



## COMPARISON BETWEEN RED CELL DISTRIBUTION WIDTH AND RED CELL INDICES IN PREDICTION OF ANAEMIA AMONG PREGNANT WOMEN

### Pathology

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### ABSTRACT

**INTRODUCTION:** Anaemia is an important nutritional problem affecting pregnant women in particular. It is the most important single cause of maternal mortality and also for various related abnormalities. Efficient diagnostic modalities which can be used for prediction of anaemia in a cost-effective manner are necessary.

**AIMS:** To determine and compare the usefulness of red cell distribution width (RDW) and red cell indices in prediction of anaemia in pregnant women.

**MATERIALS AND METHODS:** 180 pregnant women were included in this study. Haemoglobin level of less than 11.0 g/dl was considered for diagnosis of anaemia. Statistical correlation between RDW and red cell indices was calculated.

**RESULTS:** A significant statistical correlation was obtained between changes in haemoglobin level and RDW and mean corpuscular volume (MCV). The correlation between changes in haemoglobin level and RDW was statistically most significant.

**CONCLUSION:** RDW is a better indicator for prediction of anaemia in pregnant women than red cell indices.

### KEYWORDS

anaemia, red cell distribution width, red cell indices, pregnancy

### INTRODUCTION

Anaemia is an important nutritional problem affecting pregnant women in particular. It is the most important single cause of maternal mortality and also for abnormalities such as premature births, still births and neonatal mortality.<sup>1</sup>

The importance of anaemia as a major public health problem throughout the world is widely recognized. According to the World Health Organization (WHO), in India the prevalence of anaemia among pregnant women averages 49.7%.<sup>1</sup> Various studies from different regions of India have reported the prevalence of anaemia among pregnant women to be around 50%.<sup>2</sup> The single most important cause for anaemia among pregnant women in India is iron deficiency.

Poor iron stores at birth, low iron content of breast milk, and low dietary iron intake throughout infancy and childhood result in high prevalence of anaemia in childhood. This gets aggravated by increased requirements during adolescence and during pregnancy. Anaemia in pregnancy is directly responsible for 20% of the maternal deaths in India and indirectly accounts for another 20% of the maternal deaths. There is an eight to ten-fold increase in maternal mortality rate when there is a severe reduction in the haemoglobin (Hb) level.<sup>3</sup>

A substantial decrease in maternal and perinatal mortality and morbidity can be achieved by early detection and effective management of anaemia in pregnancy.

Red cell distribution width (RDW), which is a quantitative measure for red cell size variation (anisocytosis) and mean corpuscular volume (MCV), which is the average volume of red cells, are predictors of iron deficiency anaemia (IDA).

RDW and red cell indices are part of routine blood counts in laboratories using automated haematology analyzers. The automated facility is cost effective and time saving.<sup>4</sup> In the present study, comparison between RDW and MCV, along with other red cell indices, was done to determine which amongst them was a more accurate predictor of anaemia in pregnant women.

### MATERIAL AND METHODS

180 pregnant women attending the out-patient department or admitted to in-patient Obstetrics and Gynecology wards who were referred to the Pathology laboratory at BLDE (Deemed to be University) Shri B.M. Patil Medical College, Hospital and Research Centre, Vijayapur were included in this study.

Under aseptic precautions, venous blood samples were collected from

pregnant women who fulfilled the eligibility criteria, after taking informed consent. A detailed history of the included pregnant women was elicited. A complete general physical examination and systemic examination of the pregnant women was undertaken.

Two milliliters of blood were taken in an ethylene diamine tetra acetic acid vacutainer and analyzed for a complete haemogram using an automated hematology analyzer, Sysmex XN-1000 (Figure 1). Haemoglobin level of less than 11.0 g/dl was considered for diagnosis of anaemia in pregnant women.<sup>1</sup>

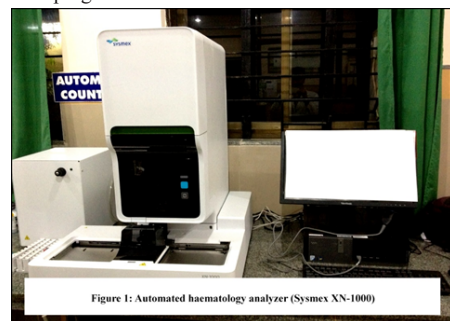


Figure 1: Automated haematology analyzer (Sysmex XN-1000)

