

Correlation Of Hemoglobin With Red Cell Indices (MCV, MCH, MCHC And RDW): A Retrospective Study

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ABSTRACT

Background: Hemoglobin (Hb) and red cell indices are routinely used together in the laboratory assessment of red blood cell abnormalities. MCV, MCH, MCHC and RDW provide complementary information about cell size, hemoglobin content and variation in red-cell size. **Aim:** To assess the correlation of hemoglobin with MCV, MCH, MCHC and RDW in retrospective CBC records. **Materials and Methods:** This retrospective observational study was conducted at Chirayu Hospital over approximately 2.5 months, from the last week of June through August. A total of 115 CBC records were evaluated. Testing was performed using Mindray BC-6800Plus 5-Part Differential Auto Hematology Analyzer and Mindray BC-6800 Auto Hematology Analyzer. Descriptive statistics and Pearson correlation were used. **Results:** Of 115 records, 58 (50.4%) were male and 57 (49.6%) were female. Mean age was 32.04 ± 12.61 years. Mean Hb was 10.90 ± 2.28 g/dL. Hb showed positive correlation with MCV ($r=0.337$), MCH ($r=0.393$) and MCHC ($r=0.266$), and negative correlation with RDW ($r=-0.506$); all associations were statistically significant ($p<0.05$). **Conclusion:** Hb was significantly associated with the evaluated red cell indices. Interpretation of these parameters together can improve the laboratory description of red-cell patterns.

Keywords: hemoglobin; MCV; MCH; MCHC; RDW; red cell indices; complete blood count; retrospective study.

INTRODUCTION

Hemoglobin is the principal oxygen-carrying protein in erythrocytes and is one of the most frequently interpreted parameters in a complete blood count. A change in hemoglobin concentration may occur with several hematological conditions, but its interpretation is strengthened by red cell indices.

MCV reflects average red-cell volume, MCH reflects the average hemoglobin content per red cell, MCHC expresses hemoglobin concentration within red cells, and RDW reflects variability in red-cell size. Together these indices assist in describing microcytic, normocytic and macrocytic patterns.

The present study was undertaken to examine the relationship of Hb with MCV, MCH, MCHC and RDW in 115 retrospective CBC records.

2. AIM

To study the correlation of hemoglobin with MCV, MCH, MCHC and RDW among patients undergoing CBC testing.

3. OBJECTIVES

- To summarize hemoglobin values in the study population.
- To assess MCV, MCH, MCHC and RDW.
- To determine the correlation between Hb and MCV, MCH, MCHC and RDW.
- To describe the hematological patterns recorded in the laboratory dataset.

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

4. MATERIALS AND METHODS

Study design: Retrospective observational study.

Study period: Last week of June to August (approximately 2.5 months).

Sample size: 115 CBC records.

Laboratory analyzers: Mindray BC-6800Plus 5-Part Differential Auto Hematology Analyzer and Mindray BC-6800 Auto Hematology Analyzer.

Data collection: Demographic and CBC parameters were obtained from available laboratory records. Patient IDs were used for dataset organization.

Statistical analysis: Continuous variables were summarized as mean $\pm$ SD. Pearson correlation coefficient was used to evaluate relationships between Hb and each red cell index. $p < 0.05$ was considered statistically significant.

Ethical considerations: Ethics committee approval, waiver or exemption should be reported according to the actual institutional documentation before journal submission. No approval number is stated here without verification.

5. RESULTS

A total of 115 records were analyzed. The dataset contained 58 male and 57 female records. Age ranged from 13 to 73 years.

