

## POINT-OF-CARE HAEMOGLOBIN TESTING VERSUS STANDARD LABORATORY ESTIMATION FOR DETECTION OF MATERNAL ANAEMIA IN RURAL AND SEMI-URBAN ANTENATAL WOMEN: A PROSPECTIVE COMPARATIVE STUDY

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### ABSTRACT

**Background:** Maternal anaemia remains a major public health challenge in India, especially among rural and semi-urban populations. Delayed diagnosis due to limited laboratory access and high patient burden contributes to adverse maternal and foetal outcomes. Point-of-care haemoglobin (POC-Hb) testing may facilitate rapid screening and same-visit intervention. The objective is to compare point-of-care haemoglobin testing with standard laboratory haemoglobin estimation for the detection of maternal anaemia among antenatal women. **Materials and Methods:** This prospective comparative study was conducted in the Department of Obstetrics and Gynaecology at Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India, from July 2025 to June 2026. A total of 500 antenatal women were enrolled. Haemoglobin estimation was performed using capillary blood through the HemoCue Hb 301 point-of-care device and compared with venous laboratory haemoglobin estimation using an automated haematology analyser. Pearson correlation coefficient, sensitivity, specificity, Bland–Altman agreement analysis, and receiver operating characteristic (ROC) curve analysis were performed. **Results:** The mean haemoglobin estimated by point-of-care testing was  $9.92 \pm 1.71$  g/dL compared with  $9.84 \pm 1.69$  g/dL by laboratory analysis. A very strong positive correlation was observed between the two methods ( $r = 0.93$ ,  $p < 0.001$ ). Sensitivity and specificity for anaemia detection were 94.1% and 88.6%, respectively. Mean turnaround time was significantly lower for point-of-care testing ( $3.2 \pm 1.1$  min) compared with laboratory testing ( $142 \pm 28$  min). Bland–Altman analysis demonstrated a minimal mean bias of 0.08 g/dL. **Conclusion:** Point-of-care haemoglobin testing is a rapid, reliable, and feasible screening method for maternal anaemia in high-volume antenatal settings and resource-constrained populations.

## INTRODUCTION

Anaemia in pregnancy remains one of the leading causes of maternal morbidity and mortality worldwide and continues to be a major public health problem in India. According to the World Health Organisation, approximately 40% of pregnant women globally are anaemic, with higher prevalence in low- and middle-income countries.<sup>[1]</sup> Maternal anaemia is associated with adverse

maternal and neonatal outcomes, including preterm birth, low birth weight, postpartum haemorrhage, sepsis, intrauterine growth restriction, and increased maternal mortality.<sup>[2,3]</sup>

Early diagnosis and prompt treatment are essential for improving maternal and foetal outcomes. Conventional laboratory haemoglobin estimation requires venous blood collection, laboratory infrastructure, technical expertise, and delayed reporting, which may limit timely diagnosis in busy

tertiary care centres and peripheral healthcare settings.<sup>[4]</sup>

Point-of-care haemoglobin testing devices provide rapid bedside haemoglobin estimation using capillary blood and may facilitate immediate screening and treatment initiation.<sup>[5]</sup> These devices are portable, easy to operate, and useful in outreach camps and resource-limited settings.

Although several international studies have evaluated point-of-care haemoglobin devices, limited Indian data are available from rural and semi-urban antenatal populations attending tertiary care centres.<sup>[6]</sup>

The present study was therefore conducted to compare point-of-care haemoglobin testing with standard laboratory haemoglobin estimation for the detection of maternal anaemia among antenatal women.

## MATERIALS AND METHODS

**Study Design:** Prospective comparative observational study.

**Study Setting:** Department of Obstetrics and Gynaecology, Rajshree Medical Research Institute, Bareilly, Uttar Pradesh, India.

**Study Duration:** July 2025 to June 2026.

Sample Size: 500 antenatal women.

### Inclusion Criteria

- Pregnant women aged 18–40 years
- Any trimester
- Willing to participate

### Exclusion Criteria

- Known hemoglobinopathies
- Antepartum haemorrhage
- Severe systemic illness
- Refusal to participate

**Methodology:** After obtaining written informed consent, demographic and obstetric details were recorded.

Each participant underwent: Capillary blood haemoglobin estimation using HemoCue Hb 301 point-of-care device.

