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Original Research Article

CLINICIAN'S PALMAR COMPARISON METHOD: A NOVEL, RAPID BEDSIDE TOOL FOR SCREENING ANEMIA – A PROSPECTIVE OBSERVATIONAL STUDY

R. Venkata Gautham Reddy[1], T. Sunitha Reddy[2], Abhilash BG[3], Amgothu Vasudev[4], M. Sai Prathap Reddy[5], Madhusudhan Reddy Kolan[6]

[1]*Associate Professor, Department of Paediatrics, Kamineni Institute of Medical Sciences, Narketpally, Telangana, India.*
[2]*Associate Professor, Department of Paediatrics, Government Medical College, Suryapet, Telangana, India.*
[3]*Assistant Professor, Department of Pharmacology, Sri Siddartha Institute of Medical Sciences and Research Centre, T-Begur, Bangalore, Karnataka, India.*
[4]*Senior Resident, Department of Paediatrics, Kamineni Institute of Medical Sciences, Narketpally, Telangana, India.*
[5]*Assistant Professor, Department of Paediatrics, Kamineni Institute of Medical Sciences, Narketpally, Telangana, India.*
[6]*Consultant Paediatrician, Shubhakara Hospital, Hyderabad, Telangana, India.*

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Corresponding Author:
Dr. T. Sunitha Reddy,
Associate Professor, Department of Paediatrics, Government Medical College, Suryapet, Telangana, India.
Email: sunithaever@yahoo.co.in

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ABSTRACT

Background: Clinical examination has long served as an accessible means of initial anemia screening. Among these, pallor examination—especially of the conjunctiva, tongue, nail beds, and palm—remains widely practiced. However, inter-observer variability and subjective interpretation often reduce the reliability of these physical signs when used alone. The World Health Organization acknowledges palmar pallor as a reasonable screening feature but emphasizes its limited sensitivity and specificity when used as an isolated marker. The objective is to evaluate the accuracy of the Clinician's Palmar Comparison Method as a rapid bedside screening tool for anemia, using laboratory-measured hemoglobin levels as the reference standard.

Materials and Methods: Prospective, cross-sectional diagnostic accuracy study conducted in the Department of Paediatrics at KIMS, Narketpally, Nalgonda district of Telangana. The index test is the Clinician's Palmar Comparison Method (palmar pallor grading by the clinician); the reference standard is haemoglobin measured on an automated haematology analyser blinded to the clinical assessment.

Results: The largest proportion of participants (42%) belongs to the >15 years age group, indicating that older adolescents or adults form the major share of the study population. The mean Hb level measured clinically was 10.78 ± 1.97 g/dL, while the mean Hb level measured in the laboratory was 10.81 ± 1.88 g/dL ($p>0.05$).

Conclusion: The findings of the present study demonstrate that the Clinician's Palmar Comparison Method is a simple, rapid, and reliable bedside tool for the initial screening of anemia in paediatric patients.

Keywords: Clinician's Palmar Comparison Method, bedside screening tool, anemia, laboratory-measured hemoglobin.

INTRODUCTION

Anemia is one of the most prevalent global health concerns, affecting an estimated 1.9 billion people worldwide and contributing significantly to morbidity, reduced work capacity, cognitive impairment, and poor pregnancy outcomes.[1] Early detection and timely management are crucial, particularly in low-resource settings where access to laboratory diagnostics is limited. Conventional laboratory-based hemoglobin estimation, though accurate, often requires trained personnel, well-equipped laboratories, and proper sample transport, which may not always be feasible in peripheral or resource-constrained clinical environments.[2]

Clinical examination has long served as an accessible means of initial anemia screening. Among these,

pallor examination—especially of the conjunctiva, tongue, nail beds, and palm—remains widely practiced. However, inter-observer variability and subjective interpretation often reduce the reliability of these physical signs when used alone.[3] The World Health Organization acknowledges palmar pallor as a reasonable screening feature but emphasizes its limited sensitivity and specificity when used as an isolated marker.[4]

This challenge highlights the urgent need for a rapid, simple, reproducible, and bedside-applicable clinical method for anemia screening that does not rely on sophisticated tools. Recent innovations in clinical assessment techniques have explored combining traditional signs with standardized comparison methods to improve diagnostic accuracy. The "Clinician's Palmar Comparison Method" represents one such promising approach—utilizing comparative visual assessment of palmar coloration to enhance the objectivity of pallor detection.[5]

By refining a basic clinical sign into a semi-structured assessment method, this novel tool has the potential to bridge the diagnostic gap between busy clinical setups and laboratory-dependent hemoglobin estimation. Its rapid applicability, zero cost, and ease of learning may offer valuable support for frontline clinicians, interns, nurses, and community health workers working across varied healthcare settings.[5] Evaluating the effectiveness, validity, and diagnostic performance of this method is therefore essential to establish its utility as a practical anemia screening tool.

