	585	44.9	
High school	53	4.1	349	26.8	
Bachelor at least	25	2.0	110	8.5	
Income (baht/month)†					0.20
< 5,000	78	6.2	288	22.7	
5,000-9,999	140	11.0	573	45.2	
10,000-19,999	19	1.5	126	9.9	
> 20,000	8	0.6	35	2.8	
Gestational age					< 0.001*
≤ 16	112	8.6	681	52.2	
> 16	139	10.7	372	28.5	
Hb electrophoresis					< 0.001*
Normal	149	11.5	787	60.4	
Abnormal	102	7.8	265	20.3	

Note : Hemoglobin electrophoresis was performed on 1,303 cases.
† Number in parenthesis is percentage.
* $p < 0.05$ is considered statistical significance.

tional age at the first prenatal visit and hemoglobin electrophoresis. There was no statistically significant correlation between anemic status and parity.

Multiple logistic regression was used to analyze the factors that had significant difference; educational status, gestational age at first antenatal clinic and hemoglobin electrophoresis. The odd ratio and 95 per cent confidence interval of these factors are demonstrated in Table 4.

DISCUSSION

Valyasevi et al[7] conducted a study on pregnant women, infants and pre-school children in Bangkok and demonstrated that the prevalence of anemia among pregnant women was 31.0 per cent. By using the same criteria, hemoglobin values less than 11 g/dl as cut off level, in the present study showed a prevalence of 25.9 per cent. By using the hemoglobin cut-off values of 10 g/dl, Areekul[8] found the prevalence of anemia in pregnant women in Bangkok was 21.8 per cent, whereas our study revealed that anemia was only 8.2 per cent. It is possible that health education has improved or the use of nutrition supplements in reproductive-age women has increased.

However, there were some conflicting results concerning the prevalence of anemia. Chaturachinda [9] reported in 1972 that the prevalence of pregnant women, who had a hemoglobin level less than 10 g/

Table 4. Odds ratio and 95% confidence interval of factors associated with anemia.

Factors	Odds ratio	95% CI
Gestational age	2.2	1.66, 2.95
Hb electrophoresis	2.1	1.53, 2.75
Educational status	1.6	1.17, 2.13

dl, was only 5.9 per cent. This may be due to the different population background such as education, income and beliefs.

Mahfouz et al[11] demonstrated that the prevalence of anemia among pregnant women in Saudi Arabia was 31.9 per cent. Compared with the study from Africa, the overall anemia in pregnancy in Tanzania was found to be 74.5 per cent[12]. The prevalence rate in the present study was quite low compared to the other developing countries. It is possible that in the present study the population represented women who lived in the Bangkok of Thailand and had adequate food and nutrition supplement during the reproductive period.

By trimester, the highest prevalence in the present study was shown in the third trimester. Multiple logistic regression also revealed that women with a late booking for the prenatal visit were at risk for anemia during pregnancy. Many studies have confirmed the findings of the present study[11,13-15].

Van den Broek et al[16] demonstrated that, for screening purposes, serum ferritin was the best single indicator of storage iron. By using the ferritin level, the study showed that approximately 20 per cent of anemic mothers had iron deficiency anemia.

Abel et al[15] and Pelas et al[17] demonstrated that iron deficiency anemia, using the ferritin level, was more prevalent among women in the third trimester. It is possible that the pregnant women who first attended the prenatal visit during the third trimester had pre-pregnant micronutrient deficiency anemia. Another possibility is that they had no iron supplement in the early period of pregnancy.

Ho et al[18] demonstrated that about 10 per cent of previously non-anemic pregnant women who had not received any supplement during their pregnancy, had clinical anemia after full-term pregnancy. Half of them had iron deficiency anemia (serum ferritin less than 12 μg/dl).

It was suggested from meta-analysis that pregnant adolescents might be particularly at risk for anemia[19]. However, most studies reported that age alone was not an important determinant of hemoglobin values[12,20,21].

The present study showed that education had an effect on maternal anemia. It is possible that the low education group had different food beliefs and behaviors which led to the intake of a bad diet. It may be due to the lack of awareness that they should prepare themselves during the pre-pregnant period.