All characteristics were summarized descriptively. For continuous variables, the summary statistics of number of cases, mean, and standard deviation were used. For categorical data, the number and percentage were used in the data summaries. ANOVA was used for multi group comparison of means. Bivariate correlation analysis using Pearson's correlation coefficient ( $r$ ) was used to test the strength and direction of relationships between the levels of variables. If the  $p$ -value was  $< 0.05$ , then the results were considered to be significant. Data were analyzed using SPSS software v.24.0.

Pregnant women who did not meet the exclusion criteria, irrespective of parity and previous obstetric history, were included in this study.

The following exclusion criteria were used. Pregnant women with gynecological disorders like tumours of the female genital tract, fibroids, or other associated disorders; pregnant women who had received parenteral iron supplementation; pregnant women who had received blood transfusion within the last 3 months; and pregnant women with bleeding disorders were not included in the study.

### RESULTS

Comparison of the mean values of study parameters with the degree of anaemia was done to determine their significance. It was found that

there was significant correlation between changes in RDW (p value <0.001), MCH (p value 0.021), and MCHC (p value <0.001) with the degree of anaemia. The change in MCV (p value 0.112) did not correlate with the degree of anaemia (Table 1).

**Table 1: Comparison of mean values of selected parameters of cases by degree of anaemia**

Parameters	Degree of anaemia	No. of cases	Minimum	Maximum	Range	Mean	SD	ANOVA p value
RDW	Severe	26	12.9	25.3	12.4	19.3	3.3	<0.001*
	Moderate	84	12.6	31.4	18.8	18.6	3.9	
	Mild	70	12.3	25.2	12.9	16.7	2.8	
MCV	Severe	26	53.6	113	59.4	76.4	15.0	0.112
	Moderate	84	53	101.7	48.7	75.8	9.2	
	Mild	70	58.6	93.3	34.7	79.0	7.3	
MCH	Severe	26	14.9	40.2	25.3	24.1	7.0	0.021*
	Moderate	84	14.8	34.2	19.4	24.0	3.9	
	Mild	70	17.6	32.2	14.6	25.9	3.3	
MCHC	Severe	26	26.5	36.9	10.4	31.1	3.1	<0.001*
	Moderate	84	27.8	35.7	7.9	31.6	1.7	
	Mild	70	30	35.8	5.8	32.7	1.4	

Note: \*significant at 5% level of significance

There was significant inverse correlation ( $r = -0.296$ ) between change in the value of RDW and Hb level. The change in value of MCV did not significantly correlate with the Hb level ( $r = 0.115$ ). Also, out of RDW and MCV, the correlation with Hb level was more with change in RDW than that with change in MCV ( $0.296 > 0.115$ ).

There was significant correlation ( $r = 0.166$ ) between change in the value of MCH and Hb level and also between change in the value of MCHC and Hb level ( $r = 0.303$ ) (Table 2).

**Table 2: Correlation between Hb and change in value of RDW and red cell indices**

Hb	RDW		MCV		MCH		MCHC	
	r value	p value	r value	p value	r value	p value	r value	p value
	-0.296	<0.001*	0.115	0.124	0.166	0.026*	0.303	<0.001*

Note: \*significant at 5% level of significance

**DISCUSSION**

The objective of our study was to determine and compare the usefulness of RDW and red cell indices in prediction of anaemia in pregnant women.

The value of RDW had an inverse relationship with change in Hb level. A decrease in the Hb level was associated with a corresponding increase in the value of RDW. This had a good correlation and was found to be statistically significant.

The value of MCV showed a decrease with decrease in the Hb level. This showed a weaker correlation with the level of Hb and was found to be statistically insignificant.

The values MCH and MCHC showed correlation with change in level of Hb. There was a corresponding decrease in the values of MCH and MCHC associated with decrease in Hb level. The correlation between these two parameters and change in Hb level was found to be statistically significant.

