

Research Article

Pattern of Anaemia and Selected Micronutrient Deficiencies Among Anaemic Postpartum Women at A Secondary Care Hospital In Rural Northern India

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A B S T R A C T

Background: Post-partum anaemia is a very prevalent problem and has the potential to affect health outcomes in both the mother and her newborn. Iron deficiency, followed by vitamin B12 deficiency and folate deficiency are important causes of anaemia, affecting pregnancy outcomes. The aim of the study was to assess the levels of folic acid, ferritin, and vitamin B12 among postpartum women aged 20 to 35 years admitted to a secondary care hospital in rural Ballabgarh, Haryana, India for observation post delivery.

Methods: Post-partum anaemic women who had a normal vaginal delivery and were confined for observation for 48 hours in the hospital ward. A semi-structured questionnaire was used to collect socio-demographic details. Point-of-care testing was done to screen for anaemia followed by venous sampling for ferritin, folate and vitamin B 12 estimation.

Results: A total of 100 anaemic post- partum women were studied. It was seen that 66% women were observed to be ferritin deficient, 58% women were folate deficient, and 24 % women had serum vitamin B12 levels between 203 and 159 pg/mL and 55% of the women had serum vitamin B12 levels less than 159 pg/mL. Dimorphic anaemia was found in 38% women, whereas 40% were deficient of ferritin and B12 levels.

Conclusion: There is a high prevalence of anaemia among post-partum women with iron, vitamin B 12 and folate deficiency being the most common causes.

Keywords: post-partum, anaemia, micronutrient deficiency ferritin, vitamin B12, Folate

Introduction

Anaemia is a severe public health problem, worldwide, especially among pregnant and lactating women. The

reported prevalence of postpartum anaemia is around 50.4% to 80% in lower and middle-income countries.¹ Postpartum anaemia is mostly caused by peripartum blood

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loss and raised iron demand for erythropoiesis during pregnancy.²

Postpartum anaemia affects health of both the mother as well as her child. Dizziness, weakness and dyspnoea in the mothers are few of the common manifestations with an overall poor quality of life for the mother. Postpartum anaemia is also associated with maternal infections, which may influence the ability to care for and bond with a newborn. It is also reported to lead to anaemia and poor cognitive development in children.³ Iron deficiency, followed by vitamin B12 deficiency and folate deficiency are important causes of anaemia, affecting pregnancy outcomes and is a crucial causal factor of maternal mortality in low- and middle-income countries.⁴ Iron supplementation in mothers has also been found to prevent iron deficiency in children. Infants obtain vitamin B12 and folate from breast milk.⁵ Vitamin B₁₂ in infants is essential for growth and cognitive development in children. Folic acid and vitamin B₁₂ deficiency among mothers may lead to deficiency in children leading to failure to thrive, developmental regression and neuropathy. Iron deficiency anaemia and ferritin level deficiency was reported to be prevalent in 40% of postpartum women.⁶ Studies have reported the prevalence of vitamin B₁₂ deficiency to range from 26% to 71%.^{7,8} where the prevalence of maternal plasma B12 insufficiency is 25.6%. Deficiency of vitamin B12 Folic acid, iron, and vitamin B₁₂ may co-exist and confer undesirable pregnancy results and further affects maternal health. Micronutrients are essential for maintaining normal cellular and molecular functions of the body. The Anaemia Mukh Bharat is the flagship programme launched by the government of India to detect and treat various causes of anaemia, especially nutritional anaemia in vulnerable population, including pregnant and lactating women. Iron and folic acid supplementation is carried out among antenatal and post-natal women as an interventional strategy.⁹ Apart from microcytic anaemia, due to iron deficiency, dimorphic anaemia due to folate and vitamin B 12 deficiency have been found to be common among adults.¹⁰ Post-partum women have been found to at a higher risk of iron, folate and other micronutrient deficiencies.¹¹ Thus, it is important to understand the pattern of micronutrient deficiencies among post-partum women so as to provide targeted interventions through various micronutrient supplementation.

The present study assessed the levels of folic acid, ferritin, and vitamin B₁₂ among postpartum women aged 20 to 35 years admitted to a secondary care hospital in rural Ballabgarh, Haryana, India for observation post delivery.

Materials and Methods

Study design

The study was a facility based cross –sectional study.

Study setting and study population

The study was conducted in the maternity ward of a secondary tier hospital in the Faridabad district of Haryana state, India. More than 4,000 deliveries are conducted at this hospital annually. After delivery, the mothers and the newborn are kept at the hospital for 48 hours for observation.

