

EARLY PREGNANCY SERUM FERRITIN IN THE NON-ANEMIC PATIENT AS A PREDICTOR OF ANEMIA AT DELIVERY

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Introduction

- Iron deficiency anemia in pregnancy is associated with poor obstetric outcomes:^{1,2}
 - Low birth weight
 - Preterm delivery
 - Perinatal mortality
 - Postpartum depression
- Non-anemic iron deficiency (NAID), defined by low serum ferritin with a normal serum hemoglobin, has been recently recognized as a precursor to iron deficiency anemia.³
- Threshold values for low ferritin or iron stores are poorly studied in pregnancy.⁴

Objectives

Determine the association between an early pregnancy ferritin level in the non-anemic patient and its prediction of anemia at delivery.

Study Design

- Prospective observational pilot study October 2020 – June 2021
- Inclusion criteria:
 - Non-anemic (Hgb \geq 11 g/dL), singleton pregnancies up to 23 weeks GA
- Exclusion criteria:
 - Multifetal gestation, iron supplementation outside of prenatal vitamin, vaginal bleeding, chronic illness, hemoglobinopathies, prior bariatric surgery, COVID infection within 3 months
- Iron studies (ferritin, transferrin, Fe, TIBC) collected
- De-identified specimens, results blinded to providers & not available in medical record
- Primary outcome:**
 - Anemia (Hgb < 11) at admission for delivery
- Statistical analysis: Student's t-test or Wilcoxon-rank test, Chi square, Receiver Operator Characteristic (ROC) curve, logistic regression model, $p < 0.05$ significant

Results

- 105 women were enrolled and 98 delivered at our institution with 22 (22%) developing anemia at admission for delivery. An ROC curve identified an early ferritin value \leq 26.4 micrograms/L in prediction of anemia (AUC=0.74; $p < 0.001$).
- Patients were divided into low ferritin (n=37) and normal ferritin (n=68) groups within the identified cutoff.
- Groups were similar in age, race, parity, obesity, and 1st trimester hemoglobin.
- Median gestational age at enrollment was 15 weeks with mean ferritin values of 17.0 ± 4.9 and 70.5 ± 8.4 micrograms/L, for low and normal ferritin, respectively ($p < 0.001$).
- The low ferritin group had lower mean hemoglobin values in the third trimester (10.9 ± 1.1 vs 11.6 ± 0.9 g/dL, $p=0.01$) and at admission (11.5 ± 1.1 vs 12.1 ± 1.1 g/dL, $p=0.007$) with a higher rate of anemia in the 3rd trimester (62% vs 19%, $p=0.002$) and at admission for delivery (43% vs 11%, $p=0.0004$).
- With multivariate logistic regression, only ferritin \leq 26.4 micrograms/L was an independent predictor of anemia at admission (OR 5.12, 95% CI 1.7-15.4; $p=0.003$).

