*Bahrain Medical Bulletin, Vol. 36, No. 3, September 2014*

# The Prevalence and Factors Associated with Iron Deficiency Anemia in Anemic Pregnant Women

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## ABSTRACT

**Background: Iron deficiency anemia is one of the most prevalent nutritional disorders worldwide affecting the general health and millions of pregnant women.**

**Objective: To evaluate the prevalence and the risk factors of iron deficiency anemia among pregnant women.**

**Design: A Cross-Sectional Study.**

**Setting: Five Health Centers in Bahrain.**

**Method: Three hundred sixty-six pregnant women were included in the study during June 2012. The pregnant women were recruited during their antenatal visit. The personal characteristics, pregnancy and dietary information were documented. In addition, hemoglobin and serum ferritin level were determined.**

**Result: Ninety-six (26.2%) women had anemia; 19 (19.79%) women had iron deficiency anemia. The main risk factors were lower educational level and close birth space (≤ 2 years). The condition was found to be more prevalent among non-Bahraini pregnant women than Bahraini women. Serum ferritin level was found to decrease significantly with increasing age; eating three main meals regularly was associated with an increase in SF level.**

**Conclusion: In a sample of three hundred sixty-six pregnant women, ninety-six (26.2%) women had anemia and only 19 (19.79%) women had iron deficiency anemia; it is more common among non-Bahraini pregnant women. Lower educational level and close birth space (≤ 2 years) were the main risk factors.**

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## INTRODUCTION

Anemia is a widespread nutritional disorder, affecting 1.6 billion people worldwide, which constitute about 25% of the global population[1].

During pregnancy, anemia is primarily related to the expansion of plasma volume without normal expansion of maternal hemoglobin (Hb) mass; also, it is caused by iron deficiency (IDA)[2,3]. Many factors play major roles in the occurrence of IDA during pregnancy among which poor nutrition, multigravid and multiparity, close birth spacing and infection[4-7]. It is estimated that during pregnancy, an average amount of 840-1210 mg of iron is needed to avoid anemia[7]**.** This amount is customarily obtained from the dietary supplements and by recycling iron from old red blood cells. In the absence of optimal blood iron concentration, blood will not be able to carry oxygen efficaciously and hence affect the ordinary function of every cell in the body[4].

Despite efforts made by the Bahrain government, which are reflected in national flour fortification program and free provision of universal health care services including antenatal care program, anemia during pregnancy remained to be a public health challenge[5,8].

The World Health Organization (WHO) defines anemia as hemoglobin level less than 11g/dl[9]. It classified anemia of pregnancy into three: mild = Hb>9.5g/dl, moderate=Hb 7-9.5g/dl and severe Hb= >7g/dl[10].

Serum ferritin (SF) level, which is the cells' storage form of iron, has the highest sensitivity and specificity for diagnosing iron deficiency in anemic patients. The generally accepted cut-off level for SF below which iron stores is considered to be depleted is <15µg/L[11]. However, the antenatal guideline of the Bahrain Ministry of health (MOH) considered the cut-off level for anemia as SF of less than 10µg/L[12]. Other studies have called for higher cut-off level of SF (<17µg/L)[5]**.**

The prevalence of IDA in the developing country is very high; it ranges from 13.6% in Iran to 75% in other countries compared to 18% in the industrialized world[4,6,13]. Moosa et al reported that 41.9% of pregnant women in Bahrain had anemia and 40% had IDA or were in danger of getting it[5]. In Kuwait, the prevalence of anemia among pregnant women was reported to be 24%, of which 66% were IDA[13].

Younger age group (≤ 24), women with three parity or more, those with close birth spacing (≤ 2 years) and women in their third trimester were at risk of IDA[4,5,13,14]. Women who intake substantial amount of tea, coffee and brown bread had lower SF; those who consumed white fortified flour bread, fruit juice and food rich in iron, were found to have higher SF concentrations[13].

In 2001, the Bahrain government commenced a program for the fortification of flour with iron and folic acid. A study conducted six months after that program, showed little improvement in the prevalence of IDA[8].

