

How to understand your bloodwork - CBC

Blood has 3 basic components

55% is plasma - the fluid in which red and white blood cells are suspended

45% is made up of RBC's - red blood cells

1% is made up of WBC's - white blood cells

1. CBC - Complete Blood Count

One of the most commonly administered blood lab tests

Usually done as a routine test

Is used to evaluate the effectiveness of medical treatments

Identifies the cause of symptoms like weakness, fatigue and bruising

Helps diagnose conditions such as anemia, bone marrow disorders, types of infections and nutritional deficiencies such as iron, B-12, folate

CBC's calculate the different types of blood cells - RBC's (red blood cells), platelets, and WBC's (white blood cells) as well as their characteristics

CBC's show

1. **RBC's** - The number of red blood cells - anemia is a low count of RBC's too many may increase the risk of blood clotting
2. **Hemoglobin** - The concentration of hemoglobin - iron containing molecules in red blood cells
3. **Hematocrit** - the proportion of blood volume that contains red blood cells which should be significantly greater than white blood cells and platelets
4. **MCV** - Mean corpuscle volume - measures red blood cell size
5. **MCH** - the average amount of hemoglobin contained in a single RBC
6. **MCHC** - the average amount of hemoglobin found in a group of RBC's rather than one.
7. **Platelets** - the number of platelets. These are tiny cell fragments essential for clotting. Too few can cause abnormal bleeding. Too many can increase the risk of heart attack, stroke or pulmonary embolism.
8. **WBC's** - the number of white blood cells - these help the immune system by protecting the body from foreign bacteria, viruses and other pathogens.

Types of WBC's - white blood cells:

1. Neutrophils
2. Lymphocytes
3. Monocytes
4. Eosinophils
5. Basophils

Deep dive:

RBC's the most plentiful type of cell in the blood. They derive their color from the protein hemoglobin.

The exact shade of red blood depends on the volume of oxygen within - brighter red blood contains more oxygen within darker red blood less

Responsible for carrying oxygen to the tissues and organs and bringing carbon dioxide back to the lungs.

They derive their color from the protein hemoglobin

The average lifespan is 120 days - hemoglobin A1c is a measurement of how much sugar is on the RBC for its lifespan.

The hormone erythropoietin (EPO) which is secreted by the kidneys plays a vital role in RBC production by stimulating stem cells in the bone marrow to produce more RBC's
Moving to a high altitude stimulates the production of RBC's by EPO to compensate for the lower levels of oxygen at a high elevation.
Iron, folate and B12 are required for the manufacture of RBC's as well

A high RBC is called polycythemia.

Hemotomachrosis is a genetic condition of too high RBC's
People who do a great deal of aerobic exercise have higher RBC's

Low RBC is anemia - the most common blood disorder in the US

Excessive bleeding as a cause ie. Women with uterine fibroids for example
Anaplastic anemia caused by bone marrow issues often chemotherapy or radiation
Advanced kidney disease, leukemia, multiple myeloma, auto-immune lupus
Iron deficient anemia
Megoblastic anemia - deficiency of folate or B12
Pernicious anemia - inability to absorb B12

Hemoglobin - Hgb

Hemoglobin and red blood cell counts are interconnected but they are not always directly proportional as red blood cells may contain unequal amounts of hemoglobin.
Normal hemoglobin counts
Men 14 to 18
Women 12 to 16
High levels of hemoglobin can happen in endurance athletes and also in people living in high altitudes or those with COPD and smoking.
High hemoglobin can be associated with increased blood thickness which can slow down the flow of blood.
It can indicate decreased oxygen levels.

Low hemoglobin - Iron, B-complex, Vit C

Hematocrit - is the proportion of your total blood volume that contains red blood cells. This is different from the red blood cell count. It reflects the proportion of your red blood cells in relation to the properties of other cells present in your blood, and indicates if you have too many or too few RBC's.

