

**A Cross-Sectional Study To Compare Serum Ferritin Level in Women With Preterm and Term Labour in Department of Obstetrics and Gynecology**

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**Abstract**

**Background:** Preterm labor, a leading cause of neonatal morbidity and mortality, often results from multifactorial mechanisms including infection and inflammation. Elevated maternal serum ferritin, an acute-phase reactant, may indicate subclinical infection and predict preterm delivery. Understanding its association with adverse outcomes can aid early identification and timely intervention in at-risk pregnancies.

**Aim:** to compare serum ferritin level in women with preterm labour and women with term labour.

**Results:** serum ferritin levels were significantly higher in preterm women ( $73.88 \pm 35.07$  ng/ml) than term ( $33.18 \pm 19.84$  ng/ml;  $p < 0.001$ ), correlating with prom  $> 12$  hours, low apgar, higher nicu admissions, and neonatal mortality. Roc analysis (AUC = 0.829) showed strong diagnostic accuracy, with a 28.4 ng/ml cutoff yielding 88% sensitivity and 80% specificity, confirming ferritin as a reliable predictor of preterm birth.

**Methods:** this cross-sectional study was conducted at the department of obstetrics and gynaecology, SMS medical college, Jaipur. One hundred women were divided into preterm (n=50) and term (n=50) groups. Serum ferritin levels were measured using an immunoturbidimetric method and correlated with maternal and neonatal outcomes. Data were analyzed using appropriate statistical tests.

**Conclusion:** serum ferritin levels were significantly elevated in preterm labor, correlating with adverse neonatal outcomes such as low apgar scores, increased nicu admissions, and higher mortality. Roc analysis confirmed ferritin’s predictive value, suggesting it as a reliable biomarker for early detection of preterm risk. Larger studies are needed to validate these findings.

**Keyword:** Preterm Labor, Gestation, Serum Ferritin Level, Neonatal Mortality, Obstetrics, Term Labour, Cross-Sectional Study.

## Introduction

Preterm labor (PTL) is defined as the onset of regular uterine contractions before 37 weeks of gestation, with intact membranes and cervical dilation  $\geq 2$  cm (ACOG, FIGO) or  $\geq 1$  cm (NICE, RCOG).<sup>1</sup> It remains a major obstetric challenge, accounting for over 80% of neonatal deaths and half of long-term morbidities among survivors.<sup>2</sup> Globally, around 15 million babies are born prematurely each year, with approximately 1 million neonatal deaths attributed to related complications (WHO). The incidence of preterm birth in India is about 18%, significantly higher than the 10–12% observed in developed nations, contributing notably to neonatal mortality. PTL leads to severe neonatal complications such as respiratory distress, sepsis, intraventricular hemorrhage, and prolonged NICU stays.

Pregnancy predisposes women to vaginocervical infections due to altered vaginal pH, allowing bacterial colonization at the chorion-decidual interface, which triggers macrophage infiltration and ferritin production as an acute-phase reactant.<sup>3</sup> PTL is multifactorial, influenced by prior preterm delivery, vaginal bleeding, anemia, low weight gain, and uterine or cervical abnormalities. Pre-labor rupture of membranes (PROM) is a major cause of PTL, often associated with subclinical infections that induce prostaglandin synthesis and cervical ripening.<sup>4</sup>

Pathophysiologically, PTL may arise from inflammation, hormonal activation, decidual hemorrhage, or uterine over distension, though the exact molecular pathways remain unclear.<sup>5</sup> Various biochemical markers such as fetal fibronectin, cervicovaginal hCG, maternal CRH, and AFP have been studied for predicting PTL, often linked to subclinical infections and elevated serum ferritin. Ferritin acts as both an iron-storage and acute-phase protein, increasing during inflammation.<sup>6</sup>

Discovered in 1937, ferritin's ability to store up to 4,000 iron atoms makes it vital for iron metabolism. It is found in multiple cellular compartments and has diverse biological functions. Ulmer et al.<sup>7</sup> first reported low ferritin levels linked with preterm labor, though later studies found elevated mid-trimester ferritin predictive of preterm birth. A prior institutional study also showed significantly higher ferritin levels in preterm labor cases.<sup>8</sup> This study Aims to compare serum ferritin level in women with preterm labour and women with term labour.

## Materials and Methods

**Study Type and Design:** Comparative cross-sectional study.

**Study Setting:** Department of Obstetrics and Gynaecology, SMS Medical College and Affiliated Hospitals, Jaipur.

**Study Duration:** From July 2023 onwards. Data collection began after Ethics Committee approval (October 2023) and continued until the required sample size was achieved, followed by two months of data compilation and statistical analysis.