Variable	Result
Total	115
Male	58 (50.4%)
Female	57 (49.6%)
Mean age	32.04 $\pm$ 12.61 years
Mean Hb	10.90 $\pm$ 2.28 g/dL

5.1 Descriptive statistics

Parameter	Mean $\pm$ SD	Minimum	Maximum
Hb	10.90 $\pm$ 2.28	6.1	15.9
MCV	84.32 $\pm$ 10.78	59.4	124.0
MCH	27.34 $\pm$ 3.97	18.4	43.0
MCHC	32.32 $\pm$ 1.96	25.4	41.1
RDW	16.34 $\pm$ 3.23	12.0	27.7

5.2 Correlation analysis

Index	Pearson r	p-value	Direction
MCV	0.337	<0.001	Positive
MCH	0.393	<0.001	Positive

MCHC	0.266	0.004	Positive
RDW	-0.506	<0.001	Negative

5.3 Figures

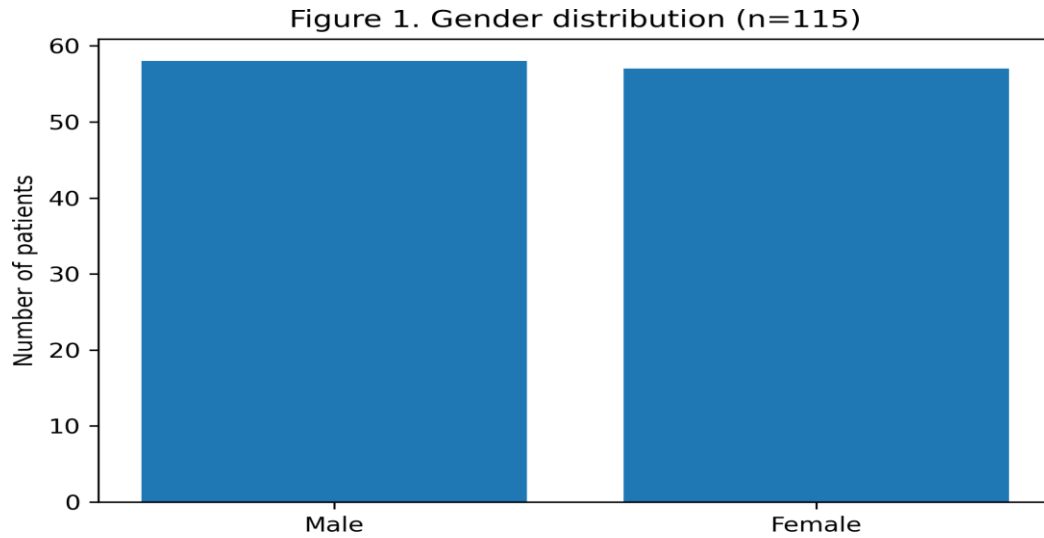


Figure 1. Gender distribution.

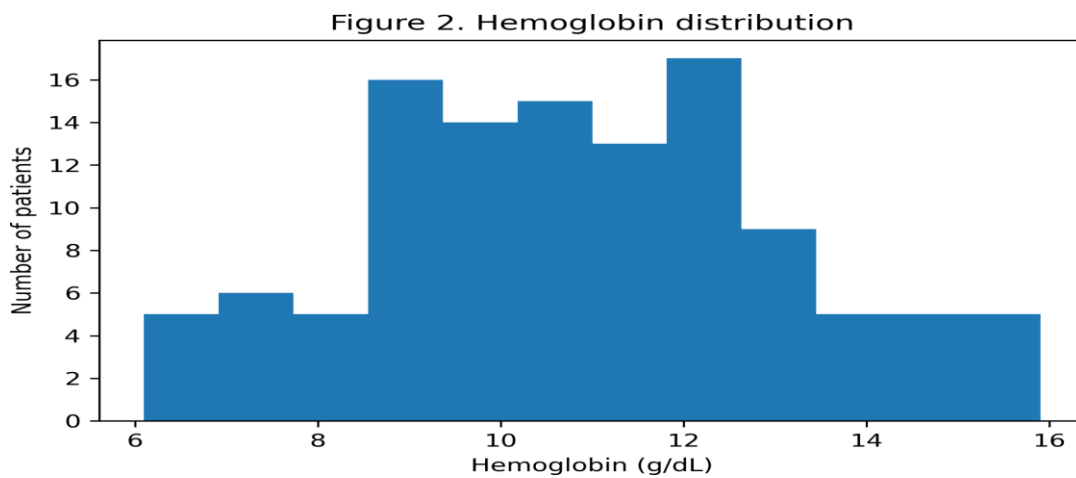


Figure 2. Hemoglobin distribution.

