University of Al-Ameed
College of Pharmacy

Physiology

Blood indices

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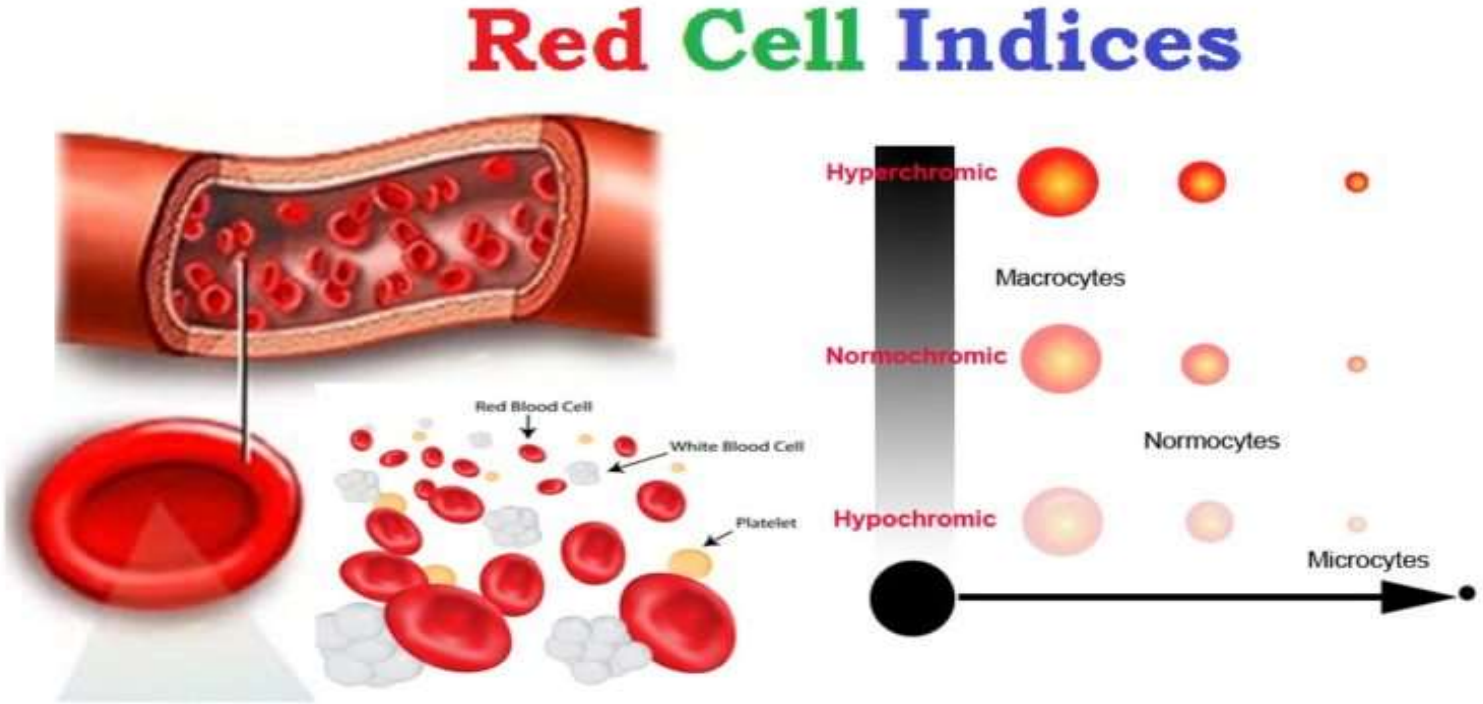
Introduction

Red blood cell (RBC) indices are part of the complete blood count (CBC) test. They are usually used to help diagnose the cause of anemia, a condition in which there are too few red blood cells.



Introduction

Red cell indices traditionally have been the derived parameters of:

1. MCV: Mean Cell Volume.
2. MCH: Mean Cell Hemoglobin.
3. MCHC: Mean Cell Hemoglobin Concentration.
4. RDW: Red Cell Distribution Width.