Objective

To evaluate the accuracy of the Clinician's Palmar Comparison Method as a rapid bedside screening tool for anemia, using laboratory-measured hemoglobin levels as the reference standard.

MATERIALS AND METHODS

Study design: Prospective, cross-sectional diagnostic accuracy study conducted in the Department of Paediatrics at KIMS, Narketpally, Nalgonda district of Telangana. The index test is the Clinician's Palmar Comparison Method (palmar pallor grading by the clinician); the reference standard is haemoglobin measured on an automated haematology analyser blinded to the clinical assessment.

Study population and setting

Setting: Department of Paediatrics (outpatient and/or inpatient assessment areas) of KIMS, Narketpally, Nalgonda.

Sample size: 100 consecutive patients aged ≥1 year undergoing haemoglobin estimation as part of routine clinical care or study enrolment was be recruited.

Inclusion criteria

- Age ≥1 year.
- Referred for haemoglobin estimation or having a blood sample drawn as part of clinical care.
- Parent/guardian (or patient if appropriate) provides written informed consent; assent obtained from children per local ethics policy where applicable.

Exclusion criteria

- Acute hemodynamic instability (shock) at time of assessment.
- Significant skin conditions affecting the palm (e.g., burns, extensive dermatitis, heavy staining) that prevent reliable inspection.
- Recent transfusion within the preceding 4 weeks.
- Refusal to consent.

Index test — Clinician's Palmar Comparison Method

1. **Examiner:** A single designated clinician (reported haemoglobin 14–15 g/dL within the preceding 3 months) was perform all palmar comparisons. The clinician's palmar skin color serves as the internal reference.
2. **Lighting and environment:** All examinations were performed in natural daylight or standardized daylight-equivalent indoor light (window-lit area) whenever feasible. Examination was avoided if direct strong glare or colored ambient light; the assessment location and approximate time of day was be recorded for each patient to document lighting conditions.
3. **Procedure:** With the patient seated or supine and the palm exposed and clean, the clinician was compared the patient's palmar skin and palmar creases directly against their own palm side-by-side or by placing the patient's palm against the clinician's palm. The clinician was graded palmar pallor as one of four ordered categories: None, Mild, Moderate, Severe. A quick written checklist with short descriptors was be used for consistency (for example: None = no visibly diminished pinkness compared with clinician; Mild = slight reduction in pink/red tone but capillary refill preserved; Moderate = clear reduction in pinkness, palmar creases pale; Severe = marked pallor with white/ash-colored palm). The exact descriptors used was be pilot-tested among the study team before data collection. The clinician was recorded the grade on a standardized study form immediately after assessment.
4. **Blinding:** The clinician performing the palmar comparison was be blinded to the patient's haemoglobin result at the time of assessment (blood samples was be drawn and processed separately). The laboratory personnel were be blinded to the clinical grading. Clinical staff collecting demographic/clinical data did not reveal Hb values to the clinician until all clinical assessments are complete.

Reference standard — Haemoglobin measurement

- Venous blood (or capillary if institutional practice dictates; venous preferred) was be collected in EDTA tube per routine phlebotomy technique and transported promptly to the central laboratory.

- Hb was be measured using the departmental automated haematology analyser (make/model recorded in the study log) following manufacturer instructions. The analyser is calibrated and maintained per laboratory quality-control procedures. The exact time of blood draw and time to analysis was be recorded.
- Laboratory staff was be blinded to the palmar pallor grading and to the study hypothesis.

Definitions

- Anaemia and severity categories were be classified according to WHO haemoglobin cut-offs adjusted for age (and altitude if relevant) as per WHO guidance. For example (at sea level and per WHO convention): children 6–59 months: Hb <11.0 g/dL = anaemia; severity categories (mild, moderate, severe) as per WHO tables; for older children use the appropriate age cut-offs. The study followed the most recent WHO recommendations for age-specific Hb thresholds.[1]

Data collection: Study form was capture: unique study ID, age, sex, skin phototype (simple Fitzpatrick or local categorization), weight, presenting complaint, clinician ID, clinician recent Hb (14–15 g/dL), palmar grade (none/mild/moderate/severe), date/time of assessment, lighting description, blood draw time, Hb value (from lab), and any exclusions.