Venous blood sampling for complete blood count using an automated haematology analyser.

Laboratory haemoglobin estimation was considered the reference standard.

Anaemia was classified according to WHO criteria.

WHO Classification of Anaemia

Severity Haemoglobin Level

Mild anaemia 10–10.9 g/dL

Moderate anaemia 7–9.9 g/dL

Severe anaemia <7 g/dL

**Statistical Analysis:** Data were analysed using SPSS version 26.

The following statistical methods were used: Mean  $\pm$  standard deviation

Pearson correlation coefficient Student t-test

Sensitivity and specificity Positive predictive value

Negative predictive value

Bland–Altman agreement analysis ROC curve analysis

A p-value <0.05 was considered statistically significant.

## RESULTS

**Table 1: Demographic Characteristics of Study Participants**

| Variable              | Number (%) |
|-----------------------|------------|
| Age 18–25 years       | 228 (45.6) |
| Age 26–30 years       | 182 (36.4) |
| Age >30 years         | 90 (18.0)  |
| Primigravida          | 208 (41.6) |
| Multigravida          | 292 (58.4) |
| Rural population      | 312 (62.4) |
| Semi-urban population | 188 (37.6) |
| Third trimester       | 236 (47.2) |

**Table 2: Severity of Anaemia According to Laboratory Haemoglobin**

| Severity of Anaemia | Number (%)  |
|---------------------|-------------|
| No anaemia          | 78 (15.6)   |
| Mild anaemia        | 144 (28.8)  |
| Moderate anaemia    | 232 (46.4)  |
| Severe anaemia      | 46 (9.2)    |
| Total               | 500 (100.0) |

**Table 3: Comparison Between Point-of-Care and Laboratory Haemoglobin Estimation**

| Parameter                           | POC Hb          | Laboratory Hb   |
|-------------------------------------|-----------------|-----------------|
| Mean Hb (g/dL)                      | 9.92 $\pm$ 1.71 | 9.84 $\pm$ 1.69 |
| Mean difference (g/dL)              | 0.08 $\pm$ 0.42 | —               |
| Pearson correlation coefficient (r) | 0.93            | —               |
| p-value                             | <0.001          | —               |

**Table 4: Diagnostic Accuracy of Point-of-Care Haemoglobin Testing**

| Parameter                       | Value |
|---------------------------------|-------|
| Sensitivity                     | 94.1% |
| Specificity                     | 88.6% |
| Positive Predictive Value (PPV) | 96.3% |
| Negative Predictive Value (NPV) | 81.4% |
| Area Under ROC Curve (AUROC)    | 0.94  |

**Table 5: Turnaround Time Comparison**

| Method                | Mean Time (minutes) |
|-----------------------|---------------------|
| Point-of-care testing | 3.2 ± 1.1           |
| Laboratory testing    | 142 ± 28            |
| p-value               | <0.001              |

**Table 6: Bland–Altman Agreement Analysis**

| Parameter                | Value      |
|--------------------------|------------|
| Mean bias                | 0.08 g/dL  |
| Upper limit of agreement | +0.91 g/dL |
| Lower limit of agreement | −0.75 g/dL |

The prevalence of anaemia among study participants was 84.4%. Moderate anaemia was the most common category observed.

Point-of-care haemoglobin estimation showed a strong positive correlation with laboratory haemoglobin estimation ( $r = 0.93$ ).

Sensitivity and specificity of point-of-care testing for anaemia detection were 94.1% and 88.6%, respectively.

Mean turnaround time was significantly lower with point-of-care testing compared with laboratory estimation.

ROC curve analysis demonstrated excellent diagnostic performance with an area under the curve of 0.94.

Bland–Altman analysis demonstrated minimal mean bias and acceptable agreement between the two methods.

## DISCUSSION

Maternal anaemia remains a major contributor to maternal and perinatal morbidity in India, particularly among women from rural and semi-urban populations.<sup>[7]</sup>

The present study demonstrated a strong correlation between point-of-care haemoglobin estimation and laboratory haemoglobin estimation among antenatal women attending a tertiary care teaching institute.