In conclusion, anemia was found in about one fifth of pregnant women who first attended the prenatal visit. Anemia was more prevalent during the third trimester. The prevalence of anemia among pregnant women in Bangkok, however, tends to change from time to time. Late- booking for antenatal visit, low educational status and abnormal hemoglobin electrophoresis increase the risk of anemia. It should be advised for both early detection of anemia and iron supplementation.

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ความชุกและปัจจัยเสี่ยงของภาวะโลหิตจางในสตรีตั้งครรภ์

พิชัย โชตินพรัตน์ภัทร, พบ,*
สมภพ ลิ้มพงศานุรักษ์, พบ, พงศ์ศักดิ์ จันทร์งาม, พบ**

วัตถุประสงค์ : เพื่อศึกษาความชุกและปัจจัยเสี่ยงของภาวะโลหิตจางในสตรีตั้งครรภ์

สถานที่ทำการศึกษา : คลินิกฝากครรภ์ ภาควิชาสูติศาสตร์-นรีเวชวิทยา คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย โรงพยาบาลจุฬาลงกรณ์

รูปแบบการวิจัย : การศึกษาเชิงพรรณนา (แบบไปข้างหน้า)

วิธีการศึกษา-วัตผล : สตรีตั้งครรภ์ที่มาฝากครรภ์เป็นครั้งแรกทุกรายได้รับการเจาะเลือดตรวจ complete blood count, hemoglobin electrophoresis ตรวจเชื้อไวรัสตับอักเสบ บี ตรวจหาเชื้อ ซิฟิลิส และ antiHIV ในสตรีตั้งครรภ์ที่พบภาวะโลหิตจาง จะได้รับการตรวจ ferritin การวินิจฉัยโลหิตจางกำหนดไว้ดังนี้ ค่าฮีโมโกลบินน้อยกว่า 11 กรัมต่อเดซิลิตร ในไตรมาสหนึ่งและสาม หรือค่าน้อยกว่า 10.5 กรัมต่อเดซิลิตร ในไตรมาสสอง นำปัจจัยที่สัมพันธ์กับภาวะซีดวิเคราะห์โดย *t*-test และ chi-square จากนั้นวิเคราะห์ปัจจัยที่ผลต่อภาวะซีดด้วย multiple logistic regression

ผลการศึกษา : สตรีตั้งครรภ์จำนวน 1,304 ราย มีภาวะโลหิตจาง 251 ราย คิดเป็นความชุกได้ร้อยละ 19.2 แบ่งเป็นความชุกในไตรมาสหนึ่ง สอง สาม เท่ากับ ร้อยละ 14.8, 20.5, 38.6 ตามลำดับ การตรวจเลือดหาระดับ ferritin เพื่อวินิจฉัยภาวะโลหิตจางจากการขาดธาตุเหล็กพบสตรีตั้งครรภ์มีระดับต่ำกว่า 12 ไมโครกรัมต่อลิตร จำนวน 32 ราย (ร้อยละ 19.9) เมื่อตรวจ hemoglobin electrophoresis พบลักษณะที่ผิดปกติ จำนวน 367 ราย (ร้อยละ 28.1) ปัจจัยที่มีผลต่อภาวะซีดระหว่างตั้งครรภ์คือ อายุครรภ์ ผลตรวจ hemoglobin electrophoresis ที่ผิดปกติ และระดับการศึกษา

สรุป : ภาวะโลหิตจางในสตรีตั้งครรภ์ที่มาฝากครรภ์ที่โรงพยาบาลจุฬาลงกรณ์ มีความชุกร้อยละ 19.2 ปัจจัยที่มีผลต่อภาวะซีดระหว่างตั้งครรภ์คือ อายุครรภ์ ผลตรวจ hemoglobin electrophoresis ที่ผิดปกติ และระดับการศึกษา

คำสำคัญ : ภาวะซีด, ตั้งครรภ์, ความชุก, ปัจจัยเสี่ยง

พิชัย โชตินพรัตน์ภัทร, สมภพ ลิ้มพงศานุรักษ์, พงศ์ศักดิ์ จันทร์งาม
จดหมายเหตุทางแพทย์ ฯ 2546; 86: 1001-1007

* ภาควิชาสูติศาสตร์-นรีเวชวิทยา, คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย, กรุงเทพ ฯ 10330