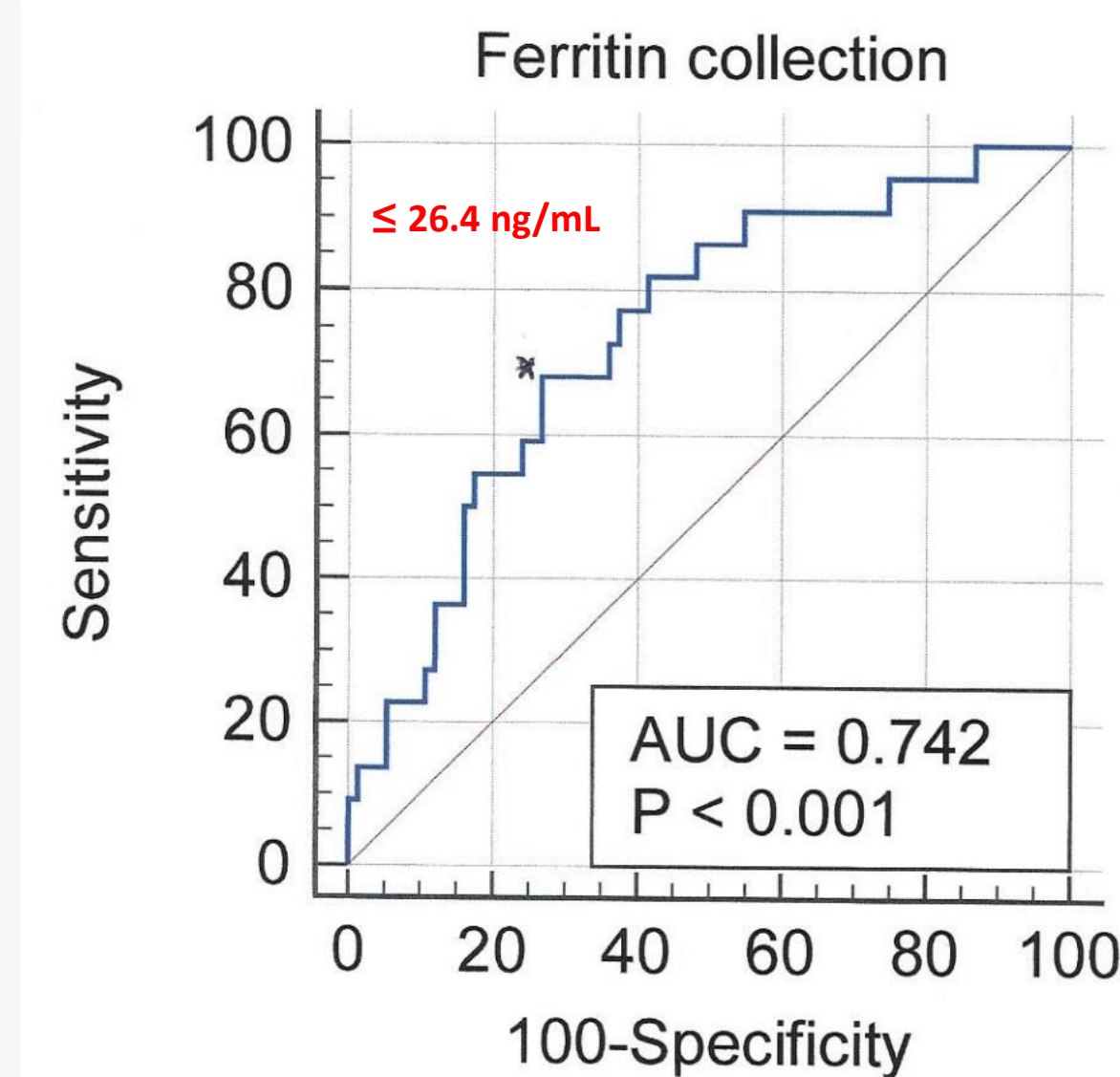


Figure 1. ROC curve showing optimal early ferritin value in prediction of Hb < 11 g/dL in 3rd trimester