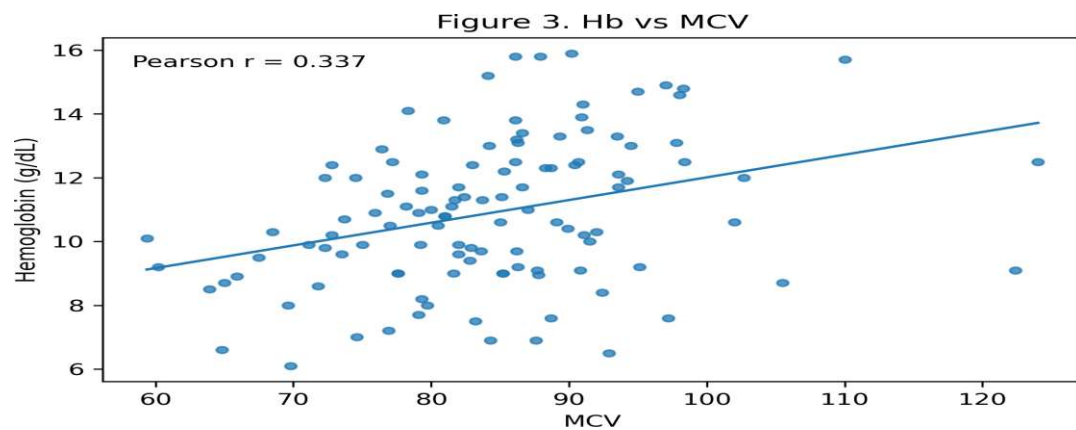


Figure 3. Hb versus MCV.

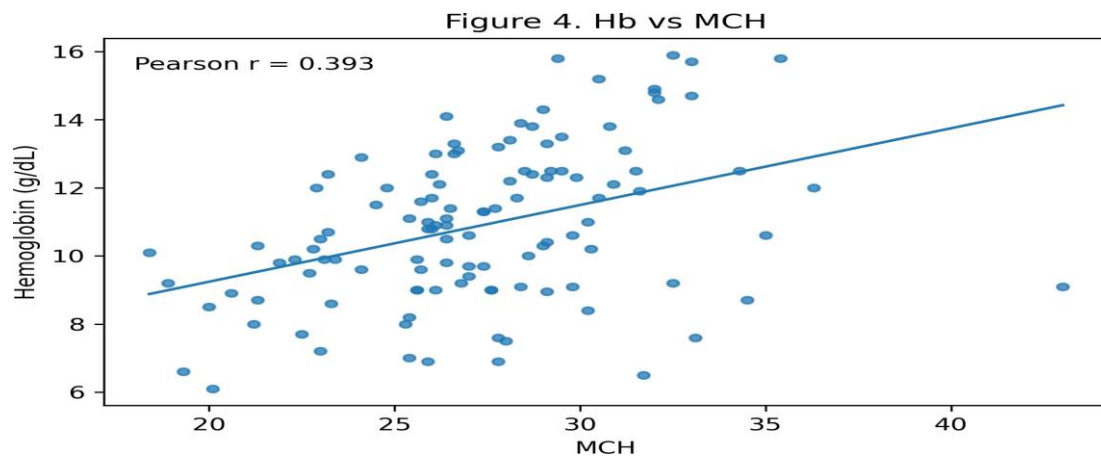


Figure 4. Hb versus MCH.

