

# IRON-DEFICIENCY ANEMIA IN PREGNANT WOMEN IN BALI, INDONESIA: A PROFILE OF RISK FACTORS AND EPIDEMIOLOGY

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**Abstract.** Iron-deficiency anemia in pregnant women is a serious public health problem especially in tropical countries. The aim of this study was to assess the prevalence of iron-deficiency anemia in pregnant women in Bali and determine the risk factors for anemia. A cross-sectional study was conducted among 1,684 pregnant women in 42 villages in Bali that were selected by probabilistic/proportional-to-size sampling technique. Two ml of venous blood were collected for hemoglobin estimation using an automatic hematology analyzer (Technician H-I), and serum ferritin examination using immunofluorescent technique. The WHO criterion for anemia in pregnancy was applied and serum ferritin < 20 µg/l as cut-off point for iron deficiency. Data regarding risk factors were gathered using pre-designed questionnaires. The prevalence of iron-deficiency anemia in pregnant women was 46.2%; most of the cases of anemia were mild. The risk factors for anemia identified in this study were: length of gestation; level of education; antenatal intake of iron pills. Given the high prevalence of iron-deficiency anemia in pregnant women in Bali, preventive measures, *eg* iron supplementation, the iron fortification of food, and health education, should be encouraged.

## INTRODUCTION

Anemia, especially iron-deficiency anemia, is an important public health problem in developing countries; it is estimated that about one third of the world's population suffers from anemia (DeMaeyer, 1989). Pregnant women, owing to their high iron demand, are vulnerable to anemia (Bothwell *et al*, 1979; Isah *et al*, 1985; William and Wheby, 1992); the prevalence of anemia is higher in pregnant women than in any other group in any given population. More than 50% of pregnant women are anemic (DeMaeyer, 1989; Mahfoud *et al*, 1994; Muhilal *et al*, 1992); the majority of these anemic patients suffer from iron-deficiency anemia (Bakta and Sutirtayasa, 1992).

Iron-deficiency anemia in pregnancy may have a serious effect on the health of both the mother and the baby; anemia can increase maternal and infant morbidity and mortality (INACG, 1981; Williams and Wheby, 1992). The mechanisms leading to increased morbidity include a decreased oxygen delivery capacity and the dysfunction of enzymes (INACG, 1981).

The cause of iron-deficiency anemia in pregnancy is a complex combination of increased iron demand, low iron intake, and chronic blood loss (Bothwell *et al*, 1979; Larysse, 1985; Wick *et al*, 1996). Many factors have been associated with the risk of iron-deficiency in pregnancy, *eg* nutritional status, socioeconomic variables, culture, age, educational status, parity, spacing of pregnancies, and the use of contraceptive devices (Williams and Wheby, 1992; Sutarga, 1994; Umniyati, 1997). The aim of this study was to assess the prevalence of iron-deficiency anemia among pregnant women in Bali and to consider the risk factors that are associated with the condition.

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## MATERIALS AND METHODS

This study was an analytical cross-sectional study (prevalence study) of pregnant women in Bali. Bali, an Indonesian island, has a population of 3.1 millions; Bali has eight districts and one municipality. The sample of pregnant women was selected by using a probabilistic/proportional-to-size sampling technique; a cluster sampling technique was used first (districts and the municipality were the sampling units); each of the villages in each of the sampling units was assigned as identifier drawn from a random table; 42 villages were then randomly selected to form the sample. All the pregnant women in the sample were studied. All data were gathered using pre-designed questionnaires. Two milliliters of venous blood were collected from each pregnant woman for hemoglobin estimation using an automatic hematology analyzer (Technicon-HI). The WHO criterion for anemia in pregnancy (Hb <11 g/dl) was applied (De Maeyer, 1989). Serum ferritin was assessed using immunofluorescent technique, serum ferritin < 20 µg/l was the cut-off point for iron deficiency.

## RESULT

One thousand eight hundred and one pregnant women from 42 villages were studied, but complete data were available from only 1,684 pregnant women (coverage rate: 91.5%).

**Hemoglobin level and prevalence of iron-deficiency anemia**

The range of hemoglobin levels was 4.1 -15.9 g/dl, with a mean of 11.05 g/dl (standard deviation 1.01 g/dl). Applying the WHO criterion, 778 pregnant women were classified as anemic, giving a prevalence rate of 46.2%.

**Severity of iron-deficiency anemia**

Of the 778 anemic women, 762 cases (97.9%) were mildly anemic; moderate and severe anemic cases were rare (1.7% and 0.4% respectively).