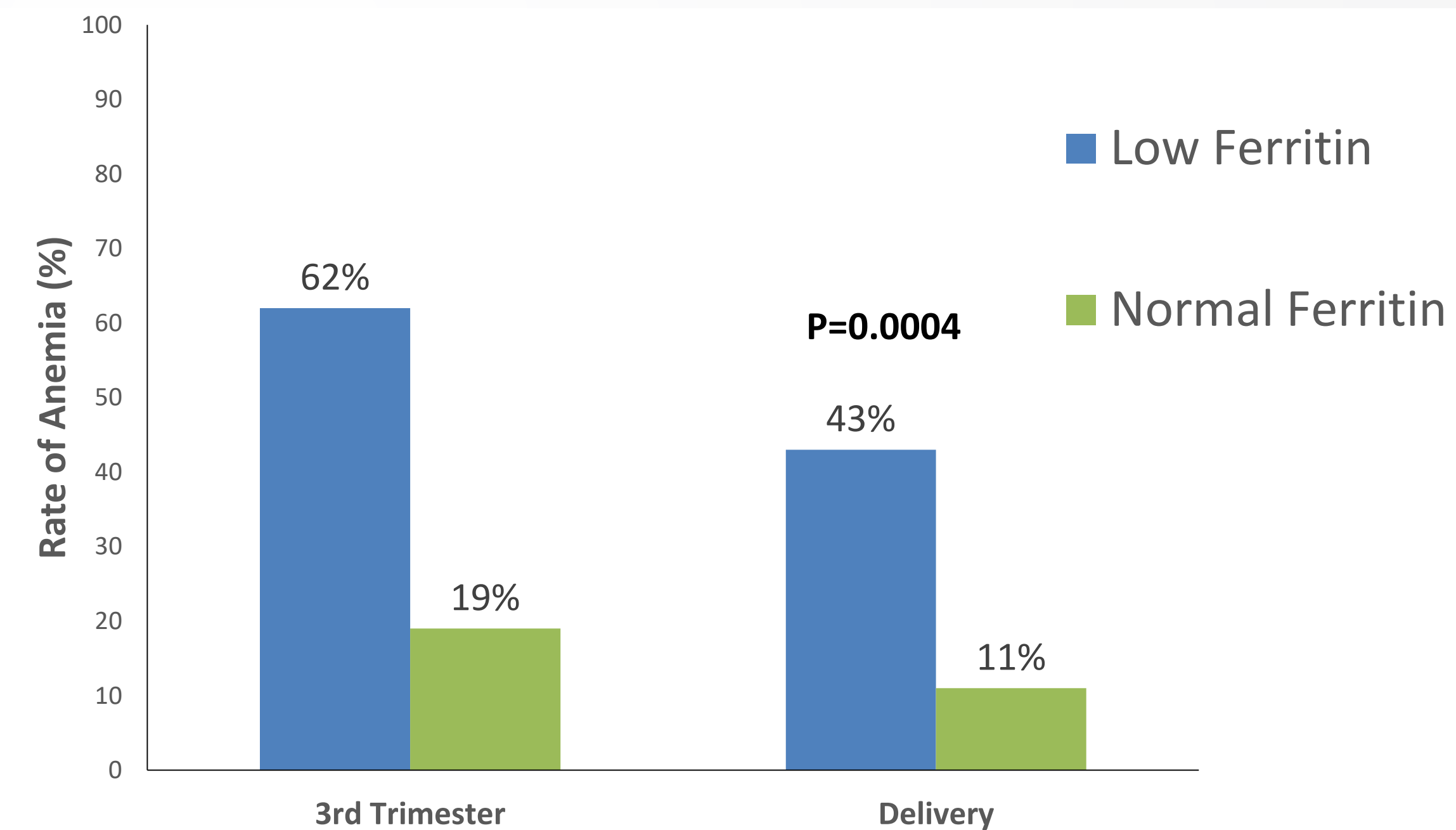


Figure 2. Comparison of anemia rates in 3rd trimester & at delivery based on low ferritin and normal ferritin group

Conclusion

- Ferritin \leq 26.4 micrograms/L in non-anemic women in early pregnancy is predictive of anemia at delivery
- Low ferritin group had a lower mean hemoglobin in third trimester & at delivery and a 5x higher rate of developing anemia at delivery
- There is potential to use a ferritin level as a first trimester screening tool to identify women at risk of developing anemia in pregnancy and provide early intervention.

Tables & Figures

Table 1. Demographic Information comparing low ferritin and normal ferritin groups

Characteristic	Low Ferritin (n = 37)	Normal Ferritin (n = 68)	P
Age (years)	31 \pm 4.9	32 \pm 5.2	0.227
Race			0.22
White	28 (75%)	41 (61%)	
Black	1 (3%)	7 (10%)	
Hispanic	5 (14%)	8 (12%)	
Asian	2 (5%)	9 (13%)	
Unknown or not identified	1 (3%)	3 (4%)	
BMI (kg/m ²)	30.3 \pm 9.0	26.8 \pm 6.9	0.02
\geq 30	16 (43%)	18 (26%)	0.08
Gestational Age at delivery (weeks)	38.9 \pm 1.7	38.9 \pm 1.4	0.79
Mode of Delivery			0.06
Vaginal delivery	17 (49%)	43 (68%)	
Cesarean Section	18 (51%)	20 (32%)	
Birthweight (g)	3425 \pm 516.03	3435 \pm 479.1	0.79
Postpartum Hemorrhage (EBL > 1500 mL)	5 (14%)	14 (23%)	0.16

data presented as mean +/- SD

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