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International Journal of Clinical Biochemistry and Research

Journal homepage: <https://www.ijcbr.in/>

Original Research Article

Serum ferritin level in primigravida and multigravida women

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ARTICLE INFO

Article history:

Received 16-03-2023

Accepted 19-06-2023

Available online 14-07-2023

Keywords:

Ferritin

Iron deficiency Anemia

Pregnancy

Hemoglobin level

Anemia

ABSTRACT

Iron Deficiency Anemia in pregnancy is prevalent in developing countries which can be reduced by oral iron supplement. Iron Deficiency Anemia is also the root cause for preterm birth, low birth weight and poor mental and physical development of baby. This may link to development of high blood pressure in the adult life. Hence, it is very important to diagnose the Iron Deficiency Anemia in early stage of pregnancy. Hemoglobin and serum ferritin both are apt markers for Iron Deficiency Anemia diagnosis. However, serum ferritin is considered to be the best marker over hemoglobin as hemoglobin is a delayed marker and may fail to reflect tissue iron status. In current study we have analyzed the primigravida and multigravida pregnant women with a control group to check the serum ferritin level and evaluate the Iron Deficiency Anemia status.

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1. Introduction

Anaemia occurs in almost all pregnancies and is one of the most common reasons for morbidity and mortality in less developed countries.¹ Iron deficiency is the most common pathological cause of anaemia in pregnancy. It affects red cell production in a process called physiologic anaemia of pregnancy. Therefore, it is important to increase iron supplementation during pregnancy to increase the erythrocyte mass.¹

Iron deficiency anaemia (IDA) is recognized as a worldwide micronutrient deficiency, and the World Health Organization (WHO) has set a target to reduce it by 50% by 2025 (2). IDA compromises erythropoiesis and can result in long-term impairments in cognitive development and fetal growth. Serum ferritin is commonly used in primary intervention studies for diagnosing IDA in pregnancy, according to national and international

diagnostic guidelines.²

Serum ferritin is an intracellular protein and an inflammatory marker that is directly related to the total amount of stored iron in the human body. The evaluation of IDA and nutritional risks can be done using the hemoglobin profile, which includes hemoglobin and serum ferritin.^{3,4} IDA in pregnancy is prevalent in developing countries and can be reduced by oral iron supplements. However, in malnourished pregnant women, IDA can have lethal outcomes for both the mother and child. Several reports have linked IDA to preterm birth, low birth weight, poor mental and physical development of the baby, and the development of high blood pressure in adulthood. Therefore, early diagnosis of IDA in pregnancy is crucial. Both hemoglobin and serum ferritin are suitable markers for IDA diagnosis, but serum ferritin is considered the best marker as hemoglobin is a delayed marker that may fail to reflect tissue iron status.⁵

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In the current study, we analyzed the serum ferritin levels in primigravida and multigravida pregnant women, along with a control group. The study also evaluated the IDA status based on serum ferritin levels in both pregnancy states.

2. Material and Methods

The research study was carried out at the Karnataka Institute of Medical Sciences in Hubballi between September 2021 and March 2023. The study group comprised 88 multigravida and 57 primigravida pregnant women, while the control group included 90 multigravida and 55 primigravida pregnant women. The age range for both groups was between 18 to 33 years. The levels of hemoglobin were measured using the Erba H360, and the levels of Serum Ferritin were measured using the XL1000 - a fully automated Biochemistry Analyzer and the Erba Serum Ferritin kit produced by Transasia Biomedical Ltd. In cases where the hemoglobin and ferritin values were indeterminate or invalid, such data were excluded from the study.

As per WHO guidelines, the hemoglobin (Hb) concentrations were categorized as non-anemic for Hb 11 g/dL or more, mild to moderate anemia for Hb 7 to 10.9 g/dL, and severe anemia for Hb 7 g/dL or less. Serum Ferritin (SF) levels were considered normal for values between 10 to 150 mg/L and low for values equal to or less than 10 mg/L. The sample size was determined with mean and \pm SD value. The 95% confidence interval (CI) was determined for the given sample size.