These findings are consistent with those of Sultana et al<sup>5</sup>, who had concluded that red cell distribution width appeared to be a reliable and useful parameter for detection of iron deficiency during pregnancy. In

their study, RDW was found to be the best parameter for prediction of IDA among pregnant women.

Similar results were obtained by Lin et al<sup>6</sup> who found that low MCV and high RDW were the characteristic changes of IDA in pregnancy and recommended the use of RDW and MCV in the initial classification of anaemia in pregnancy.

The findings of Khan et al<sup>7</sup> matched with our study. They had found that increase in RDW (36.2% of cases) was more sensitive than decrease in MCV (19% of cases) for prediction of IDA.

Our findings match with those of McClure et al<sup>8</sup>, who found that an increased RDW was 66% specific and 100% sensitive for the diagnosis of IDA. Similar results were also obtained by Casanova et al<sup>9</sup>.

Viswanath et al<sup>10</sup> also found that RDW had a higher sensitivity in the diagnosis of mild and moderate IDA.

In a study by AlQuaiz et al<sup>11</sup>, they found that RBC parameters were useful in the diagnosis of IDA, findings that are consistent with our study. However, unlike our study, where RDW was found to be the best parameter for the diagnosis of IDA, they found that MCV was better than RDW in this regard.

The findings of Tiwari et al<sup>12</sup> that RDW had utility in diagnosis of IDA in pregnant women ( $r = -0.420$ ,  $p = 0.013$ ) matched with our study. However, they also found significant correlation ( $r = 0.496$ ,  $p = 0.000$ ) between Hb levels and value of MCV, which was not found in our study. Also, they found that MCH ( $r = 0.052$ ,  $p = 0.605$ ) and MCHC ( $r = 0.035$ ,  $p = 0.728$ ) were not useful parameters for diagnosis of IDA.

However, a study by Aulakh et al<sup>4</sup> had contradictory results. They found that, with a sensitivity and specificity of 81.0% and 53.4% and a positive and negative predictive value of 63.0% and 72.2% respectively, RDW had a limited specificity in the diagnosis of IDA.

The findings of Abdelrahman et al<sup>13</sup> highlighted the poor performance of RDW in the diagnosis of IDA in pregnant women. The results of this study did not match with our study, probably due to use of serum ferritin as the gold standard for diagnosis of IDA.

In our study, we found that the correlation coefficients (r) between change in level of Hb and change in values of RDW, MCV, MCH, and MCHC was -0.296 (p value <0.001), 0.115 (p value = 0.124), 0.166 (p value = 0.026), and 0.303 (p value <0.001), respectively. These correlations were statistically significant at 5% level of significance. Between RDW and MCV, the correlation with change in level of Hb was stronger with RDW than MCV.

Anaemia in pregnancy continues to be a common and severe problem in developing countries like India, making an important contribution to maternal morbidity and mortality.<sup>14</sup> It is also associated with poor intrauterine growth and increased risk of preterm births and low birth weight rates, contributing to perinatal morbidity and mortality.<sup>3</sup> Thus, anaemia in pregnancy is associated with adverse consequences for the mother and the infant.

There can be significant reduction in the complications associated with anaemia in pregnancy if there is early detection and prompt management. There can be substantial reduction in undernutrition in childhood, adolescence, and improvement in adult height.

In the current scenario, with a high prevalence rate of anaemia in pregnancy and in a system where health care services are burdened with high work load, it is necessary to make the diagnosis with minimum laboratory tests. An early diagnosis will lead to formation of better management strategies, eventually reducing the burden on health care services.

RDW and red cell indices, which are part of routine haematological parameters in laboratories using automated haematology analyzers, can be helpful in early diagnosis of anaemia in pregnancy.

**CONCLUSION**

RDW is the best indicator for prediction of iron deficiency anaemia in pregnancy. The rise in the value of RDW correlates more significantly than changes in MCV with change in level of haemoglobin in

pregnancy. It is recommended to use RDW and MCV in the antenatal care centres for early diagnosis of IDA in pregnant women as they are cost effective and simple methods for the initial diagnosis.

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