RBC indices

- Red blood cell (RBC) indices are part of the **complete blood count** (CBC) test. They are used to help diagnose **the cause of anemia**, a condition in which there are **too few red blood cells** and/or **low Hb concentration**.

- The indices include:

- **Mean Cell Volume** (MCV)
- **Mean Cell Hemoglobin** (MCH)
- **Mean Cell Hemoglobin Concentration** (MCHC)

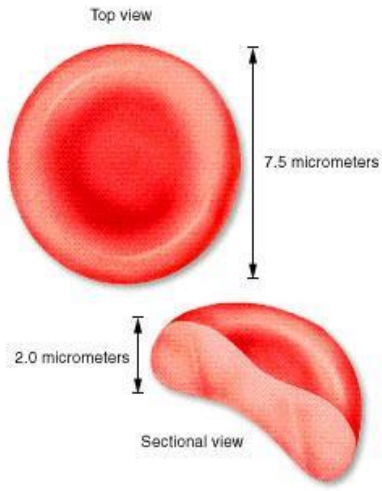
Mean Cell Volume (MCV)

- Index for: the average RBC **size**

- Calculation:

$$\textbf{MCV (fL)} = \frac{\text{PCV (\%)}}{\text{RBC count (million/mm}^3\text{)}} \times 10$$

$fL=10^{-15}$ L



- **Normal range for MCV is 80–100 fL/cell**

Less → **Microcytic**

- **Iron deficiency anemia**
- Kidney failure
- **Thalassemia**
- Lead poisoning
- Anemia of chronic disease

Within the range → **Normocytic** → **With anemia**

- Acute hemorrhage
- Sickle cell anemia
- G6PD deficiency

More → **Macrocytic**

- Folic acid deficiency
- **Vitamine B12 deficiency**
- Cirrhosis
- Excessive alcohol intake
- **Liver** disease
- Hypothyroidism
- **Hemolytic anemia**
- **Bone marrow failure**
- Myelodysplastic syndrome

Mean Cell Hemoglobin (MCH)


Hemoglobin molecules

- Index for: Hb amount per RBC

- Calculation:

$$\textbf{MCH (pg)} = \frac{\text{Hb (g/dl)}}{\text{RBC count (million/mm}^3\text{)}} \times 10 = \text{pg /RBC}$$

$pg=10^{-12}$ g

- Normal range for adults: 27-33 picograms (pg)/RBC in adults

- **Within the range → Normochromic**
- **More than the range → Still Normochromic but there may be Macrocytic anemia**
- **Less than the range → Hypochromic (Low Hb) → e.g. Iron deficiency anemia and thalassemia**

Mean Cell Hemoglobin Concentration (MCHC)

- Index for: The **amount of hemoglobin relative** to the **size of the cell** (hemoglobin concentration) per red blood cell

- Calculation:

$$\text{MCHC (g/dl)} = \frac{\text{Hb (g/dl)}}{\text{PCV (\%)}} \times 100 = \text{g/dl}$$

- Normal range for adults: 33-36 g/dL

- **Within the range → Normochromic**
- **More than the range → Normochromic, but may be due to low PCV as in sickle cell anemia**
- **Less than the range → Hypochromic (Low Hb)**

Summary of RBC indies in common anemias:

Anemia	MCV	MCH	MCHC
Normocytic normochromic	N	N	N
Microcytic hypochromic	D	D	D
Macrocytic normochromic	I	I	N

N: Normal

D: Deficiency

I: Increasing