

BLOOD TESTS

(Normal value and its importance)



COMPLETE BLOOD COUNT

NAME	DEFINATION	NORMAL RANGE
Hb or Hbg (hemoglobin)	This is the protein in your blood that holds the oxygen.	men -14 to 17 gm/dl women - 12 to 15 gm/dL
White blood cells (WBCs)	also called leukocytes or leucocytes, are the cells of the immune system	4,500 to 10,000 cells per microliter (cells/mcL).
RBC (red blood cell count)	they carry oxygen through your body. They also help filter carbon dioxide	Men- 14 to 17 gm/dL women - 12 to 15 gm/dL.
Hct (hematocrit).	is the volume % percentage of red blood cell.	It is normally 40% for men and 31% for women.
MCV (mean corpuscular volume).	This is the average size of your red blood cells.	MCV score - 80 to 95.
Platelets.	also called thrombocytes are a component of blood whose function is to stop bleeding by clumping and clotting blood vessel	140,000 to 450,000 cells/mcL

NAME	DEFINATION	NORMAL RANGE
ESR (Westegren) 1hr	<p>An ESR test can help determine if you have a condition that causes inflammation.</p> <p>If your ESR is high, it may be related to an inflammatory condition</p>	<p>Male - 1-10mm</p> <p>Female - 5-15mm</p>

Liver Function Tests (LFT)

Bilirubin Total	Bilirubin is a reddish yellow pigment made during the normal breakdown of red blood cells.	0-1 mg/dl
Conjugated (D.Bilirubin)	Direct bilirubin is the more soluble, less toxic and conjugated with glucuronic acid.	0-0.35 mg/dl
Unconjugated (I.D.Bilirubin)	Bilirubin that is bound to a certain protein (albumin) in the blood	0.2-0.65 mg/dl
SGOT (AST)	Serum glutamic oxaloacetic transaminase, an enzyme that is normally present in liver and heart cells.	10-40 iu/l
SGPT (ALT)	Serum glutamic pyruvic transaminase, an enzyme that is normally present in liver and heart cells	10-40 iu/l
Alkaline Phosphatase	Alkaline phosphatase is an enzyme found throughout the body. However, it tends to be most concentrated in the liver, the bile ducts, bones and placenta.	40-112 u/l
Total Protein	is a biochemical test for measuring the total amount of protein in serum. Protein in the serum is made up of albumin and globulin.	6-8.5 gm/l
Albumin	is produced in the liver and forms a large proportion of all plasma protein.	3.5-5 gm/l
Globulin	group of proteins in blood, play an important role in liver function, blood clotting, and fighting infection.	2-3.5 gm/l

KIDNEY FUNCTION TEST

Test Name	Defination	Normal value
Blood urea	▪Urea is the terminal product of protein metabolism, and 1g of protein can produce about 0.3g of urea	10-50 mg/dl
Serum Creatinine	▪Creatinine is a chemical waste product in the blood that passes through the kidneys to be filtered and eliminated in urine.	0.6–1.1 mg/dl In Women & 0.7–1.3 mg/dl In Men.
Serum Uric Acid	▪Uric acid is a product of the metabolic breakdown of purinenucleotide, and it is a normal component of urine.	2.4-6.0 mg/dl (female) and 3.4-7.0 mg/dl (male).
Serum Sodium	Sodium is key to controlling the amount of fluid in your body. body needs it for brain and muscles to work the right way.	135-145 mmol /L.
Serum Potassium	A potassium test is used to measure the amount of potassium in your blood. Potassium is an electrolyte that's essential for proper muscle and nerve function..	Adults: 3.5-5.1 mEq/L or mmol/L Children: 3.4-4.7 mEq/L or mmol/L (age dependent)
Chloride	Chloride is an electrolyte that helps keep a proper fluid and acid-base balance in body.	98-106 mmol/L
Total Protein	Albumin and globulin are two types of protein in your body. The total protein test measures the total amount albumin and globulin in your body.	6 -8.3 grams per deciliter (g/dL).

Lipid profile: Lipid profile (Cholesterol and triglycerides)

Test Name	Defination	Normal Range
Total Cholesterol	Total cholesterol: This is the total amount of cholesterol in your blood.	<200 mg/dL
Triglycerides	Triglycerides, another type of fat that causes hardening of the arteries	10 to 150 mg/dL
HDL Cholesterol High-density lipoprotein	This is referred to as “good” cholesterol because it helps remove LDL cholesterol from your blood.	> 40 to 60 mg/dL
LDL Cholesterol Low-density lipoprotein	This is referred to as “bad” cholesterol. Too much of it raises your risk of heart attack, stroke, and atherosclerosis.	70 to 130 mg/dL
VLDL- Very Low-Density Lipoprotein	VLDL cholesterol is a type of blood fat. It's considered one of the "bad" forms of cholesterol, along with LDL cholesterol and triglycerides.	less than or equal to 2 to 30 mg/dL (0.1 to 1.7 mmol/l).