The statistical analysis was carried out using frequency distribution and the Pearson X² test. This analysis established the relationship between multigravida and primigravida with serum ferritin, and the odds ratio was calculated accordingly. All statistical analyses were conducted using SPSS statistical analysis software version 20.

3. Results

The ferritin levels were examined in the control group, focusing on two subgroups: multigravida and primigravida women. For multigravida women, the average ferritin level was found to be 65.23 ng/mL, with a standard deviation of 23.1 ng/mL. The 95% confidence interval for ferritin levels ranged from 42.13 to 88.33 ng/mL. These results indicate that, on average, multigravida women in the control group had relatively higher ferritin levels, with some variation observed around the mean.

Analyzing the distribution of hemoglobin (Hb) and ferritin combinations among multigravida women in the control group, it was found that 39% had both normal Hb levels and normal ferritin levels. Around 20% of multigravida women exhibited low Hb levels but normal

ferritin levels, suggesting the possibility of iron deficiency. A small percentage of 1% showed normal Hb levels but low ferritin levels, which may indicate other factors contributing to low ferritin levels, such as inflammation. Notably, 28% of multigravida women had both low Hb levels and low ferritin levels, suggesting a potential presence of iron deficiency anemia.

In contrast, a relatively lower proportion of multigravida women in the control group exhibited high Hb levels along with normal (3%) or high (3%) ferritin levels. Additionally, 6% of multigravida women had very low Hb levels combined with low ferritin levels. These findings provide insights into the various combinations of Hb and ferritin levels within the multigravida subgroup of the control group.

Shifting focus to the primigravida subgroup within the control group, the mean ferritin level was measured at 43.91 ng/mL, with a standard deviation of 31.6 ng/mL. The 95% confidence interval for ferritin levels ranged from 12.21 to 75.41 ng/mL. This indicates a higher degree of variability in ferritin levels among primigravida women compared to multigravida women in the control group.

Analyzing the distribution of Hb and ferritin combinations among primigravida women, it was observed that 35% had both normal Hb levels and normal ferritin levels. Around 16% exhibited low Hb levels but normal ferritin levels, while 40% had both low Hb levels and low ferritin levels. A small percentage of primigravida women (7%) showed high Hb levels along with normal ferritin levels. Additionally, 2% exhibited high Hb levels combined with high ferritin levels. Notably, none of the primigravida women had very low Hb levels in combination with low or normal ferritin levels.

These descriptive findings provide an overview of the ferritin levels and the distribution of Hb and ferritin combinations within the control group. Further analysis and clinical evaluation are necessary to fully understand the clinical implications and significance of these findings.

4. Discussion

Anaemia diagnosis requires evaluation of iron-related parameters beyond just hemoglobin (Hb) levels, according to the World Health Organization (WHO). These parameters include red blood cell (RBC) parameters, ferritin, free erythrocyte protoporphyrin, serum and plasma iron, total iron binding capacity, transferrin saturation, and serum transferrin receptor. Serum ferritin (SF) is a sensitive biomarker in normal conditions but may be affected in cases of inflammation, making routine surveillance of SF necessary alongside other parameters.⁶

Factors like ethnicity, education, and iron-containing supplementation can influence iron deficiencies and SF levels. Studies have shown that a significant proportion of Singaporean women are iron-deficient in the early