The current study included postpartum anaemic women, within 48 hour of delivery. All postpartum women with Hb level of 5–9.9 g/dl, who delivered a live baby through normal vaginal route, were included in the study. Women who were known cases of renal or hepatic impairment were excluded.

Sample size

The sample size was 102, taking the prevalence of ferritin deficiency to be 40%, a power of 80%, type one error of 5%, absolute error of 10% and a non-response rate of 10%.

Sampling strategy

Consecutive sampling was adopted for recruitment of participants. Postpartum women were included until the sample size was achieved.

Biochemical Assessment

The blood parameters measured included haemoglobin, serum ferritin, vitamin B12 and serum folate.

Study tools

A semi-structured and self-designed questionnaire was employed to collect participants' sociodemographic, marital, obstetric and menstrual history. As per standard guidelines, anthropometry (height and weight) were examined. A digital hemoglobinometer -HemoCue 201+ (HemoCue B-Hb photometer; Angelhom Sweden)¹² was used to measure the haemoglobin using the capillary blood method. The middle finger was pricked following aseptic conditions. The first drop of blood was discarded as it might be contaminated due to sloughing skin or tissue fluid and the second drop of blood was used for the microcuvette. The steps of haemoglobin measurement was carried out as described in the standard manual issued by the manufacturer. The haemoglobin estimation was carried out by staff who were trained for the estimation process. Venous blood sampling was performed for serum ferritin, folate, and vitamin B₁₂ level estimation and were measured

by employing Chemin Luminescence Immunosorbent Assay (CLIA) with the help of VITROS ECIQ- Immunodiagnostic System.¹³ Immunonephelometry method with the usage of Nephstar specific protein analyser was used to estimate the serum high CRP (hsCRP).¹⁴ Micronutrient testing was performed for all the selected 100 participants. On the basis of body mass index (BMI), all the participants were grouped to have underweight, normal weight, obesity, and class of obesity. To classify the BMI of participants, WHO Asian Adult BMI cutoffs¹⁵, age and gender specific extended International Obesity Task Force (IOTF) cutoff points¹⁶ were employed.

Operational Definitions

The haemoglobin (Hb) level <12 g/dL was opted to consider a participant as an anemic. Participants were categorised to have moderate and severe anemia, when Hb level was 8.0-10.9g/dl, and <8.0 g/dl, respectively. Participants were categorised to have ferritin deficiency if the levels were <15ug/L in the absence of inflammation hsCRP <3g/dL, and <70ug/L, when inflammation was present hsCRP >3g/dL. The cut-offs employed for vitamin B12 deficiency include levels less than 203 pg/mL as deficiency and 159 pg/mL as depleted.¹⁷ Folate and B12 deficiency were defined as serum folate and B12 levels of <6.8 nmol/L and <149.8 pmol/L, respectively.¹⁸ Anaemic participants were further classified, on the basis of micronutrient deficiency, into (a) iron deficiency anaemia – if only the serum ferritin level was low, (b) folate or B12 deficiency anaemia – a low folate or B12 level coupled with a normal ferritin level, (c) dimorphic anaemia – a low ferritin level with a low level of either folate or B12 level.

Various quality control measures were followed up in the present study. Interview schedule was deciphered into the native language (Hindi) and employed after pre-testing. Standard operating procedure (SOP) was designed for anthropometry, collection of blood sample, transportation, processing of samples, and storage for further experimental usage. The laboratory tests were carried out in National Accreditation Board for Hospitals (NABH) accredited labs

under AIIMS Delhi with internal and external quality control. All the diagnostic machines were calibrated as per need. Co-investigators performed cross verification of 5% of data entries randomly.

Statistical analysis

Data was collected through EpiCollect version 5 and analysed in StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC.¹⁹ The proportion of anaemia and micronutrient deficiencies were expressed through percentages and 95% confidence interval. Logistic regression was done to find an association between anaemia and independent variables. A p-value of less than 0.05 was taken to be statistically significant.

Ethical Considerations

The study was conducted after approval from the Institute Ethics Committee of AIIMS, New Delhi. Participant information sheet was explained to the participants in local language, and informed written consent was obtained.