BLOOD SUGER TEST

Plasma glucose test	Definition	Normal	Prediabetes
Random	A random blood sugar test checks your blood glucose at a random time of day.	79–160 mg/dl	N/A
Fasting	Fasting, as the name suggests, means refraining from eating or drinking any liquids other than water for eight hours. It is used as a test for diabetes.	90 to 110mg/dL	110 to 125 mg/dl
2 hour post-prandial	postprandial blood glucose test measures blood glucose exactly 2 hours after eating a meal,timed from the start of the meal.	Below 140 mg/dl	140 to 199 mg/dl
Glucose tolerance test	A glucose tolerance test measures how well your body's cells are able to absorb glucose(75 gm), or sugar, after you ingest a given amount of sugar.	Fasting	60 to 100 mg/dL
		1 hour	<200 mg/dL
		2 hour	<140 mg/dL

HbA1c Blood Test

HbA1c

HbA1c is a marker that can determine your average blood sugar (glucose) levels over the previous 3-months

HbA1c (%)	What it means
4.5 – 6.4	Excellent
6.5 – 7.0	Good
7.1 – 8.0	Acceptable
>8.0	Poor



URINE TEST

Measurement	Reference range	
Color	yellow	cloudy, dark, or blood-colored.
Appearance	Clear	Cloudy urine may be caused by crystals, deposits, white cells, red cells, epithelial cells or fat globules.
Specific gravity (g/ml)	1.005-1.030	Increases in specific gravity - dehydration, diarrhea, emesis, excessive sweating, urinary tract/bladder infection, glucosuria , renal artery s tenosis ...
PH	5.0-8.0	A high (alkaline) pH can be caused by severe vomiting, a kidney disease , some urinary tract infections, and asthma.
Protein (mg/dl)	Negative	Protein may be present in the urine because of acute inflammation or kidney stone disease, or as a sign of kidney damage.
Glucose (mg/dl)	Negative	when blood sugar levels rise well above a target range- which can occur in type 1 and type 2 diabetes-the kidneys often release some of the excess sugar from the blood into the urine .
Ketones (mg/dl)	Negative	High ketone levels in urine may indicate diabetic ketoacidosis (DKA), a complication of diabetes that can

Bilirubin	Negative	In certain liver diseases, such as biliary obstruction or hepatitis, excess bilirubin can build up in the blood and is eliminated in urine .
Blood	Negative	Painful blood in the urine can be caused by a number of disorders, including infections and stones in the urinary tract. Painless blood in the urine can also be due to many causes, including cancer .
Nitrite	Negative	This test is commonly used in diagnosing urinary tract infections (UTI). A positive nitrite test indicates that the cause of the UTI is a gram negative organism, most commonly Escherichia coli.
Urobilinogen	0.2-1.0	Too much urobilinogen in urine can indicate a liver disease such as hepatitis or cirrhosis.
Leukocyte esterase	Negative	Leukocyte esterase is a screening test used to detect a substance that suggests there are white blood cells in the urine . This may mean you have a urinary tract infection.
WBC/HPF (WBCs per high power field, HPF).	0-4	This test is usually ordered to determine if someone has a urinary tract infection. ... If both WBC and leukoesterase are elevated, it more strongly suggests a UTI.
Squamous epithelium	0-4	The presence of squamous epithelial cells may indicate contamination of the urine specimen.

CARDIAC BLOOD TESTS

Test	Definition	Normal Range	
Creatine phosphokinase -MB (CPK-MB)	CPK-MB test is a cardiac marker used to assist diagnoses of an acute myocardial infarction.	5 to 25 IU/L.	
Troponin	A troponin test measures the levels troponin T or troponin I proteins in the blood. These proteins are released when the heart muscle has been damaged, such as occurs with a heart attack.	less than 0.01 ng/mL	
C-Reactive Protein and Heart Disease Risk	CRP seems to predict the chance of having cardiovascular problems at least as well as cholesterol levels.	Test Result	Risk
		Less than 1.0 mg	Low
		1.0-2.9 mg	Intermediate
		Greater than 3.0 mg	High