Women with anemia during pregnancy are at risk of having perinatal mortality and morbidity[15]. The mortality rate ranges from 27 in India to 194 per 100,000 live births deaths in Pakistan[15,16]. A study showed that maternal mortality rate in women with Hb less than 10g/dL was 70/10000 deliveries compared with 19.7/10000 in non-anemic women[17]. Low

birth weight is another major complication that affects babies[18,19]. Iron supplementation improved the birth weight of newborns[20,21].

Women who were first diagnosed with anemia (Hb<10.4 g/dL) at 13–24 weeks of gestation had 1.18–1.75-fold higher relative risk of preterm birth, low birth weight, and prenatal mortality[22]. On the other hand, an association between maternal anemia and lower infant Apgar Scores (AS) was documented. A study showed that higher maternal Hb concentrations were correlated with greater AS and with a lower risk of birth asphyxia[23]. A study showed that pregnant women supplemented with iron, their infants had significantly higher AS than those infants whose mothers received placebo[24].

The aim of the study is to evaluate the prevalence and the risk factors of iron deficiency anemia among pregnant women.

## METHOD

Three hundred sixty-six pregnant women from the antenatal care in five primary health centers during 2012 were randomly selected. The sample size was based on the reported IDA of 40%[5,6]. Pregnant women with either hemolytic anemia or chronic diseases (diabetes, rheumatoid arthritis, renal disease) were excluded.

A questionnaire was adopted from a previous study and modified for Bahraini food habits[4]. For each pregnant woman, CBC or SF were requested if it was not quantified earlier.

An informed consent was taken from each woman assuring the confidentiality of the information.

## RESULT

The response rate of the 366 pregnant women was 100%. Their ages ranged between 16-45 years with a mean of 28±6 years. Two hundred forty-two (66.1%) were Bahraini and 286 (78.1%) were not working. One hundred sixty-one (44%) were having a diploma or higher degree. One hundred forty-six (55.9%) had an income of less than 500 BD per month, see table 1. Two hundred forty-six (67.2%) were multigravida, 73 (19.9%) gave history of abortion, 168 (69.3%) had birth interval of ≥2 years and 190 (51.9%) were in their third trimester during the interview, see table 2.

**Table 1: Personal Characteristics of Pregnant Women**

| | | Number and Percentage |
|---|---|---|
| **Age Group** | <25 | 103 (28.1%) |
| | 25-34 | 206 (56.3%) |
| | 35-44 | 57 (15.6%) |
| | Total | 366 (100.0%) |
| **Nationality** | Bahraini | 242 (66.1%) |
| | Non Bahraini | 124 (33.9%) |
| | Total | 366 (100.0%) |
| **Level of education** | Below secondary | 63 (17.2%) |
| | Secondary | 142 (38.8%) |
| | Diploma or above | 161 (44.0%) |
| | Total | 366 (100.0%) |
| **Occupation** | Working | 80 (21.9%) |

| | | |
|---|---|---|
| | Not working | 286 (78.1%) |
| | Total | 366 (100.0%) |
| **Family income** | <500 | 146 (55.9%) |
| | 500+ | 115 (44.1%) |
| | Total | 261* (100.0%) |

*Number of missing values is 105.

**Table 2: Obstetric data**

| | | Number and Percentage |
|---|---|---|
| Age at first pregnancy | < 20 | 50 (13.8%) |
| | 20-29 | 289 (79.6%) |
| | 30+ | 24 (6.6%) |
| | Total | 363[a] (100.0%) |
| Gravida | Primigravida | 120 (32.8%) |
| | >1 | 246 (67.2%) |
| | Total | 366 (100.0%) |
| Parity | Nil | 127 (34.7%) |
| | Yes | 239 (65.3%) |
| | Total | 366 (100.0%) |
| Abortion | None | 293 (80.1%) |
| | ≥1 | 73 (19.9%) |
| | Total | 366 (100.0%) |
| Birth interval | < 2 years | 74 (30.6%) |
| | ≥2 years | 168 (69.4%) |
| | Total | 242[b] (100.0%) |
| The gestational period of existing pregnancy | First trimester | 21 (5.7%) |
| | Second trimester | 155 (42.3%) |
| | Third trimester | 190 (51.9%) |
| | Total | 366 (100.0%) |

a.Number of missing values is 3.
b.Number of primi is 120 and number of missing values is 4.

