Blood Biochemistry
BCH 471
Red Blood Indices
Red blood cell (RBC) indices:

• A part of a routine blood test (calculated RBC parameters) called the complete blood count (CBC).

• Assist with the differentiation of anemias and serve as quality control checks.
Mean corpuscular hemoglobin (MCH):

• Amount of hemoglobin in average red cell or average amount of Hb in all the red cell.

• It is directly proportional to the amount of hemoglobin and the size of the erythrocyte.

\[
MCH = \frac{Hb\, (gm/dl)}{RBC\, in\, million} \times 10
\]

Normal range = 27-32pg

1pg = 10-12g
Interpretation of MCH values:

Low MCH values: Found in microcytic hypochromic anemias and also when red cells are microcytic and normochromic. In thalassaemia minor the MCH is low even when anemia is mild (MCHC is often normal).

Raised MCH values: Found in macrocytic normochromic anemia.
Mean Corpuscular Volume (MCV):

• It is defined as the average volume of red cell.
• It provides information on red cell size.
• It is measured in femtolitres.

\[ MCV = \frac{PCV}{RBC \text{ in million}} \times 10 \]

• Normal range = 87±5fl
• 1fL = 10^{-15}L
Interpretation of MCV values:

**Low MCV values:** Found in microcytic anemias particularly iron deficiency, anemia of chronic disease and thalassaemia.

**Raised MCV values:** Found in macrocytic anemias, marked reticulocytosis, and chronic alcoholism.
Mean corpuscular hemoglobin concentration (MCHC):

• The MCHC expresses the average concentration of hemoglobin per unit volume of erythrocytes.

• It is expressed in percentage.

• Normal value= 32-36%
Interpretation of MCHC values:

Low MCHC values: Found in iron deficiency anemia and other conditions in which the red cells are microcytic and hypochromic.

Increased MCHC values: Occur in marked spherocytosis.
**Summary of red cell indices in common anemias:**

<table>
<thead>
<tr>
<th>Anemia</th>
<th>MCV</th>
<th>MCH</th>
<th>MCHC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normocytic normochromic</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Microcytic hypochromic</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>Macrocytic normochromic</td>
<td>I</td>
<td>I</td>
<td>N</td>
</tr>
</tbody>
</table>
Red cell distribution width (RDW):

- Degree of red cell size variability in a blood sample. Coefficient of variation of the size of the RBCs.
- Expressed as %.
- Derived from automated instruments that can directly measure the MCV.
- Normal: 11-15 %
Complete Blood Count:

- White Blood Count (WBC)
- Red Blood Cell Count (RBC)
- Platelet Count (Plt)
- Hemoglobin (Hb or Hgb)
- Hematocrit (Hct)
- Red Cell Indices (MCV, MCHC, MCH)
- Red Cell Distribution Width (RDW)
- Differential Count (Diff)