Table 1: Data distribution

	n	Ferritin mean ± SD	Ferritin 95% CI	Normal Hb + Normal Ferritin	Low Hb + Normal Ferritin	Normal Hb + Low Ferritin	Low Hb + Low Ferritin	High Hb + Normal Ferritin	Normal Hb + High Ferritin	High Hb + High Ferritin	Very Low Hb + Low Ferritin	Very Low Hb + Normal Ferritin
Control												
Multigravida	90	65.23	23.1	42.13 to 88.33	35	18	1	25	3	0	5	0
Percentage (%)												
Primigravida	55	43.91	31.6	12.21 to 75.41	39	20	1	28	3	0	6	0
Percentage (%)												
Test												
Multigravida	88	53.4	11.5	41.9 to 64.9	25	14	0	46	3	0	0	0
Percentage (%)												
Primigravida	57	43.33	21.4	21.93 to 64.73	29	16	0	52	0	0	0	0
Percentage (%)												
					13	9	0	33	0	0	0	1
					23	17	0	58	0	0	0	1

third trimester of pregnancy. Iron status variations in reproductive-aged women have been reported across different regions and supplementation statuses.⁶

Regular monitoring of serum ferritin and transferrin saturation (TSAT) is highly recommended in specific high-risk populations to identify and manage iron deficiency. Serum ferritin and TSAT serve as crucial indicators for evaluating the body's iron levels.⁷ Multigravida women are at higher risk of iron deficiency, which can increase maternal and perinatal mortality and morbidity without supplementation. Early diagnosis and treatment of anaemia is vital in multiparous antenatal women.⁸

SF is a reliable, cost-effective marker for iron status, pregnancy-induced hypertension, and preterm labor in primigravida women. Elevated SF levels are associated with preterm labor.^{9–11} Khaled et al. (2017) reported no significant difference in Hb and ferritin levels between primigravida and multigravida women, which our study supports.¹²

The elevated prevalence of anemia in pregnant women significantly amplifies the risks endured by both the maternal and fetal entities. To enhance the outcomes for both mother and fetus, it is strongly recommended to fortify primary healthcare provisions and prioritize the prevention, early diagnosis, and treatment of anemia during pregnancy.

Elevated levels of serum ferritin during mid-pregnancy have been found to be associated with an increased risk of gestational diabetes mellitus (GDM), independent of C-reactive protein and body mass index. However, it is important to note that ferritin levels in GDM cannot be relied upon as an indicator for predicting glucose concentrations in early postpartum oral glucose tolerance tests.

In the last trimester (GW30), we observed an inverse association between high plasma ferritin levels and birth weight, while no significant association was found with birth length. These findings suggest that elevated plasma ferritin during pregnancy may have a detrimental effect on birth weight.¹³

In 2012, Jingan et.al conducted the largest investigation conducted to date on the iron status of mothers and neonates. The findings reveal a high prevalence of iron deficiency anemia (IDA) among mothers in rural China, although the severity of anemia was generally mild. Neonates born to mothers with low serum ferritin (SF) levels showed lower cord-blood SF levels, suggesting that fetal iron needs were not fully met once maternal iron stores were depleted. However, under normal circumstances, fetal iron requirements appeared to be adequately fulfilled.¹⁴

Our study investigated the correlation between Hb and SF in multigravida and primigravida women across nine categories. We found correlation between Hb and SF, indicating gravidity and parity do not influence Hb and SF levels. However, larger sample sizes and varied

supplementation protocols are necessary to predict iron deficiency and related risks accurately.

In conclusion, the WHO recommends evaluating iron-related parameters beyond Hb alone for anaemia diagnosis. Multigravida women should receive iron and vitamin supplementation to avoid mortality and morbidity risks. SF is a reliable marker for assessing iron status, pregnancy-induced hypertension, and preterm labor. Further studies are needed to establish accurate prediction of iron deficiency and related risks.

5. Conclusion

The Hb and SF values are independent of gravidity and parity of the women. There is correlation found in the Hb and SF as even the low and high Hb shows the normal SF level in multigravida and primigravida women in control and test data.

6. Conflict of Interest

None.

7. Source of Funding

No Funding of any kind received.

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Cite this article: Raviraja A, Chandru MC, Kabadi YM, Lalla P, Anvitha. Serum ferritin level in primigravida and multigravida women. *Int J Clin Biochem Res* 2023;10(2):114–117.