Ninety-six (26.2%) had anemia (Hb<11g/dl) of which 87 (90.6%) were having mild anemia (Hb 9.5-10.9g/dl), and 9 (9.4%) had moderate anemia (Hb 7-9.5g/dl), see table 3. Nineteen had IDA (SF<15µg/L according to WHO criteria).

**Table 3: Anemia and Its Degree**

| | | Number and Percentage |
|---|---|---|
| **Presence of Anemia** | Yes | 96 (26.2%) |
| | No | 270 (73.8%) |
| | Total | 366 (100.0%) |
| **Degree of Anemia** | Mild | 87 (90.6%) |
| | Moderate | 9 (9.4%) |
| | Total | 96 (100.0%) |

IDA was found to be more prevalent among women aged between 25-34 years and in non-Bahraini, not working and who had higher family income (≥ 500 BD). Although, these findings were not statistically significant, it was found that the low educated women (lower than secondary education) had lower SF level compared to the higher educated women (secondary and above) (P value<0.040); IDA was significantly related to the birth interval, see table 4. The majority of those who had birth interval of less than two years tend to develop IDA (P<0.008), see table 5. Anemic pregnant women who ate three meals regularly

had significantly less chance of developing IDA compared to anemia in general (P<0.018), see table 6.

**Table 4: Personal Characteristics of the Anemic Women**

| | | IDA* | Non-IDA | Total | Chi-Square P-Value |
|---|---|---|---|---|---|
| | | **Number and Percentage** | **Number and Percentage** | **Number and Percentage** | |
| Age Group[1] | <25 | 4 (28.6%) | 10 (71.4%) | 14 (100.0%) | <0.562[a] |
| | 25-34 | 12 (31.6%) | 26 (68.4%) | 38 (100.0%) | |
| | 35-44 | 3 (17.6%) | 14 (82.4%) | 17 (100.0%) | |
| Nationality[1] | Bahraini | 14 (25.5%) | 41 (74.5%) | 55 (100.0%) | <0.508[b] |
| | Non-Bahraini | 5 (35.7%) | 9 (64.3%) | 14 (100.0%) | |
| Level of education[1] | Below secondary | 5 (62.5%) | 3 (37.5%) | 8 (100.0%) | <0.040 |
| | Secondary | 5 (17.2%) | 24 (82.8%) | 29 (100.0%) | |
| | Diploma or above | 9 (28.1%) | 23 (71.9%) | 32 (100.0%) | |
| Occupation[1] | Working | 3 (15.0%) | 17 (85.0%) | 20 (100.0%) | <0.136 |
| | Not working | 16 (32.7%) | 33 (67.3%) | 49 (100.0%) | |
| Family income[2] | <500 | 5 (29.4%) | 12 (70.6%) | 17 (100.0%) | <0.723 |
| | ≥500 | 10 (34.5%) | 19 (65.5%) | 29 (100.0%) | |

a. Cramer's V test.
b. Fisher's Exact test
1. Number of missing values is 27.
2. Number of missing values is 50.
*Serum Ferritin Level < 15µg/L

