

BLOOD TESTS: THE COMPLETE BLOOD COUNT (CBC)

What is a CBC blood test?

The complete blood count (CBC) is one of the most common blood test used. It analyzes the three major types of cells in blood: red blood cells, white blood cells, and platelets. The CBC counts these cells, measures hemoglobin (the oxygen-carrying molecule in red blood cells), estimates the red cells' volume, and sorts the white blood cells into five subtypes, referred to as the CBC differential.

What do the acronyms on the CBC blood test results mean?

CBC TEST NAMES	
Acronym	Definition
WBC	White Blood Cells
RBC	Red Blood Cells
HGB	Hemoglobin
HCT	Hematocrit
MCV	Mean Corpuscular Volume
MCH	Mean Corpuscular Hemoglobin
MCHC	Mean Corpuscular Hemoglobin Concentration
RDW	Red Cell Distribution Width
PLT	Platelets
MPV	Mean Platelet Volume

What is the purpose of white blood cells?

White blood cells (WBC), sometimes referred to as leukocytes, are produced by the immune system to help defend the body against infection. They are formed in the bone marrow and enter the blood for migration to key organs; such as the spleen or lymph nodes. These cells are bigger than red blood cells, and there are far fewer WBCs in the bloodstream. A high white blood cell count likely indicates that an infection is present somewhere in the body, whereas a low number might indicate that an infection or disease has slowed the ability of the bone marrow to produce new white blood cells.

Typically one cubic millimeter of blood contains about 10,000 white blood cells.

There are several different types of white blood cells, which are identified in a CBC with differential blood test.

What is the purpose of red blood cells?

Red blood cells (RBC), often referred to as erythrocytes, are responsible for delivering oxygen throughout the body. There are between 3.6 to 6.1 million in a single milliliter of blood. A low red blood cell count can indicate anemia, which can lead to fatigue.

What is hemoglobin?

Hemoglobin (HGB) is an iron-rich protein found inside red blood cells, which gives blood its red color. Oxygen travels through the bloodstream bound to hemoglobin. The amount of hemoglobin in the blood is an indicator of the amount of oxygen the blood can carry throughout the body. A low hemoglobin number is a good indicator of anemia; whereas, dehydration can temporarily increase hemoglobin levels.

What does hematocrit represent?

Hematocrit (HCT) refers to the amount of your blood that is occupied by red blood cells. A low hematocrit percentage is a good indicator of anemia. The value is expressed as a percentage of cells in blood. For example, a hematocrit value of 42% means that there are 42 milliliters of red blood cells in 100 milliliters of blood.

What does Mean Corpuscular Volume indicate?

Mean Corpuscular Volume (MCV) measures the size of red blood cells. Larger red blood cells may indicate anemia due to vitamin B6 or folic acid deficiency; smaller red blood cells may indicate anemia due to iron deficiency. Some drugs can cause MCV to increase without necessarily causing anemia.

Explain mean corpuscular hemoglobin?

Mean corpuscular hemoglobin (MCH) measures the amount of hemoglobin in red blood cells. Both hemoglobin and hematocrit are used to calculate this number. Low levels indicate anemia.

What does red cell distribution width mean?

Red blood cells can come in different sizes. Red cell distribution width (RDW) looks at the range of these sizes in a blood sample. If anemia is suspected, based on other blood counts, RDW test results are often used together with MCV results to figure out what the cause of the anemia might be.

What is the purpose of platelets

Platelets (PLT) are tiny cells produced by the bone marrow to help your blood clot in the event of a cut or scrape. A high number might be seen in people with cancer, a blood disease, or rheumatoid arthritis. A decreased platelet count is called thrombocytopenia.

There are a number of possible causes

of thrombocytopenia, including a disorder of the immune system that causes antibodies produced by the spleen to kill platelets (idiopathic thrombocytopenia purpura, or ITP). This can be problematic and often warrants immediate medical care.

Mean Platelet Volume

The mean platelet volume (MPV) test measures the average volume (size) of your platelets. A higher-than-normal MPV has been shown to be associated with a greater risk of heart attacks and stroke.

If my doctor orders a CBC with a differential, what do the differential values represent?

The **differential** is a breakdown of the different types of white blood cells. There are actually two main types of white blood cells: phagocytes and lymphocytes. Phagocytes attack germs directly and are powerful defenses against certain infections. Lymphocytes, which include T-cells, play a large role in fighting chronic infections. The 5 subtypes of white blood cells are displayed both as a percentage of white blood cells and as an absolute number of cells. Each subtype acronym is followed by a percent (%) sign, and a pound (#) sign representing percentage and absolute number of cells. Multiplying the percentage of the cell type by the total number of white blood cells will provide the "absolute" number of these types of cells. The number of white blood cells is the equivalent of the sum of the absolute value of the subtype cells. The sum of the percentages for these cells should always equal 100%.

CBC DIFFERENTIAL TEST NAMES	
Acronym	Definition
NEU	Neutrophils (Sometimes labeled GR or Grans.)
LYM	Lymphocytes
MONO	Monocytes
EOS	Eosinophils
BASO	Basophils

What is the purpose of these different white cells?

Neutrophils (NEU) (also known as segs, PMNs, grans (GR)), surround, engulf, and destroy invading microbes, normally accounting for anywhere between 38% and 80% of the white blood cell count. The bacterial infection; a low number can put

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you at a greater risk of experiencing sickness from a bacterial infection.