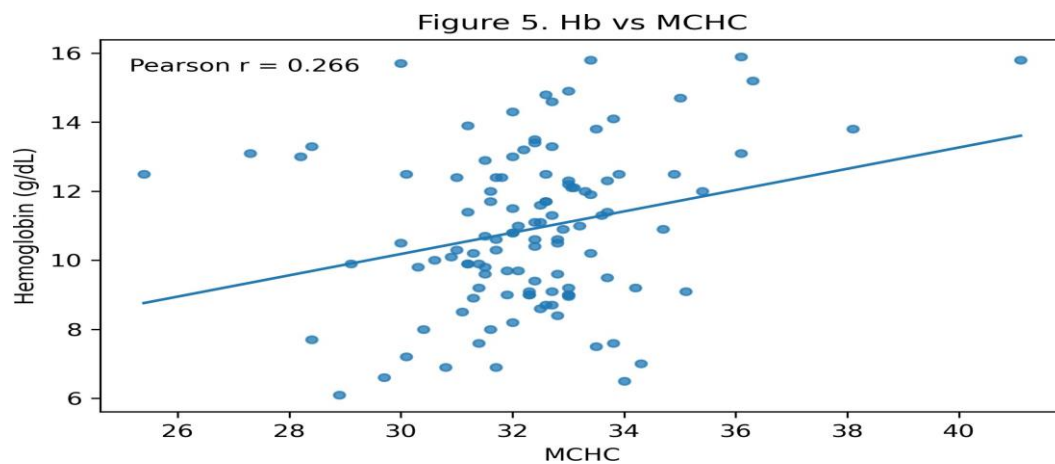


Figure 5. Hb versus MCHC.

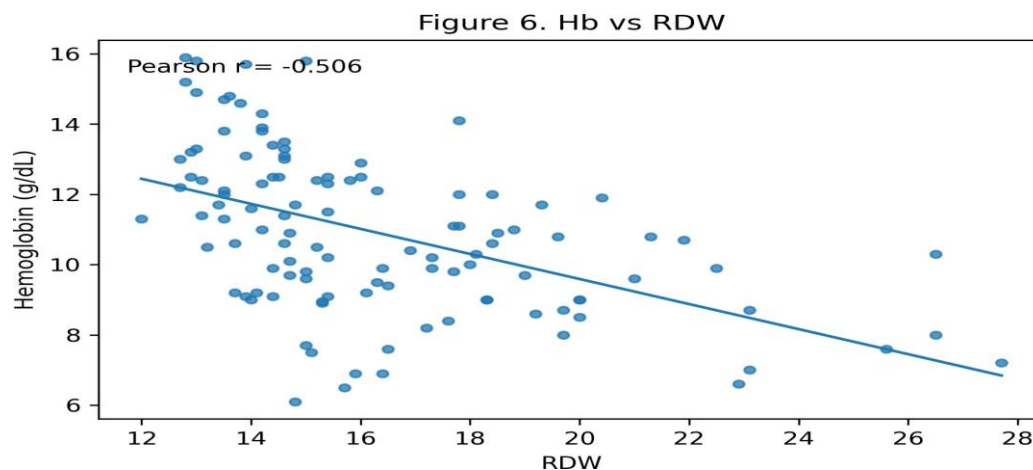


Figure 6. Hb versus RDW.

6. DISCUSSION

The analysis showed positive relationships between Hb and MCV, MCH and MCHC, whereas RDW was inversely related to Hb. The Hb–MCH relationship was particularly strong ($r=0.393$). The inverse association with RDW indicates that greater red-cell

size variability tended to occur with lower Hb in this dataset. These findings should be interpreted as statistical associations within a retrospective laboratory sample and not as evidence of causation.

The observed variation in red cell indices also illustrates why Hb is better interpreted together with

erythrocyte indices rather than in isolation. The dataset included microcytic, normocytic and macrocytic patterns, supporting the usefulness of combined index interpretation.

LIMITATIONS

- Retrospective study design.
- Single-centre dataset.
- Clinical history and confirmatory etiological investigations were not available in the dataset.
- Sample size was limited to 115 records.
- The results represent association and should not be interpreted causally.

DECLARATIONS

Ethical approval: To be completed from actual institutional IEC approval/waiver/exemption documentation.

Consent: To be stated according to institutional policy and target journal requirements.

Conflict of interest: To be declared by the author.

Funding: To be declared by the author.

Author contribution: Jyoti Singh: study concept, data organization, analysis, interpretation and manuscript preparation, subject to verification of actual contribution.

Data availability: Patient-level data should be shared only in accordance with institutional privacy and ethical requirements.

CONCLUSION

In this retrospective sample of 115 CBC records, hemoglobin showed significant correlations with MCV, MCH, MCHC and RDW. The findings support the use of red cell indices alongside Hb for laboratory characterization of red-cell abnormalities.

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