**Table 5: Obstetric Data and IDA among Anemic Pregnant Women**

| | | IDA* | Non- IDA | Total | |
|---|---|---|---|---|---|
| | | **Number and Percentage** | **Number and Percentage** | **Number and Percentage** | Chi-Square P-value |
| **Age at first pregnancy[1]** | < 20 | 2 (25.0%) | 6 (75.0%) | 8 (100.0%) | 0.215[a] |
| | 20-24 | 13 (32.5%) | 27 (67.5%) | 40 (100.0%) | |
| | 25-29 | 4 (28.6%) | 10 (71.4%) | 14 (100.0%) | |
| | 30+ | 0 (0.0%) | 7 (100.0%) | 7 (100.0%) | |
| | Primigravida[1] | 3 (16.7%) | 15 (83.3%) | 18 (100.0%) | 0.348 |
| | 2-3 | 11 (35.5%) | 20 (64.5%) | 31 (100.0%) | |
| | >3 | 5 (25.0%) | 15 (75.0%) | 20 (100.0%) | |
| **Parity[1]** | 0 | 3 (15.0%) | 17 (85.0%) | 20 (100.0%) | 0.326 |
| | 1-2 | 11 (33.3%) | 22 (66.7%) | 33 (100.0%) | |
| | >2 | 5 (31.3%) | 11 (68.8%) | 16 (100.0%) | |
| **Abortion[1]** | None | 15 (28.8%) | 37 (71.2%) | 52 (100.0%) | 0.763[b] |
| | One or more | 4 (23.5%) | 13 (76.5%) | 17 (100.0%) | |
| **Birth interval[2]** | < 2 years | 6 (75.0%) | 2 (25.0%) | 8 (100.0%) | 0.008[b] |
| | ≥ 2 years | 10 (23.3%) | 33 (76.7%) | 43 (100.0%) | |
| **Gestational period[1]** | First trimester | 0 (0.0%) | 2 (100.0%) | 2 (100.0%) | 0.325[a] |
| | Second trimester | 8 (22.2%) | 28 (77.8%) | 36 (100.0%) | |
| | Third trimester | 11 (35.5%) | 20 (64.5%) | 31 (100.0%) | |

a. Cramer's V test
b. Fisher's Exact test
1. Number of missing values is 27
2. Number of primigravida is 18 and number of missing values is 27
*Serum Ferritin Level < 15µg/L

**Table 6: Iron and Other Food Intake in the Anemic Women**

| | IDA* | Non-IDA | Total |
|---|---|---|---|

| | | Number and Percentage | Number and Percentage | Number and Percentage | Chi-Square P-value |
|---|---|---|---|---|---|
| **Frequency of iron tablet[1]** | <5 | 6 (50.0%) | 6 (50.0%) | 12 (100.0%) | 0.148[a] |
| | ≥5 | 10 (23.8%) | 32 (76.2%) | 42 (100.0%) | |
| **Intake of iron with fruit juice[1]** | No | 8 (30.8%) | 18 (69.2%) | 26 (100.0%) | 0.860 |
| | Yes | 8 (28.6%) | 20 (71.4%) | 28 (100.0%) | |
| **Intake of iron supplement before eating immediately[1]** | No | 8 (27.6%) | 21 (72.4%) | 29 (100.0%) | 0.723 |
| | Yes | 8 (32.0%) | 17 (68.0%) | 25 (100.0%) | |
| **Intake of iron supplement after eating immediately[1]** | No | 4 (32.0%) | 10 (71.4%) | 14 (100.0%) | 1.000[a] |
| | Yes | 12 (30.0%) | 28 (70.0%) | 40 (100.0%) | |
| **Intake of iron with milk or dairy product[1]** | No | 15 (28.8%) | 37 (71.2%) | 52 (100.0%) | 0.509[a] |
| | Yes | 1 (50.0%) | 1 (50.0%) | 2 (100.0%) | |
| **Intake of antacids with iron tablet[1]** | No | 13 (26.5%) | 36 (73.5%) | 49 (100.0%) | 0.148[a] |
| | Yes | 3 (60.0%) | 2 (40.0%) | 5 (100.0%) | |
| **Eating 3 main meals[2]** | No | 3 (100.0%) | 0 (0.0%) | 3 (100.0%) | 0.018[a] |
| | Yes | 16 (24.2%) | 50 (75.8%) | 66 (100.0%) | |
| **Drinking tea with or immediately after meals[2]** | No | 11 (25.0%) | 33 (75.0%) | 44 (100.0%) | 0.532 |
| | Yes | 8 (32.0%) | 17 (68.0%) | 25 (100.0%) | |
| **Food rich in iron[2]** | No | 1 (10.0%) | 9 (90.0%) | 10 (100.0%) | 0.264[a] |
| | Yes | 18 (30.5%) | 41 (69.5%) | 59 (100.0%) | |
| **Eating fruits[2]** | No | 1 (33.3%) | 2 (66.7%) | 3 (100.0%) | 1.000[a] |
| | Yes | 18 (27.3%) | 48 (72.7%) | 66 (100.0%) | |
| **Eating fish[2]** | No | 3 (27.3%) | 8 (72.7%) | 11 (100.0%) | 1.000[a] |
| | Yes | 16 (27.6%) | 42 (72.4%) | 58 (100.0%) | |
| **Eating chicken[2]** | No | 2 (20.0%) | 8 (80.0%) | 10 (100.0%) | 0.715[a] |
| | Yes | 17 (28.8%) | 42 (71.2%) | 59 (100.0%) | |
| **Eating meat[2]** | No | 6 (26.1%) | 17 (73.9%) | 23 (100.0%) | 0.849 |
| | Yes | 13 (28.3%) | 33 (71.7%) | 46 (100.0%) | |
| **Eating eggs[2]** | No | 0 (0.0%) | 10 (100.0%) | 10 (100.0%) | 0.052[a] |
| | Yes | 19 (32.2%) | 40 (67.8%) | 59 (100.0%) | |
| **Eating legumes[2]** | No | 6 (21.4%) | 22 (78.6%) | 28 (100.0%) | 0.348 |
| | Yes | 13 (31.7%) | 28 (68.3%) | 41 (100.0%) | |
| **Pica[2]** | No | 15 (24.2%) | 47 (75.8%) | 62 (100.0%) | 0.085[a] |
| | Yes | 4 (57.1%) | 3 (42.9%) | 7 (100.0%) | |

