

RED BLOOD CELLS INDICES

They are used to classify anemias. Results are expressed in absolute numbers independent of other sizes and these are erythrocyte constants and the characteristics of erythrocytes expressing the relative numbers compared with normal values, red cell indices are. RBC indices are not established directly, but they are calculated by the automated analyzer from the first ones.

Erythrocyte constants are:

1. Number of erythrocytes (RBC)
2. Hemoglobin of the blood (HGB)
3. Haematocrite (HCT)
4. Mean corpuscular diameter.

Red cell indices are:

1. Mean corpuscular volume (MCV) is the average size/volume of an individual RBC; it serves to classify in macrocytic, normocytic or microcytic anemia.

$$\text{MCV} = \frac{\text{HCT (\%)} \times 10}{\text{E (mil)}}$$

Normal values: $80 \div 94 \mu\text{m}^3$ (normocyte)

RBCs having a MCV lower than $80 \mu\text{m}^3$ are called microcytes and the condition is named microcytosis. A MCV higher than $100 \mu\text{m}^3$ characterizes macrocytes and the condition is called macrocytosis.

The MCV allows the morphological classification of anaemias in microcytic or macrocytic. The most common causes of microcytic anaemia are: iron deficiency (due to inadequate iron intake, pregnancy, menstruation loss, gastrointestinal bleeding, cancer), thalassemia. Macrocytosis occurs in: vitamin B₁₂ and folic acid deficiencies, liver diseases and alcoholism.

2. Mean corpuscular hemoglobin (MCH) is an average of hemoglobin content of an erythrocyte.

$$\text{MCH} = \frac{\text{HGB} \times 10}{\text{E (mil)}}$$

Normal range: $28 \div 33 \text{ pg}$

MCH depends on the size of erythrocytes and their hemoglobin content; when erythrocytes are small MCH is low, and when erythrocytes are large MCH is increased.

3. Mean corpuscular hemoglobin concentration (MCHC) is an average concentration of erythrocyte hemoglobin expressed as a percentage; shows the percentage of erythrocyte volume occupied by HGB.

$$\text{MCHC} = \frac{\text{HGB} \times 100}{\text{HCT}}$$

Normal range: $32 \div 36 \text{ g Hb /dl}$

If corpuscular volume increase MCHC does not exceed 34%; if the concentration decreases it means microcytosis and hypochromia. MCHC may decrease in hypo chromic anemia and increase in spherocytosis, intravascular haemolysis and presence of cold agglutinins.

4. Red blood cell distribution width (RDW).

It is an index that is calculated by the analyzers by two methods, based on the values of the MCV and the RBCs. The first is referred to as the **RDW- CV**, which is the ratio of the width of the RBCs distribution curve at 1 SD divided by the MCV. The normal value for adults is **11-14.5%**. Microcytosis tends to increase its value, while macrocytosis minimizes the changes in the RDW-CV. The second method refers to **RDW-SD**, that is a direct measurement of the RBCs distribution width

taken at the 20% frequency level (normally $\text{RDW-SD} = 42 \pm 5 \text{ fL}$). It is more sensitive to the appearance of minor populations of macrocytes or microcytes. This index reflects a state of anisocytosis (heterogeneous population of RBC).