Results

A total of 100 postpartum women were included in the study. The mean age of the postpartum women was observed to be 24 ± 3.0 years. The age of the women ranged from 18 to 30 years with one women aged more than 30 years. One-fourth of the participants (24%) delivered a low birth weight (< 2500g) baby. Multiparous women constituted 63.4% of the study participants. Mean weight of the women was 51.6 ± 8.7 Kg. All the women included in the study were anaemic with a mean haemoglobin of 8.4 ± 1.1 g/dL, 72.3% moderate anaemic and 28 women (27.7%) severely anaemic. (Table 1)

It was seen that 66% women were ferritin deficient, 58% women were folate deficient, and 24 % women had serum vitamin B₁₂ levels between 203 and 159 pg/mL and 55% of the women had serum vitamin B₁₂ levels less than 159 pg/mL. Dimorphic anaemia was found in 38% women, whereas 40% were deficient of ferritin and B₁₂ levels (Table 2). The haemoglobin ranged from 5.8 to 9.8 g/dL. (Table 2)

Table I. Distribution of study participants by socio-demographic and other baseline characteristics

(n=100)

Variables	Total number of participants n (%)
Years	-
18-25	69 (69)
26-30	30 (30)
31-35	01 (01)
Parity	-
1	37 (37)
2	31 (31)

3	28 (28)
4	04 (04)
Nutritional status (BMI kg/m²)	-
Underweight (< 18.5)	14 (14)
Normal weight (18.5-24.9)	66 (66)
Overweight (25-29.9)	18 (18)
Class of obesity (30-34.9)	02 (02)
Birth weight of newborns (grams)	-
< 2500	24 (24)
≥ 2500	76 (76)

Table 2. Distribution of participants by anaemia and based on deficiencies of micronutrients

(n=100)

Variables	Total number of participants n (%)
Anaemia	-
Present	100
Absent	-
Micronutrient deficiency	-
Ferritin deficiency	66 (66)
Folate deficiency	58 (58)
Vitamin B ₁₂ deficiency	79 (79)
Ferritin and Folate	38 (38)
Ferritin and B ₁₂	40 (40)
Folate and B ₁₂	38 (38)
Ferritin, Folate, and B ₁₂	38 (38)

Discussion

The current study assessed the pattern of anaemia and various micronutrient deficiencies- iron, folate and vitamin B12 deficiency anaemia, among anaemic post-partum women confined to the ward for observation in a secondary care hospital of rural Haryana. Almost 50 to 80 percent of post-partum women have been found to have anaemia posing a significant health problem.²⁰ In the study, of the 100 women studied, 66% were found to have ferritin deficiency. It has been believed that about half of anaemia cases are due to iron deficiency.²¹ Iron supplementation is a mainstay of interventional strategy under the Anemia Mukh Bharat to target the most common cause of anaemia, iron deficiency. Previous studies have reported 29.2 % to 33.4% of post-partum women to be ferritin deficient in both high and low income countries, which is lower than the proportion of ferritin deficiency reported in the present study. A few studies reported 66% of the enrolled women to be ferritin deficient after 48h of delivery.^{22,23}

Of all the participants, 79% were found to have vitamin B12 deficiency which is comparable to the previously reported

studies (75%).²⁴ The changes in total vitamin B12 levels are due to physiological changes rather than a state of reported vitamin B12 deficiency. There is a shift toward the metabolically active vitamin B12 (holoTC) in post-partum women leading to insufficient available total vitamin B12. The levels of vitamin B12 secreted in breast milk are also reported to be low.²⁵ Folate deficiency, more common in the post-partum period due to the increased demands of the mother and the fetus was found to occur in 58% of the participants. It is much higher than reported prevalence of 10.2% in existing studies.²⁶ Vitamin B12 and folate levels have been found to be deficient in Indian population, the most probable reason being the predominantly vegetarian diet adopted by the population.²⁷ Iron folate supplementation is a mainstay of antenatal care in India and high levels of anaemia suggests the necessity of ensuring adherence to the supplementation.²⁸

Finally, almost 38% of the participants were deficient in all three parameters highlighting the need for monitoring the nutritional status of women in the post partum period, and ensuring adherence to IFA supplementation in the

post-partum period. Studies among young women, in the community settings have shown similar prevalence of micronutrient deficiencies with almost all participants not having adequate dietary diversity.²⁹ impacting their health, education, and offspring. Despite ongoing efforts, a comprehensive understanding of anaemia remains limited.

Limitations of the study include the cross-sectional design of the study. Further studies comparing the levels of haemoglobin, ferritin, folate and vitamin B12 immediate before and after delivery can help to understand and track the depletion of the micronutrient store during delivery. A study in the community based settings shall provide a more complete picture to the changes in the micronutrient levels post discharge from the hospital due to the interplay of a multitude of social and biological factors.

Conclusion

There is a high prevalence of anaemia among post-partum women with iron, vitamin B 12 and folate deficiency being the most common causes. Ensuring adherence to the existing supplementation programme and focus on dietary counselling may lead to improvement in this vulnerable physiological state and ensure better outcomes for both the mother and the child.

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Conflict of interest: None of the authors have any conflict of interest to declare

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