**Study Universe:** All women attending the labour room at SMS Medical College and affiliated hospitals.

**Study Population:** All pregnant women fulfilling the inclusion criteria.

**Ethics Clearance:** Approval obtained from the Institutional Review Board and Ethics Committee before study initiation.

**Sample Size:** A total of 100 participants (50 in each group). Calculated based on a previous study showing a minimum detectable mean serum ferritin difference of 11.8 with SD 20.2, 95% CI, and 80% power.

**Inclusion Criteria:** Women with a single live pregnancy beyond 24 weeks of gestation, who provided written

informed consent and were not participating in any other research study, were included.

**Exclusion Criteria:** Women with medical disorders (liver, renal, cardiac diseases, diabetes, anemia, chronic infections), conditions causing preterm labor (polyhydramnios, preeclampsia, placenta previa), fetal malformations, raised ferritin conditions (RA, thalassemia, hyperthyroidism), or history of alcohol, smoking, or drug abuse were excluded.

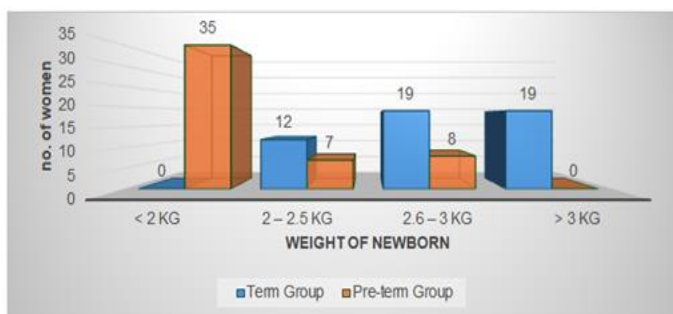
**Methodology:** Participants were divided into two groups: Group 1 – Preterm labor (n=50) and Group 2 – Term labor (n=50). Serum ferritin was analyzed using the particle-enhanced immunoturbidimetric method, and hemoglobin spectrophotometrically.

**Statistical Analysis:** Data were entered in Excel, expressed as mean  $\pm$  SD or percentages, analyzed using appropriate tests, with  $p < 0.05$  considered statistically significant.

**Results & Observations**

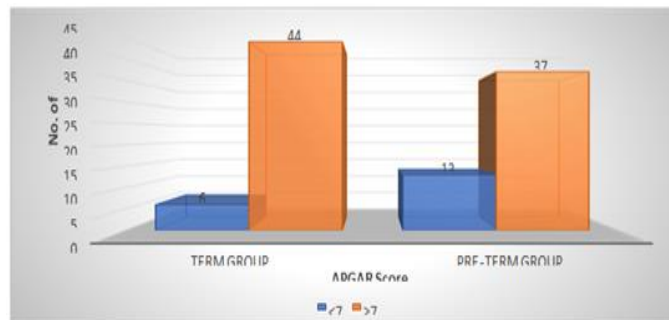
Most women were aged 26–35 years (term 58%, preterm 60%), urban (66%, 72%), Hindu (72%, 80%), and had comparable mean age ( $26.18 \pm 3.68$  vs  $26.22 \pm 4.46$ ;  $p = 0.96$ ). BMI was higher in preterm ( $30.15 \pm 0.67$  vs  $25.21 \pm 0.61$ ;  $p < 0.05$ ). Serum ferritin was significantly higher in preterm ( $73.88 \pm 35.07$  vs  $33.18 \pm 19.84$ ;  $p < 0.001$ ), correlated with PROM, lower APGAR, NICU admission, and neonatal mortality ( $p = 0.001$ ), indicating strong association with preterm birth outcomes.

Figure 1: Distribution of study population according to weight of new born.



Among term newborns, all weighed above 2 kg, with 38% each in the 2.6–3 kg and >3 kg ranges. In contrast, 70% of pre-term newborns weighed <2 kg, and few weighed 2–3 kg. The mean birth weight was significantly higher in term ( $2.87 \pm 0.39$  kg) than pre-term ( $1.62 \pm 0.62$  kg) groups ( $p < 0.0001$ ).

Figure 2: APGAR Scores of neonates in two groups.