Lymphocytes, (**LYM**) produce antibodies, which are specific proteins that attack and help destroy specific germs, but most of these circulating in the blood either attack invaders (these are called cytotoxic lymphocytes) or coordinate the attack of antibodies. Lymphocytes include T-cells, B-cells, and natural killer (NK) cells and should account for between 15% and 49% of the total white blood cell count. Viral infections can either increase or decrease the total percentage of lymphocytes.

Monocytes (**MONO**) or mononuclear phagocytes are the largest white blood cells in the bloodstream; they remove dead cells and microbes from the blood. A low number can put you at a higher risk of getting sick from an infection, particularly those caused by bacteria.

Eosinophils (**EOS**), a type of phagocyte that produces the anti-inflammatory protein histamine, are usually elevated in people with allergies or parasitic infections.

Basophil (**BAS**) cells are responsible for controlling inflammation and damage of tissues in the body, such as liver inflammation due to hepatitis.

What do my CBC test results mean?

Test results are reported numerically and are interpreted according to the test's reference range, which may vary by the patient's age, sex, as well as the instrumentation or kit used to perform the test. High or low results are normally reported with an "H" or "L" next to the test result value. A specific result within the reference (normal) range for a CBC blood test does not ensure health just as a result outside the reference range may not indicate disease. IDI recommends you consult your physician to discuss your test results as a

part of a complete medical examination.

What does it mean if my test result is out of the reference range?

Based on the laws of probability, 1 out of 20 (or 5%) determinations will fall outside the established reference range, thus a single test value may mean nothing significant. Generally, the test value is only slightly higher or lower than the reference range. To put this in more perspective: If a doctor runs 20 different tests on you, there's a good chance that one result will fall out of a reference range despite the fact that you are in good health.

A specific result within the reference range for a CBC blood test does not ensure health just as a result outside the reference range may not indicate disease

Of course, the result may indicate a problem. The first thing your doctor is likely to do is to re-run the test. Perhaps the sample being measured happened to be high that day because something went awry, such as the blood specimen was not refrigerated, or the serum was not separated from the red cells, or it was exposed to heat. Laboratories generally report the findings based on age and sex, allowing the physician to interpret the results based on factors such as your diet, your level of activity, or medications you are taking.

How is a blood test's reference range determined?

A blood test's reference range is determined by testing a large number of healthy people within a variety of groups defined by age or sex, or other variables; such as pregnant women and observing what appears to be "normal"

for that group for a specific test. The results would be averaged and a range of normal values would be established. For example, hemoglobin and hematocrit both decline as a natural part of the aging process. Another example, blood loss through menstruation may cause lower hemoglobin and hematocrit levels in pre-menopausal women. These are examples of tests with reference ranges keyed to both age and sex.

Are there other factors that will affect the test values?

Yes! A plethora of additional factors can affect your test results: your intake of caffeine, tobacco, alcohol, and vitamin C; your diet (vegetarian vs. carnivorous); stress or anxiety. Laboratories will generally report your test results accompanied by a reference range associated with your age and sex. Your physician then will interpret the results based on personal knowledge of your particulars, including any medications or herbal remedies you may be taking, or a pregnancy.

Should I keep a record of my CBC blood tests?

Yes! This is especially important if you move frequently, or travel, as your medical records may not be immediately available. A spiral notebook, electronic spreadsheet, and The Personal Health Profile offered by IDI are several techniques that can be used to record your treatments. The following spreadsheet example, Table 1, can be used as a guide. You can add the differential values as your time and need dictate. One advantage of using a spreadsheet is that a graph, Figure 1, can be created.

COMPLETE BLOOD COUNT (CBC) WITHOUT DIFFERENTIAL							
Testing Lab	ABC	ABC	ABC	ABC	ABC	ABC	ABC
Year	2004						
Month/Day	1/8	2/19	3/18	5/17	6/24		
Test Name	Reference Range						
WBC	((4.5 - 11)10**3)	10.30	10.30	11.60	H	7.79	10.10
RBC	((4.7 - 6.1)10**6)	4.9	4.7	4.6	L	4.7	4.8
HGB	(14 - 18 g/dL)	15.0	14.7	14.5		13.8	L 14.5
HCT	(40 - 52 %)	42.9	42.0	40.8		39.5	L 40.9
MCV	80 - 100 fL	95.0	95.0	95.0		95.0	94.2
MCH	27 - 31 pg	33.2	33.3	33.7		33.3	33.4
MCHC	32 - 36 gm/dL	35.0	35.0	35.5		35.0	35.4
PLT	((140 - 420)10**3)	222	225	242		255	233
RDW	11 - 14 %	13.5	13.4	14.5	H	13.9	14.0
MPV	7.4 - 10.4 mu3	7.71	7.53	7.83		7.97	7.85

Table 1. CBC Record

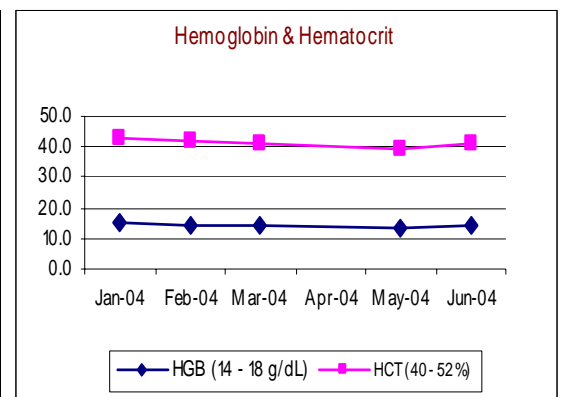


Figure 1. HGB & HCT Chart.

SAMPLE PHLEBOTOMY ORDER
"Phlebotomize 500cc once a period if Hgb > 12.5g/dL."**
 **Period of time should reflect frequency desired.