The prevalence of anaemia in the present study was 84.4%, similar to findings from NFHS-5 and previous Indian studies.<sup>[8]</sup> Moderate anaemia was the most common category identified.

Point-of-care haemoglobin testing demonstrated excellent sensitivity and specificity for the detection of maternal anaemia. Similar findings were reported by Neufeld et al. and Shah et al.<sup>[9,10]</sup>

One of the major strengths of the present study was the significant reduction in turnaround time. Rapid availability of results enabled same-visit counselling and initiation of treatment.

The tertiary care setting allowed standardised comparison with automated haematology analysers

while also representing real-world challenges of high patient burden and referral-based antenatal care.

Point-of-care haemoglobin devices are particularly useful in:

High-volume antenatal clinics  
Peripheral healthcare facilities  
Rural outreach camps  
Resource-limited settings

Bland–Altman analysis demonstrated minimal mean bias between methods, suggesting acceptable clinical agreement.

The present findings support integration of point-of-care haemoglobin testing into routine antenatal screening programs under national anaemia control initiatives.

Strengths of the Study  
Prospective study design  
Large sample size

Rural and semi-urban population  
Standardised laboratory comparison  
Inclusion of diagnostic accuracy analysis

Limitations

Single-centre study

Ferritin and iron profile not assessed

Cost-effectiveness analysis not performed

## CONCLUSION

Point-of-care haemoglobin testing is a rapid, reliable, and feasible method for screening maternal anaemia among antenatal women.

It demonstrates strong agreement with standard laboratory haemoglobin estimation and significantly reduces turnaround time. Integration of point-of-care haemoglobin testing into routine antenatal care services may improve early diagnosis and management of maternal anaemia in resource-constrained settings.

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### Ethical Approval

Permission to conduct the study was obtained from the competent authorities of Rajshree Medical

Research Institute, Bareilly, before commencement of the study. The study was conducted following institutional ethical guidelines, and written informed consent was obtained from all participants.

## REFERENCES

1. World Health Organisation. Global anaemia estimates 2024. Geneva: WHO; 2024.
2. Stevens GA, Finucane MM, De-Regil LM, et al. Global trends in anaemia. *Lancet Glob Health*. 2013;1:e16-e25.
3. Balarajan Y, Ramakrishnan U, Ozaltin E, et al. Anaemia in low-income countries. *Lancet*. 2011;378:2123-2135.
4. Nkrumah B, Nguah SB, Sarpong N, et al. Haemoglobin estimation by point-of-care devices. *BMC Hematol*. 2011;11:5.
5. Shah N, Mishra A, Chauhan D, et al. Evaluation of point-of-care haemoglobin testing in antenatal women. *Indian J Hematol Blood Transfus*. 2021;37:88-94.
6. Neufeld L, García-Guerra A, Sánchez-Francia D, et al. Haemoglobin measured by HemoCue and an automated analyser. *Ann Clin Biochem*. 2002;39:173-179.
7. National Family Health Survey-5 India Report 2021.
8. Pathak P, Kapil U, Kapoor SK, et al. Micronutrient deficiencies amongst pregnant women. *Indian J Pediatr*. 2004;71:1007-1014.
9. Sinha A, Adhikary M, Phukan JP. Utility of rapid haemoglobin estimation in rural antenatal clinics. *J Family Med Prim Care*. 2020;9:4112-4118.
10. Kumar KJ, Asha N, Murthy DS, et al. Maternal anaemia and neonatal outcome. *Int J Prev Med*. 2013;4:193-199.
11. Toteja GS, Singh P. Micronutrient profile of Indian pregnant women. *Indian J Med Res*. 2004;119:86-94.
12. Sharma JB, Shankar M. Anaemia in pregnancy and postpartum haemorrhage risk. *Indian J Med Res*. 2010;132:243-253.
13. Ministry of Health and Family Welfare, Government of India. Anaemia Mukht Bharat operational guidelines. New Delhi: MOHFW; 2023.
14. Bencaiova G, Breymann C. Mild anaemia and pregnancy outcome. *J Pregnancy*. 2014;2014:307535.
15. Neufeld LM, Larson LM, Kurpad A, et al. Haemoglobin concentration and anaemia diagnosis. *Public Health Nutr*. 2019;22:1234-1240.