## DISCUSSION

According to WHO, more than one quarter of the sample had anemia of which 27.5% had IDA compared to 41.9% and 40% have anemia and IDA respectively in previous studies in Bahrain[5,6]. This improvement could be due to the health care services offered by the MOH in Bahrain during the past few years as well as free iron supplementation to pregnant women. It may also be related to a woman's quality standard of living, proper sanitation and the improvement in the quality of food.

None of the studied pregnant women were found to have severe anemia, which is similar to other studies from Saudi Arabia and Kuwait[16,25].

SF dropped significantly with increasing age. This finding could be related to the increasing number of pregnancies with increasing age, which would lead to depletion of the iron storage. IDA was more prevalent among non-Bahraini pregnant women, which could be related to the nutritional habits of this population who mainly depend on carbohydrates in their feeding.

Those who were less educated had significantly lower SF as they did not have sufficient knowledge regarding nutrition, especially food rich in iron, compared to those who had higher education[16,25].

Beard reported that adolescent women are at higher risk of developing IDA, which is similar to our study[4,7]. Moreover, iron requirements are high in adolescent girls because of the adolescent growth and the nutritional need of the fetus[4,7,24,26].

Women with more than two pregnancies and/or deliveries were found to show higher prevalence of IDA. Women with close birth spacing are at higher risk of IDA. Similar findings were reported in other studies[4,7,22,26].

It was also found that IDA was more prevalent among third trimester pregnant women. This could be due to increased requirement as the gestational age progressed[4,7,22,23].

Pregnant women who ate three meals regularly that contained fruits for more than one time per week had higher SF. SF decreases when iron is consumed with milk, dairy product and antacids, which interfere with iron and calcium absorption. IDA was found more in women who indulged themselves in pica (desire for eating strange non-nutrient substances), which is a known cause for IDA.

## CONCLUSION

**The prevalence of anemia among pregnant women in Bahrain had decreased compared to previous studies. The risk factors associated with higher prevalence of IDA were found to be lower educational level and close birth space. However, eating three regular meals per day is associated significantly with higher SF level.**

**It is recommended to focus on educating women during and before the antenatal period, family planning and birth spacing during antenatal visit. It is also recommended to utilize the WHO guidelines for the diagnosis of IDA should.**

### Limitation

**Due to the small sample size with anemia or IDA, the result of this study should not be generalized.**

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**Author Contribution:** All authors share equal effort contribution towards (1) substantial contributions to conception and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version to be published. Yes.

**Potential Conflicts of Interest**: None.

**Competing Interest:** None. **Sponsorship:** None.

**Submission Date**: 9 February 2014. **Acceptance Date:** 6 July 2014.

**Ethical Approval:** Approved by Ministry of Health's Research Committee.

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