- These indices can provide a basis for classifying anemias

1. Mean cell volume (MCV)

- Mean cell volume (MCV) is the average volume of an individual RBC.
- MCV is correlated with RBC size.
- Normal range
- Men and women 80 - 100 femtoliters (fl)
- Calculation
- It can be calculated from Hct (or PCV) and the RBC count as follows:

Mean cell volume (MCV)

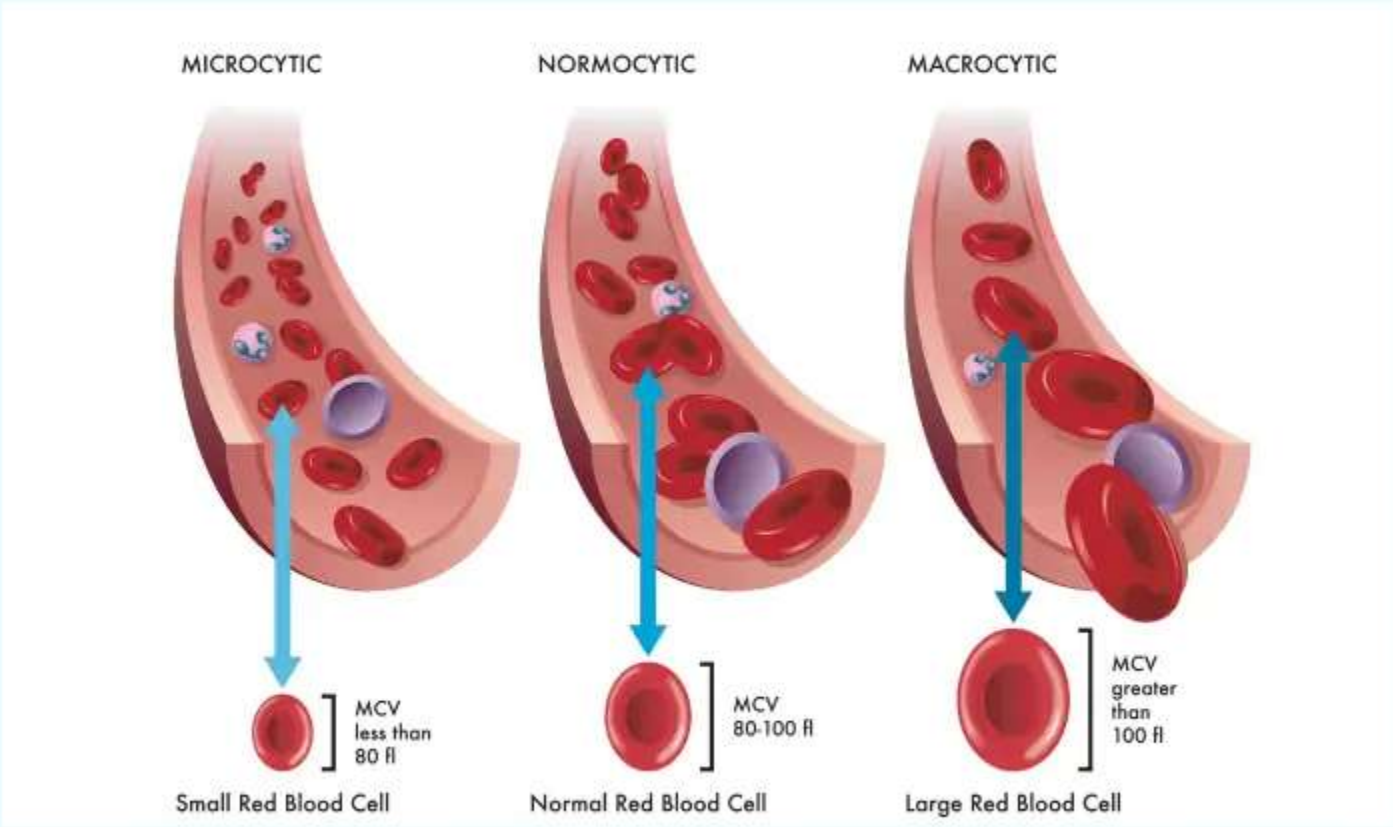
MCV in fl = Hct [%] / RBC [in x10^ 12/L] x 10

E.g: 48 / 4.5 x10 = 106.6 fl (what does this result mean?)