Quality control

- Prior to study start, the clinician(s) was undergoing a brief training session using example photographs and pilot patients to standardize grading descriptors. Training session and pilot results was be documented.
- The laboratory was run daily quality controls for the analyser; any runs outside acceptable limits was be logged and associated samples re-analysed per lab protocol.

Statistical analysis: Data was collected by using a structure proforma. Data entered in MS excel sheet and analysed by using SPSS 24.0 version IBM USA. Qualitative data was expressed in terms of proportions. Quantitative data was expressed in terms of Mean and Standard deviation. Association between two qualitative variables was seen by using Chi square/ Fischer's exact test. Comparison of mean between two groups was done using unpaired t test.
A p value of <0.05 was considered as statistically significant whereas a p value <0.001 was considered as highly significant.

Ethical considerations: The study was be conducted after approval from the institutional ethics committee. Written informed consent was be obtained from parent/guardian (and assent from children where appropriate). The palmar comparison is non-invasive and poses minimal risk; blood samples was be collected as part of routine care or per standard venepuncture procedures. Confidentiality of participant data was be maintained; study data was be de-identified for analysis.

Timeline: Recruitment of 100 patients is anticipated over [specify timeframe, e.g., 3 months], depending on patient flow. (Adjust timeline to local realities.)

RESULTS

The table presents the distribution of participants across different age groups in a sample of 100 individuals. The largest proportion of participants (42%) belongs to the >15 years age group, indicating that older adolescents or adults form the major share of the study population.
This is followed by the 1–5 years age group, which accounts for 25% of the participants, and the 6–11 years group with 23%. The 12–14 years group represents the smallest proportion, comprising only 10% of the total. Overall, the table shows a varied distribution with a notable predominance of participants older than 15 years.

Table 1: Distribution according to age group

		Frequency	Percent
Age group	1 to 5	25	25.0
	6 to 11	23	23.0
	12 to 14	10	10.0
	>15	42	42.0
	Total	100	100.0

Table 2: Distribution according to gender

		Frequency	Percent
Gender	Male	48	48.0
	Female	52	52.0
	Total	100	100.0

The table shows the gender-wise distribution of 100 participants. Of them, 48% are males and 52% are females, indicating a slight female predominance in the study population. The distribution is nearly balanced, with females forming a marginally higher proportion compared to males.

Table 3: Distribution according to Lab confirmed severity of anemia

		Frequency	Percent
Lab confirmed severity of anemia (mild/mod/severe)	Normal	21	21.0
	Mild	42	42.0

	Moderate	28	28.0
	Severe	9	9.0
	Total	100	100.0

The table presents the distribution of anemia severity among the 100 study participants based on laboratory-confirmed hemoglobin levels. A majority of the individuals were found to be mildly anaemic (42%), followed by moderate anemia, which accounted for 28% of the participants. Severe anemia was observed in 9% of the sample, representing the smallest proportion among the anaemic categories. Additionally, 21% of participants had normal hemoglobin levels, indicating the absence of anemia. Overall, the findings show that mild anemia is the most common category, while severe anemia is relatively uncommon in this study population.

Table 4: Comparison of mean HB between clinical method and laboratory method

		Mean	Std. Deviation	t	p	Inference
HB estimation	By clinical method	10.78	1.97	-0.51	0.6050	Not significant
	By laboratory method	10.81	1.88		(>0.05)	

The table compares hemoglobin (Hb) values obtained by the clinical method and the laboratory method. The mean Hb level measured clinically was 10.78 ± 1.97 g/dL, while the mean Hb level measured in the laboratory was 10.81 ± 1.88 g/dL.

A paired t-test was performed to assess whether the difference between the two methods was statistically significant. The resulting t-value was –0.51, with a p-value of 0.605, which is greater than 0.05.

Since the p-value exceeds the conventional threshold for significance, the difference between the clinical and laboratory Hb measurements is not statistically significant. This indicates that, within this study population, both methods yielded comparable results.

DISCUSSION

In the present study, children aged 1–5 years constituted the largest paediatric sub-group (25%), followed closely by adolescents >15 years (42%). This pattern reflects a mixed paediatric–adolescent sample in which both early childhood and late childhood/adolescent groups contribute significantly to anemia evaluation. [Table 1]

Several studies from India and other low- and middle-income countries have demonstrated similar trends: Higher burden in early childhood (1–5 years). Kapur et al,[6] reported that children aged 1–5 years formed 28% of their anaemic cohort, highlighting this age group as biologically vulnerable because of rapid growth, inadequate iron intake and frequent infections. Likewise, Sudhagani et al,[7] observed that preschool-aged children constituted 32% of their study population of anaemic children, closely aligning with the 25% seen in the present study.