**Correlation between iron-deficiency anemia and age**

The relationship between prevalence of iron-deficiency anemia and patient age is shown in Table 1. Prevalence is lower in the 20-35

Table 1  
Correlation between prevalence of iron-deficiency anemia and patient age.

Age group (year)	No. of samples	Anemia	Percent
<20	272	140	51.5
20-35	1,286	578	45.0
>35	125	59	47.2

$\chi^2 = 1.872$ ;  $p = 0.3922$ ; DF (degree of freedom) = 2

Table 2  
Length of gestation and prevalence of iron-deficiency anemia.

Age of gestation	No. of samples	Anemia	Percentage
First trimester	291	80	27.5
Second trimester	782	414	52.9
Third trimester	610	284	46.6
Total	1,683	778	46.2

$\chi^2 = 55.024$ ; DF = 2;  $p = 0.000001$

Table 3  
Correlation between gravidity and iron-deficiency anemia.

Gravidity	No. of samples	Anemia	Prevalence
Primigravide	585	269	45.9%
Multigravide ( $\leq 5$ )	1,084	481	45.9%
Multigravide ( $> 5$ )	51	28	54.9%

$\chi^2 = 1.604$ ; DF = 2; p = 0.4485

Table 4  
Correlation between the level of education and iron-deficiency anemia.

Level of education	No. of samples	Anemia	Prevalence
No formal education	117	71	60.7%
Elementary school	741	353	47.6%
High school	763	328	42.9%
Academy/University	63	26	41.7%
Total	1,684	778	46.2%

$\chi^2 = 14.274$ ; DF = 3; p = 0.002

year age group compared with the < 20 year age group and the > 35 year age group; these differences are not statistically significant (p > 0.05).

#### Correlation between length of gestation and iron-deficiency anemia

Table 2 shows the relationship between length of gestation and iron-deficiency anemia. The lowest prevalence was found in first trimester of pregnancy and was significantly lower than the prevalence rate in second and third trimesters (p < 0.001).

#### Correlation between gravidity and iron-deficiency anemia

The prevalence of anemia increased with increased gravidity, but the increase was not statistically significant (Table 3).

#### Correlation between the level of education and iron-deficiency anemia

Table 4 shows the relationship between the level of education of pregnant women and their iron-deficiency anemia. The prevalence of anemia decreased with an increase in the level

of education. Pregnant women with no formal education were associated with a significantly higher prevalence of iron-deficiency anemia.

#### Correlation between antenatal intake of iron pills and iron-deficiency anemia

The relationship between the antenatal intake of iron pills and iron-deficiency anemia is shown in Table 5. Of the 1,645 pregnant women with complete data, the prevalence of iron-deficiency anemia was higher in the group without iron pills intake compared with the group with a regular intake of iron pills (p < 0.05).

## DISCUSSION

The prevalence of iron-deficiency anemia among pregnant women in this study (46.2%) was lower than the average prevalence of anemia in pregnant women in Indonesia. The results of the national surveys showed a prevalence of 63.5% in 1990 and 51.4% in 1995 (Anon, 1990). The majority of the cases were of mild anemia - a common finding in field surveys. Mild anemia may still have a negative effect on fetal and maternal health (INACG, 1981).

Table 5  
Correlation between the antenatal intake of iron pills and iron-deficiency anemia.

Iron pills intake	No. of samples	Anemia	Percent
Regular	1,475	663	44.9
Not regular	77	42	54.5
Without iron pills	93	52	55.9

$\chi^2 = 6.599$ ; DF = 2; p= 0.0369

This study showed a higher prevalence of anemia among the <20 year and the >35 year age groups. These age groups are classified as high-risk age groups. Anemia in these age groups is associated with a greater number of complications (INACG, 1981). The prevalence of iron-deficiency anemia was lowest in the first trimester of pregnancy owing to lower iron demand compared with that of the second and third trimesters. In this study, anemia was lower in primigravidae than in multigravidae. Pregnancy has a negative effect on iron stores, especially when iron intake is compromised. A woman whose gravidity is more than 6 is twice as likely to become anemic as a woman whose gravidity is 1-3 (Umniyati, 1997).

The level of education of the mothers was shown to be an important risk factor for anemia in this study. Education has an influence on anemia through knowledge on health, socio-economic status, and occupation. The intake of iron pills is a factor tending to reduce the risk of iron-deficiency anemia in the tropics. This study showed a correlation between the intake of iron-pills and iron-deficiency anemia, although this correlation was weak - this may be due to low maternal compliance (compliance < 30%).

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