MCV increases in megaloblastic anaemia (macrocytosis) due to malnutrition where deficiency of Vitamin-B_{12}, deficiency of Folic acid and/or others types of Vitamin B and also it's may be due to some liver diseases or hypothyroidism.

MCV decreases microcytic anaemia (microcytosis) due to Iron deficiency or by thalasaemia.

Mean cell volume (MCV)



2. Mean cell hemoglobin (MCH)

Mean cell hemoglobin (MCH) is the average weight of hemoglobin in an individual RBC.

MCH helps in diagnosing various health issues ranging from nutrient deficiencies to chronic diseases

Hemoglobin is a type of protein that carries oxygen from the lungs to the blood so that it reaches every end of the body through the bloodstream.

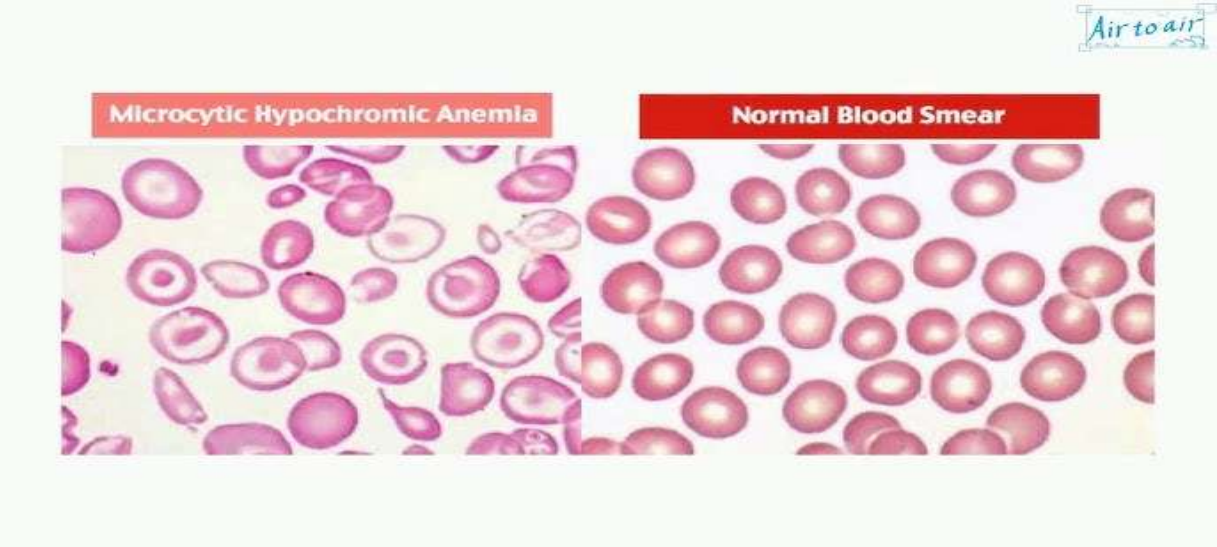
2. Mean cell hemoglobin (MCH)