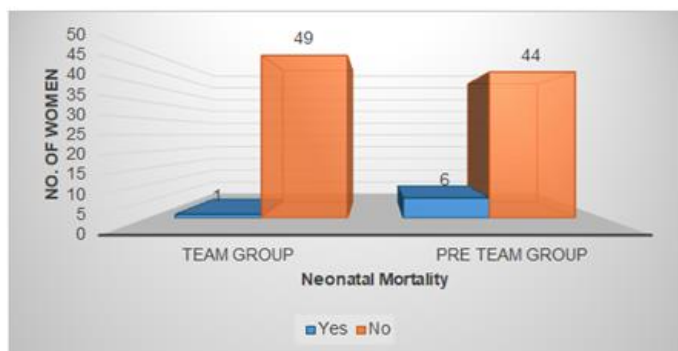
Most neonates in both groups had APGAR scores  $\geq 7$  (88% term, 74% pre-term). Low scores (<7) were more frequent in pre-term neonates (26%) than term (12%). The mean APGAR score was significantly higher in the term group ( $7.12 \pm 0.71$ ) than pre-term ( $6.6 \pm 0.8$ ;  $p = 0.008$ ).

Figure 3: NICU Admission of Neonates in two groups.



The distribution of study population according to NICU Admission, the majority of neonates in both groups did not require NICU admission (98% in the term group and 86% in the pre-term group). However, NICU admissions were more frequent among pre-term neonates (14%) compared to term neonates (2%). This difference was found to be statistically significant ( $p = 0.02$ ).

Figure 4: Neonatal Mortality in the two groups.



The distribution of study population according to Neonatal Mortality, neonatal mortality was observed in 12% of pre-term neonates compared to only 2% of term

neonates. The majority of neonates survived in both groups (98% in the term group and 88% in the pre-term group). The difference in neonatal mortality between the two groups was statistically significant ( $p = 0.02$ )

Table 1: Distribution of Study Population According to Serum Ferritin Levels

Serum Ferritin (ng/ml)	Serum Ferritin Levels			
	Term Group		Pre-term Group	
	No. of Women	Percentage	No. of Women	Percentage
≤30	19	38	2	4
31–40	11	22	4	8
41–50	5	10	4	8
51–60	7	14	14	28
>60	8	16	26	52
Total	50	100	50	100
Mean±SD	33.18±19.84		73.88±35.07	
P-Value	<0.001			

The study showed significantly higher serum ferritin levels in the pre-term group ( $73.88 \pm 35.07$  ng/ml) than in the term group ( $33.18 \pm 19.84$  ng/ml). Most pre-term

women had ferritin > 60 ng/ml (52%), whereas 38% of term women had ≤ 30 ng/ml. The difference was highly significant ( $p < 0.001$ ).

Table 2: Correlation of Serum Ferritin Levels with Duration of PROM in Term and Pre-term Groups

Group	Duration of PROM	No. of Women	Percentage	Serum Ferritin Levels	P-Value
				Mean±SD	
Term Group	≤12 hours	8	40	33.12±23.9	0.99
	>12 hours	12	60	33.23±17.05	
Pre-term Group	≤12 hours	10	28.57	45.19±35.38	0.01
	>12 hours	25	71.43	69.79±36.31	

In term pregnancies, serum ferritin levels showed no significant difference between PROM ≤12 hours and >12

hours ( $p = 0.99$ ). However, in pre-term pregnancies, ferritin levels were significantly higher in cases with

PROM >12 hours ( $69.79 \pm 36.31$  ng/ml) than  $\leq 12$  hours ( $45.19 \pm 35.38$  ng/ml;  $p = 0.01$ ), indicating prolonged

PROM elevates ferritin.

Table 3: ROC Analysis of the Serum Ferritin for the prediction of term/preterm pregnancy

ROC Analysis	
AUC	0.829
P-Value	<0.0001
95% CI	0.750-0.909
Cutoff Value	28.4
Sensitivity	88
Specificity	80

ROC analysis showed serum ferritin as a strong predictor of preterm delivery, with an AUC of 0.829 (95% CI: 0.750–0.909), indicating good diagnostic accuracy. The optimal cutoff of 28.4 ng/ml yielded 88% sensitivity and 80% specificity ( $p < 0.0001$ ), highlighting its value as a reliable biomarker for preterm prediction.

### Discussion

Preterm labour, a major pregnancy complication, accounts for over 80% of neonatal deaths and 50% of long-term morbidity.<sup>2</sup> Pregnancy alters vaginal pH, predisposing to infections where ferritin acts as an acute phase reactant.<sup>3</sup> This cross-sectional study compares serum ferritin levels in preterm and term labour at the Department of Obstetrics and Gynaecology.