THYROID FUNCTION TEST

HORMONES	DEFINATION	NORMAL RANGE
TRIIODOTHYRONINE (T3)	Abnormally high levels most commonly indicate a condition called Grave's disease.This is an autoimmune disorder associated with hyperthyroidism.	75 -200 ng/dL
THYROXINE (T4)	A high level of T4 indicates an overactive thyroid (hyperthyroidism). Symptoms include anxiety, unplanned weight loss, tremors, and diarrhea.	4.5 -11.5 ug/dL
THYROID-STIMULATING HORMONE (TSH)	is a pituitary hormone that stimulates the thyroid gland to produce (T4), and then (T3) which stimulates the metabolism of almost every tissue in the body.	0.3 - 5.0 U/mL

Blood Tests for Infertility

FSH Follicle-stimulating hormone	It helps control a woman's menstrual cycle and the production of eggs.	5-20 IU/L (THIRD DAY OF MENSTRUAL PERIOD)	
LH Luteinizing Hormone Level	In women, luteinizing hormone (LH) is linked to ovarian hormone production and egg maturation.	5 – 20 mIU/ ml 25 – 40 mIU/ml (24 – 36 hours before ovulation)	
Prolactin	In women, a prolactin test is done to find out why they are not menstruating, or why they are having infertility problems or abnormal nipple discharge	Non pregnant females: 2 to 29 ng /mL. Pregnant females: 10 to 209 ng/mL.	
Ovarian Reserve (AMH) Test Anti-Mullerian Hormone	The level of AMH in a woman's blood is generally a good indicator of her ovarian reserve.	High (often PCOS) Normal Low normal range Low	Over 4.0 ng/ml 1.5-4.0 ng/ml 1.0-1.5 ng/ml 0.5-1.0 ng/ml

Blood Tests for Infertility

Vitamin B12	Vitamin B12 , also called cobalamin, is a water-soluble vitamin that has a key role in the normal functioning of the brain and nervous system via the synthesis of myelin (myelinogenesis), and the formation of red blood cells.	300-900 pg/ml
Vitamin D	Vitamin D is a nutrient essential for proper growth and formation of teeth and bones. A vitamin D test measures the level of 25-hydroxyvitamin D and/or 1,25-dihydroxyvitamin D in the blood to detect a deficiency or excess.	20 nanograms/milliliter to 50 ng/mL
Serum Calcium	All cells need calcium in order to work. Calcium helps build strong bones and teeth. It is important for heart function, and helps with muscle contraction, nerve signaling, and blood clotting	8.5-10.2 mg/dL
Bone density test	A bone density test is the only test that can diagnose osteoporosis before a broken bone occurs. This test helps to estimate the density of your bones and your chance of breaking a bone.	A T-score -1.0 or above is normal bone density. A T-score of -2.5 or below is a diagnosis of osteoporosis.

SEMAN ANALYSIS

Volume	The average volume of semen produced at Ejaculation.	1.5 – 5 mL
Concentration (sperm count)	sperm per milliliter	50 to 150 million
Motility	How many moving sperm are present. Low motility can also indicate hormonal problems or a varicocele.	50 – 60%
Morphology	What percentage of sperm are normally shaped?	more than 50 percent
Liquefaction	While semen is initially thick, its ability to liquefy, or turn to a watery consistency, helps sperm to move. If semen does not liquefy in 15 to 30 minutes, fertility could be affected	It should take 15 to 30 minutes before semen liquefies.
pH level	A pH level higher than 8.0 could indicate the donor has an infection	between 7.2 - 7.8

Tumor marker

Tumor marker	Associated tumor types
Alpha fetoprotein(AFP)	Hepatocellular Carcinoma, germ cell tumor
CA15-3	Breast Cancer
CA27-29	Breast Cancer
CA19-9	Mainly pancreatic cancer, but also colorectal cancer and other types of gastrointestinal cancer
CA-125	Mainly ovarian cancer, but may also be elevated in endometrial cancer, fallopian tube cancer, lung cancer, breast cancer and gastrointestinal cancer, in endometriosis
Calcitonin	medullary thyroid carcinoma
Human chorionic gonadotropin(hCG)	gestational trophoblastic disease, germ cell tumor, choriocarcinoma

Tumor marker		Associated tumor types		
Neuron-specific enolase (NSE)		It is a substance that has been detected in patients with certain tumors, namely: neuroblastoma , small cell lung cancer , medullary thyroid cancer , carcinoid tumors, endocrine tumors of the pancreas , and melanoma.		
CEA: Carcinoembryonic antigen		is a protein found in many types of cells but associated with tumors and the developing fetus. CEA is tested in blood. CEA level is the tumor marker most often used in colorectal cancer .		
Prostate-specific antigen (PSA) test		A prostate-specific antigen (PSA) test measures the amount of <u>prostate-specific antigen</u> in the blood. PSA is released into a man's blood by his prostate gland .	Age Range (Years)	Asian Americans
			40 to 49	0 to 2.0 ng/mL
			50 to 59	0 to 3.0 ng/mL
			60 to 69	0 to 4.0 ng/mL
			70 to 79	0 to 5.0 ng/mL