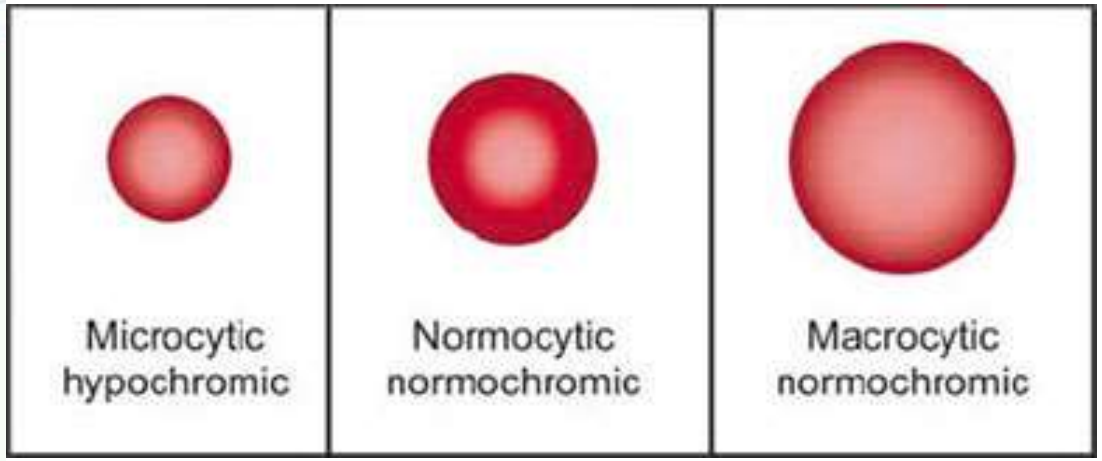
- Normal range
- Men and women 28 – 34 picograms (pg).
- Calculation : ● MCH in pg = Hb [g/dl] / RBC [x10^ 12/L] x 10
- Example: ● MCH = 12.5 / 4.1 x 10 = 30.5 pg

2. Mean cell hemoglobin (MCH)

Interpretation:

- Normal MCH: normochromic RBC. (normal color)
- Low MCH: hypochromic RBC. (faint color)
- High MCH: hyperchromic RBC. (highly pigmented RBCs)





3.Mean cell hemoglobin concentration (MCHC)

Mean cell hemoglobin concentration (MCHC) is the ratio of hemoglobin mass to cell volume.

- Normal range
- Men and women 32 – 36 g/dl.

Mean cell hemoglobin concentration (MCHC)

Calculation

- MCHC is the only measurement that can be obtained with reasonable accuracy by manual methods because this is derived from Hb and PCV (Hct) as the following:
- MCHC in g/dl =

Hb [g/dl] / Hematocrit (%) x 100

- Example:
- MCHC = 12.5 / 37 x 100 = 33.7 g/dl

Mean cell hemoglobin concentration

A high MCHC

One of the most common causes of elevation is associated with a condition known as hemolytic anemia.

In hemolytic anemia, red blood cells begin to break down earlier than normal, leading to increased hemoglobin levels and an elevated MCHC value.

Hemolytic anemia can occur for a number of reasons, such as autoimmune anemia.

Another possible cause is a deficiency of vitamin B12 or folate.

In addition, a blood disorder called hereditary spherocytosis can also cause this value to rise.

Mean cell hemoglobin concentration

Low MCHC means that red blood cells contain less hemoglobin than normal.

In addition, a low value may indicate the following conditions:

Iron deficiency anemia,

Vitamin B12 or folate deficiency,

Thalassemia or other types of genetic anemia,

Chronic diseases.

4. Red cell distribution width (RDW)

Red cell distribution width (RDW) is a parameter that measures variation in red blood cell size.

- RDW is related to variation in red cell size (anisocytosis).
- Normal range ● 11.5 – 14.5 %

*Importance (comparing with MCV)

RDW, along with MCV, is helpful in narrowing the

cause of anemia

What are the variations in the morphology and shapes of RBCs?

1. **Normocytic** when the size is normal (7 to 8 µm).
2. **Normochromic** when the color is normal.
3. **Microcytic** when the size is smaller than normal RBC, and these are less than 6 µm.

In iron deficiency anemia, thalassemia, and hemoglobinopathies.

4 **Macrocytic** when the size is larger than > 8 µm.

Found in liver diseases, alcoholism, and oval in megaloblastic anemia.

5. **Anisocytosis** is an abnormal variation in size from the normal diameter of 6 to 8 µm, seen in severe anemia like iron deficiency and hemolytic anemia.

What are the variations in the morphology and shapes of RBCs?

6.Hypochromasia occurs when the RBCs are pale and have decreased Hb concentration.

7.Poikilocytes are when RBCs have variations in shape.

8.Spherocytes when RBCs are round without the central pale area.

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في وسط التحديات والضغوط الدراسيه
لا تنسوا ان الله مع الصابرين , والتوكل عليه يمنح الطمأنينه والنجاح.

Thank You