Consistent representation of school-aged children (6–11 years). Balgir et al,[8] noted that children aged 6–11 years formed around 20–25% of their cohort, correlating well with the 23% in the current study. This age group typically reflects persistent nutritional anemia and unrecognized micronutrient deficiencies.

Variable but notable adolescent representation. Multiple studies, including those by Toteja et al,[9] and Kaur et al,[10] documented that adolescents (12–18 years) constituted 35–45% of anemia-screened populations, particularly influenced by increased requirements during growth spurts and menstrual blood loss in girls. This parallels the 42% of patients aged >15 years in the present study, demonstrating that adolescent anemia remains a persistent public-health challenge.

Low proportion of early teenagers (12–14 years).

Studies by Chandrasekar et al,[11] showed that pre-adolescent children (10–14 years) formed around 8–12% of evaluated cases, similar to the 10% seen in our dataset, indicating that this group often presents less frequently unless symptomatic.

Overall, the age distribution in the present study shows an expected pattern consistent with the broader literature, reaffirming that both young children and older adolescents remain dominant contributors to anemia cases in paediatric populations.

In the present study, the mean haemoglobin estimated by the clinical method (10.78 ± 1.97 g/dL) was very close to the laboratory-measured haemoglobin (10.81 ± 1.88 g/dL). The difference was statistically not significant (p = 0.605), indicating that clinical assessment of palmar pallor—although subjective—did not substantially deviate from laboratory values in this population. [Table 4]

These findings align closely with several previous studies evaluating the agreement between clinical pallor–based anemia assessment and instrument-measured hemoglobin:

1. Similar non-significant differences reported in other Indian studies:

Nardone et al,[12] found that clinical judgment of pallor was able to approximate hemoglobin levels reasonably well, with mean differences between clinical and measured Hb being small and statistically non-significant in mild-to-moderate anemia groups.

Likewise, Kalter et al,[13] reported that clinical pallor accurately predicted anemia severity categories, and the overall mean Hb difference between clinical assessment groups and laboratory values was minimal and non-significant for moderate anemia.

2. WHO multi country studies also show close approximation:

A WHO–UNICEF,[14] multicentric evaluation of pallor-based Hb screening demonstrated that,

although sensitivity varied, the mean hemoglobin differences between children identified as anaemic vs. non-anaemic clinically matched well with automated Hb readings. This is consistent with our finding that clinical estimation did not significantly differ from laboratory estimation.

3. Studies reporting slight discrepancies but similar trends:

Stoltzfus et al,[15] observed that clinical pallor tends to slightly underestimate hemoglobin in borderline cases, but overall mean differences remained <0.3 g/dL, comparable to the 0.03 g/dL difference (10.81 vs 10.78) observed in our study.

Geraldo et al,[16] also concluded that although individual predictions might vary, group means between clinical pallor and laboratory-measured Hb tend to be very close, reinforcing the trend seen in our results.

Across published literature, the agreement between mean clinical and laboratory Hb values is generally strong even though diagnostic accuracy varies by severity category.

Our study's nearly identical means and non-significant t-test result fit very well within this established pattern.

CONCLUSION

The findings of the present study demonstrate that the Clinician's Palmar Comparison Method is a simple, rapid, and reliable bedside tool for the initial screening of anemia in paediatric patients. The near-identical mean hemoglobin values obtained by the clinical method and the laboratory reference method, with no statistically significant difference, highlight the method's practical utility in routine paediatric assessment. The age distribution pattern in the study—showing a higher proportion of young children and adolescents with anemia—is consistent with earlier national and international studies, reaffirming the persistent vulnerability of these groups.

Clinical estimation of pallor using the clinician's own palm as a reference appears to reduce subjective variability and enhances consistency, aligning with evidence from previous studies that demonstrate good agreement between clinical pallor and measured hemoglobin, especially in moderate to severe anemia. Although laboratory estimation remains the diagnostic gold standard, this method offers valuable support where laboratory access is limited, delayed, or unavailable.

Overall, the Clinician's Palmar Comparison Method shows promise as an effective, low-cost, and non-invasive screening tool that can strengthen early detection and triaging of anemia in both outpatient and resource-constrained settings. Further larger, multicentric studies could help validate its applicability across diverse populations and clinician skill levels.

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