Normal ranges for Hematocrit

Men 36 to 50

Women 34 to 44

Elevated levels are caused by the same as hemoglobin

Low hematocrit - is usually due to blood loss

MCV - Mean Corpuscular Volume

MCV is a measurement of the average volume or size of your red blood cells.

High > 100

Normal 80 - 100

Low < 80

High MCV may be due to a *deficiency of B12 or folic acid.*

Alcohol abuse, liver disease - chemotherapy - some medications, birth control pills or hemolytic anemia

High MCV can accompany elevated liver enzymes - AST and ALT

B-complex vitamins can help

Low MCV is usually caused by iron deficiency

Removal of spleen can also be a cause

RDW - red cell distribution width. This reflects the amount of variation in RBC size
The normal range for RDW is 11.7 to 15.0 percent.

MCH - Mean Corpuscular Hemoglobin

Measures the amount of hemoglobin contained in a single red blood cell.

MCH is measured in picograms

High > 43

Normal 26 - 43

Low < 26

The common cause overlaps with MCV

MCHC - Mean Corpuscular Hemoglobin Concentration

Reflects the hemoglobin concentration in a given unit of packed red blood cells.

It also helps assess anemia and other blood disorders - similar to MCV - MCHC may be higher in pregnant women which return to normal after birth. High MCHC is associated with elevated liver enzymes AST and ALT

High > 37

Normal 31 - 37

Low < 31

B-complex vitamins help treat this if elevated.

Platelets -

Their main function is to stop bleeding. They also transport inflammatory compounds such as cytokines and neurotransmitters. 2% of serotonin is contained in platelets. Abnormal platelets are linked to many conditions such as auto-immune, cancer, chronic inflammation and iron deficiency.

High > 400,000

Normal 150,000 to 400,000

Low < 150,000

Thrombocythemia is when the bone marrow produces too many platelets

Too high platelets can produce symptoms including headache, numbness of the hands and feet. Abnormal bleeding bruising easily, bleeding in the mouth or gums, and frequent nosebleeds.

Whey protein has been reported to minimize platelet aggregation. Green Tea and Resveratrol all help with high platelet counts.

Low platelets - can be caused by an enlarged spleen, chemotherapy, excessive alcohol consumption, leukemia, toxic chemical and heavy metal exposure

White Blood Cells - known as leukocytes are an essential component of the immune system. When infection develops in the body, the number of white blood cells quickly increases and are transported to the infection site to attack the bacteria or virus or other "bug" 5 types

1. **Neutrophils:** the most common type accounting for 50% of the total WBC's. Immature are called band cells and fully developed are called polys
2. **Lymphocytes:** 2 types of lymphocytes are B cells and T cells produced in lymphoid tissues, the spleen, lymph nodes, and thymus gland. B cells make antibodies that attack bacteria and toxins. T cells target once-healthy cells that have become cancerous or overtaken by a virus.
3. **Monocytes** - distinguished by their large nucleus that develop into either macrophages or dendritic cells. Macrophages ingest microbes while dendritic cells acquire antigens that trigger antibody production so that T cells are able to identify them.

4. **Eosinophils** - aid the body in fighting off parasitic infection. When they accumulate they can contribute to allergic inflammation such as asthma. Eosinophilia is considered to be a reaction to certain diseases, parasites, or allergens
5. **Basophils** - are less than 1% of the total WBC count. They are unique in their ability to kill parasites that are external to the body including ticks. When their number climbs too high they can contribute to allergies.

A white blood cell differential test calculates the number of each WBC type

Total white blood cells	4,500 - 11,000
Neutrophils	1,800 - 7,800
Lymphocytes	1,000 - 4,800
Monocytes	0 - 800
Eosinophils	0 - 450
Basophils	0 - 200

A high WBC count is leukocytosis a low count is called leukopenia

A low WBC can be caused by chemotherapy, bone marrow dysfunction, allergies and autoimmune, hyperthyroidism, HIV, Leukemia.

Swollen lymph nodes are a sign

All information on this paper came directly from

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