This study shows the distribution of newborn weight among term and preterm groups. Term neonates had a significantly higher mean birth weight ( $2.87 \pm 0.39$  kg) than preterm neonates ( $1.62 \pm 0.62$  kg;  $p < 0.0001$ ). Similarly, Alrasheed N A J et al<sup>9</sup> reported  $2.08 \pm 0.16$  kg vs  $2.91 \pm 0.46$  kg, and Abdul Hamid N A et al<sup>10</sup> found  $2.5 \pm 0.5$  kg vs  $3.01 \pm 0.4$  kg, both showing significant differences.

Most neonates had APGAR  $\geq 7$  (88% term; 74% preterm). Mean APGAR was higher in term ( $7.12 \pm 0.71$ ) than preterm ( $6.6 \pm 0.8$ ;  $p = 0.008$ ). Alrasheed N A J et

al<sup>9</sup> reported lower preterm scores (1 min:  $6.52 \pm 1.22$ ; 5 min:  $6.96 \pm 1.28$ ) compared to term (1 min:  $7.62 \pm 1.63$ ; 5 min:  $9.28 \pm 1.37$ ;  $p < 0.0001$ ). Bhattacharjee S et al<sup>11</sup> similarly found 26% of preterm and 12% of term neonates with APGAR  $< 7$ , supporting the present study findings.

Most neonates did not require NICU care (98% term; 86% preterm). NICU admissions were higher in preterm (14%) than term (2%) neonates ( $p = 0.02$ ). Hassan A M et al<sup>12</sup> found 49.4% of 692 NICU admissions were preterm, while Schimmel D et al<sup>13</sup> reported only 2.75% term admissions among 192,527 neonates, showing higher vulnerability of preterm infants. Ferritin was elevated in NICU-admitted preterm neonates ( $p = 0.001$ ). Neonatal mortality was higher among preterm neonates (6%) compared to term neonates (0%), indicating a significant difference ( $p < 0.05$ ). Similarly, Hassan A M et al<sup>12</sup> reported increased mortality among preterm infants admitted to NICU (12%) versus term (2%), while Schimmel D et al<sup>13</sup> observed mortality of 5.8% in preterm and 0.3% in term neonates, emphasizing greater vulnerability and poorer outcomes in preterm births.

This study found significantly higher mean serum ferritin levels in preterm women ( $73.88 \pm 35.07$  ng/ml) than in term women ( $33.18 \pm 19.84$  ng/ml,  $p < 0.001$ ). Similarly,

Alrasheed N A J et al<sup>9</sup> reported elevated ferritin in preterm deliveries ( $32.5 \pm 5.04$  ng/ml) versus term ( $26.84 \pm 6.05$  ng/ml), while Kundu P R et al<sup>14</sup> observed markedly higher ferritin in preterm ( $89.09 \pm 106.07$  ng/ml) compared to term ( $32.13 \pm 31.40$  ng/ml,  $p = 0.004$ ), confirming a strong association.

This study found serum ferritin levels inversely correlated with gestational age, being higher in preterm ( $85.24 \pm 31.08$  ng/ml) than term ( $33.18 \pm 19.84$  ng/ml) women. Similarly, Omran A A et al<sup>15</sup> reported elevated ferritin in preterm ( $72.54 \pm 15.78$  ng/ml) versus term ( $23.88 \pm 18.82$  ng/ml,  $p < 0.001$ ), while Kumari S et al<sup>16</sup> also observed higher ferritin in preterm pregnancies ( $71.5 \pm 14.8$  ng/ml) than term ( $20.7 \pm 12.9$  ng/ml), confirming an inverse relationship.

The ROC analysis showed that serum ferritin effectively differentiates term from preterm pregnancies (AUC = 0.829, 95% CI: 0.750–0.909; cutoff = 28.4 ng/ml; sensitivity = 88%, specificity = 80%;  $p < 0.0001$ ). Similarly, Abdel-Malek K et al<sup>17</sup> found a cutoff of 31 ng/ml with 92.8% sensitivity and 99.4% specificity, while Alrasheed N A J et al<sup>9</sup> reported AUC 0.756,  $\geq 30$  ng/ml cutoff, 72% sensitivity, and 62% specificity, confirming ferritin's predictive value for preterm birth.

### Conclusion

The study concludes that serum ferritin levels are significantly higher in preterm labor, correlating with lower APGAR scores, increased NICU admissions, and adverse outcomes. Clinical factors like gestational age, BMI, and birth weight were linked to preterm delivery. ROC analysis confirmed ferritin's predictive value, suggesting its usefulness as an early biomarker.

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