BLOOD TEST FOR ARTHRITIS

Rheumatoid factor (RF)	RF are proteins produced by your immune system that can attack healthy tissue in your body.	Less than 15 IU/mL
Antinuclear antibody (ANA)	It detects antinuclear antibodies (ANA) in your blood. Your immune system normally makes antibodies to help you fight infection.	Positive or negative
Anti-cyclic citrullinated peptide (anti-CCP)	Anti-cyclic citrullinated peptide (anti-CCP) is an antibody present in most rheumatoid arthritis patients.	Less than 20 u/ml
HLA-B27	Human leukocyte antigen B27 is a major histocompatibility complex class 1 molecule that is strongly associated with the disease ankylosing spondylitis.	Positive or negative
C-reactive protein	– This test measures body-wide inflammation. It measures a substance produced by the liver that increases in the presence of inflammation.	Below 3.0 mg/dL

Antistreptolysin O titer (ASO)

Positive titre: >200 IU/mL

- Detects antibody to the antigen streptolysin O produced by group A streptococci. Titer rises to a peak at 4-6 weeks and may remain elevated for 1 year.

Positive in:

- Streptococcal infection (eg, upper airway infections, scarlet fever)
- post-streptococcal infection complication (eg, glomerulonephritis and rheumatic fever)

False positive in

- Some bacterial infections.

WIDAL TEST

Table 7.11 : Show materials for examination at different phases of enteric fever		
Stage	Examination	Result (% positive)
1st week	Blood culture Blood picture	95 Leucopenia with relative lymphocytosis
2nd week	Blood culture Widal test	40-50 Low titre antibody
3rd week	Widal test Blood culture Stool and urine culture	100 15-20 80
4th week	Widal test Stool and urine culture Blood culture	100 90 5-10

Table of differences between the various types of parasites that cause malaria				
Plasmodium type	Type that causes malaria	Endemic area	Febrile seizures period	Involvement and severity
Falciparum	tropical malaria	In all endemic areas	Irregular Crisis	Very serious It can cause death if not treated quickly and effectively.
Vivax	tertian malaria	South America and Asia	Every 2 days	Grave, but with a delayed onset.
malariae	quartan malaria	South America and Asia	Every 3 days	Moderate, less frequently.
Ovale	tertian malaria	Africa	Every 2 days	Moderate, less frequently.

Dengue Serology

- NS1 is a glycoprotein that is common to all dengue serotypes and can be used to detect either primary or secondary infections in the earliest stages.
- Serology testing for dengue virus-specific antibodies, types IgG and IgM, can be useful in confirming primary or secondary diagnosis.

Chikungunya

- The type of testing performed is typically dictated by the timing and volume of samples available. Blood test is the only reliable way to identify chikungunya since the symptoms are similar to much more deadly dengue fever.
- Common laboratory tests for chikungunya include for instance **RT-PCR** and **serological tests**.

Name	Defination
Hepatitis A	It is a liver disease caused by the hepatitis A virus. The virus is primarily spread when an uninfected (and unvaccinated) person ingests food or water that is contaminated with the faeces of an infected person. The disease is closely associated with unsafe water or food, inadequate sanitation and poor personal hygiene.
Hepatitis B	HBsAg (also known as the Australia antigen) is the surface antigen of the hepatitis B virus (HBV). It indicates current hepatitis B infection.
Hepatitis C	Hepatitis C is an infectious disease caused by the hepatitis C virus (HCV) that primarily affects the liver.During the initial infection people often have mild or no symptoms. Occasionally a fever, dark urine, abdominal pain, and yellow tinged skin occurs.

HIV -1 & HIV-2

- **HIV tests** are used to detect the presence of the human immunodeficiency virus (HIV), the virus that causes acquired immunodeficiency syndrome(AIDS), in serum, saliva, or urine. Such tests may detect antibodies, antigens, or RNA.
- The **CD4 T-cell count** is not an HIV test, but rather a procedure where the number of CD4 T-cells in the blood is determined.
- A CD4 count does not check for the presence of HIV.
- It is used to monitor immune system function in HIV-positive people.
- **A normal CD4 count can range from 500 cells/mm³ to 1000 cells/mm³.**
- **In HIV-positive people- CD4 count below 200 cells/μL**