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Blood Indices Or Corpuscular Constants

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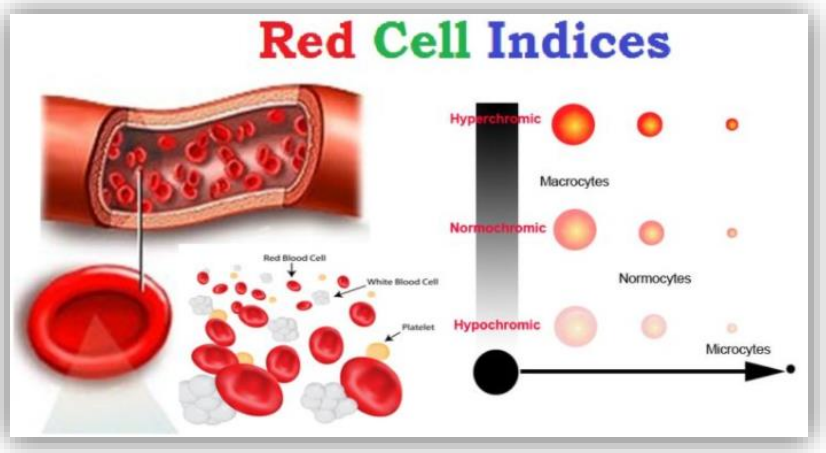

Introduction

- ***Blood indices*** are calculated parameters that are part of an automated blood count report.
- **Blood indices include:** Mean Corpuscular Volume (***MCV***), Mean Corpuscular Hemoglobin (***MCH***), Mean Corpuscular Hemoglobin concentration (***MCHC***), and Color Index (***CI***).
- These parameters identify characteristics of the red cells that are circulating at the time that the sample was collected.
- ***Blood indices*** have ***two primary uses***: Assist with the differentiation of anemias and serve as quality control checks.

Mean Corpuscular Volume (MCV)

- ***MCV*** indicates the average size of a single RBC in femtoliter (fL) (One femtoliter is 10^{-15} Liter)
- ***MCV*** = Packed cell volume (PCV) (ml/L)/ RBC Count (count/L). Normal Range : ***80-95 fL***.
- ***MCV*** is the most useful value in the RBC indices to help determine the type of anemia.
- ***MCV*** can be ***low*** (***microcytic***) , ***normal (normocytic)***, or ***high (macrocytic)***.

High MCV

The MCV is higher than normal when red blood cells are larger than normal. This is called *macrocytic (megaloblastic)anemia.*

Macrocytic anemia can be caused by:

Vitamin B-12 deficiency	folate deficiency	chemotherapy

Low MCV

The MCV will be lower than normal when red blood cells are too small. This condition is called *microcytic anemia.*

Microcytic anemia can be caused by:

iron deficiency, which can be caused by poor dietary intake of iron, menstrual bleeding, or gastrointestinal bleeding, thalassemia , and lead poisoning.

Normal MCV

If you have a normal MCV, it means that your red blood cells are normal in size. You can have a normal MCV and still be anemic if there are too few red blood cells or if other RBC indices are abnormal. This is called *normocytic anemia.*

Normocytic anemia occurs when the RBCs are normal in size and hemoglobin content, but there are too few of them. This can be caused by:

Sudden and significant blood loss	Tumor	Chronic disease, such as a kidney disorder

Mean Corpuscular Hemoglobin (MCH)

- ***MCH*** indicates the average weight of hemoglobin in a single RBC in picogram (One picogram = 10^{-12} gram)
- ***MCH*** = Hb (gm/L)/ RBC Count (count/L). Normal Range : ***27-32 pg***.
- ***Example:*** Hb=15.6 g/100 ml, RBC count:5.340.000 cell/µl MCH=156/5.340.000 *10^12 cell/L= 29.2 *10^{-12} g=29.2 pg.
- ***MCH*** expresses the Hb amount in a single unit without taking the size into account. Therefore, it is of a limited use and less useful in classification of anemia than MCHC.

Mean Corpuscular Hemoglobin Concentration (MCHC)

- ***MCHC*** refers to the average concentration of hemoglobin in the RBCs contained within the sample and expressed as %.
- ***MCHC***= Hb (gm/dL)/ PCV (%) ×100. Normal Range : **32-36 %**.
- Example: Hb=15.6 g/100 ml, PCV=45%, MCHC=(15.6/45)*100=34.7%.
- **MCHC** can be low (***hypochromic anemia***), normal (***normochromic anemia***), or high (***hyperchromic anemia***).

Low MCHC

If ***MCHC is low***, it means that the relative hemoglobin concentration per red blood cell is low. The red blood cells will be seen with a lighter color when viewed under the microscope. Individuals with anemia and a corresponding low MCHC are said to be ***hypochromic***.

Conditions that can cause low MCHC include the same conditions that cause low MCV.

Generally, a ***low MCV*** and a low ***MCHC*** will be found together. Anemias in which both ***MCV and MCHC*** are low are called ***microcytic hypochromic anemia***.

High MCHC

If you have a ***high MCHC***, this means that the relative hemoglobin concentration per red blood cell is high. Individuals with anemia and a corresponding high MCHC are said to be ***hypechromic***.

MCHC can be elevated in diseases such as: hereditary spherocytosis and sickle cell disease

Color Index (CI)

Definition

- CI is the index that gives you a hemoglobin content of a single RBC.

Formula

CI=Hb(% of normal value)/Number of RBCs (% of normal value)

Normal Values of Selected Ages

Normal values of selected ages are presented here:

Age	RBC conc/ml	Hb gm/ml	MCV	MCH	MCHC
First day	5.1 million	19.5	106	38	36
One year	4.5	11.2	78	25	32
Adult male	5.4	16	87	29	34
Adult female	4.8	14	87	29	34

Note: you do not have to memorize the numbers in the table, just take a look to get a general idea.

THE RISK OF Iron Deficiency

IRON DEFICIENCY IS THE MOST COMMON NUTRIENT DEFICIENCY **IN THE WORLD**[1]

4 TO 5 BILLION

Up to 4 to 5 billion people may suffer from iron deficiency.[2]

Although prevalences can vary across communities, iron deficiency anaemia affects approximately 15% of the world population.[3]

111 MILLION

In the high developed countries, 9.1% of the population is affected resulting in 111 million affected people.[4]