

# BLOOD TESTS

(Normal value and its importance )



# COMPLETE BLOOD COUNT

| NAME                                  | DEFINATION  | NORMAL RANGE                                      |
|---------------------------------------|---|---|
| <b>Hb or Hbg (hemoglobin)</b>         | This is the protein in your blood that holds the oxygen.  | men -14 to 17 gm/dl<br>women - 12 to 15 gm/dL     |
| <b>White blood cells (WBCs)</b>       | also called leukocytes or leucocytes, are the cells of the immune system  | 4,500 to 10,000 cells per microliter (cells/mcL). |
| <b>RBC (red blood cell count)</b>     | they carry oxygen through your body. They also help filter carbon dioxide   | Men- 14 to 17 gm/dL<br>women - 12 to 15 gm/dL.    |
| <b>Hct (hematocrit).</b>              | is the volume % percentage of red blood cell.   | It is normally 40% for men and 31% for women.     |
| <b>MCV (mean corpuscular volume).</b> | This is the average size of your red blood cells.   | MCV score - 80 to 95.                             |
| <b>Platelets.</b>                     | also called <b>thrombocytes</b> 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)     | <b>Direct bilirubin</b> 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         | <b>Alkaline phosphatase</b> 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 <a href="#">liver</a> 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   |
|-------------------------|--|--|
| <b>Blood urea</b>       | ▪Urea is the terminal product of protein metabolism, and 1g of protein can produce about 0.3g of urea  | 10-50 mg/dl  |
| <b>Serum Creatinine</b> | ▪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.                                       |
| <b>Serum Uric Acid</b>  | ▪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).                                     |
| <b>Serum Sodium</b>     | 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.   |
| <b>Serum Potassium</b>  | 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<br>Children: 3.4-4.7 mEq/L or mmol/L (age dependent) |
| <b>Chloride</b>         | Chloride is an electrolyte that helps keep a proper fluid and acid-base balance in body.   | 98-106 mmol/L  |
| <b>Total Protein</b>    | 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   |
|--|---|--|
| <b>Total Cholesterol</b>                           | Total cholesterol: This is the total amount of cholesterol in your blood.   | <200 mg/dL   |
| <b>Triglycerides</b>                               | Triglycerides, another type of fat that causes hardening of the arteries  | 10 to 150 mg/dL  |
| <b>HDL Cholesterol</b><br>High-density lipoprotein | This is referred to as “good” cholesterol because it helps remove LDL cholesterol from your blood.  | > 40 to 60 mg/dL   |
| <b>LDL Cholesterol</b><br>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  |
| <b>VLDL- Very Low-Density Lipoprotein</b>          | 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      |
|-------------------------------|--|-----------------|------------------|
| <b>Random</b>                 | A <b>random blood sugar</b> test checks your blood glucose at a random time of day.  | 79–160 mg/dl    | N/A              |
| <b>Fasting</b>                | 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 |
| <b>2 hour post-prandial</b>   | <b>postprandial</b> 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 |
| <b>Glucose tolerance test</b> | 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 <b>urine</b> 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 <b>specific gravity</b> - dehydration, diarrhea, emesis, excessive sweating, urinary tract/bladder infection, glucosuria , renal artery s tenosis ...   |
| PH                      | 5.0-8.0         | A <b>high</b> (alkaline) <b>pH</b> can be caused by severe vomiting, a kidney <b>disease</b> , some <b>urinary</b> tract infections, and asthma.   |
| Protein (mg/dl)         | Negative        | <b>Protein</b> may be present in the <b>urine</b> because of acute inflammation or kidney stone disease, or as a sign of kidney damage.  |
| Glucose (mg/dl)         | Negative        | when blood <b>sugar</b> 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 <b>sugar</b> from the blood into the <b>urine</b> . |
| Ketones (mg/dl)         | Negative        | High <b>ketone</b> levels in <b>urine</b> may indicate diabetic ketoacidosis (DKA), a complication of diabetes that can  |

|  |                 |  |
|--|-----------------|--|
| <b>Bilirubin</b>                                 | <b>Negative</b> | In certain liver diseases, such as biliary obstruction or hepatitis, excess <b>bilirubin</b> can build up in the blood and is eliminated in <b>urine</b> .   |
| <b>Blood</b>                                     | Negative        | <b>Painful</b> blood in the urine can be caused by a number of disorders, including infections and stones in the urinary tract. <b>Painless</b> blood in the urine can also be due to many causes, including <b>cancer</b> . |
| <b>Nitrite</b>                                   | Negative        | This test is commonly used in diagnosing <b>urinary</b> tract infections (UTI). A positive <b>nitrite</b> test indicates that the cause of the UTI is a gram negative organism, most commonly Escherichia coli.              |
| <b>Urobilinogen</b>                              | 0.2-1.0         | Too much <b>urobilinogen in urine</b> can indicate a liver disease such as hepatitis or cirrhosis.   |
| <b>Leukocyte esterase</b>                        | Negative        | <b>Leukocyte esterase</b> is a screening test used to detect a substance that suggests there are white blood cells in the <b>urine</b> . This may mean you have a <b>urinary</b> tract infection.                            |
| <b>WBC/HPF (WBCs per high power field, HPF).</b> | 0-4             | This test is usually ordered to determine if someone has a <b>urinary</b> tract infection. ... If both <b>WBC</b> and leukoesterase are elevated, it more strongly suggests a UTI.   |
| <b>Squamous epithelium</b>                       | 0-4             | The presence of <b>squamous epithelial cells</b> may indicate contamination of the <b>urine</b> 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    |
|--|---|-----------------|
| <b>TRIIODOTHYRONINE (T3)</b>             | Abnormally high levels most commonly indicate a condition called Grave's disease.This is an autoimmune disorder associated with hyperthyroidism.            | 75 -200 ng/dL   |
| <b>THYROXINE (T4)</b>                    | 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 |
| <b>THYROID-STIMULATING HORMONE (TSH)</b> | 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

|   |   |   |   |
|---|---|---|---|
| <p><b>FSH</b><br/>Follicle-stimulating hormone</p>                  | <p>It helps control a woman's menstrual cycle and the production of eggs.</p>   | <p>5-20 IU/L (THIRD DAY OF MENSTRUAL PERIOD)</p>  |   |
| <p><b>LH</b><br/>Luteinizing Hormone Level</p>                      | <p>In women, luteinizing hormone (LH) is linked to ovarian hormone production and egg maturation.</p>   | <p>5 – 20 mIU/ ml<br/>25 – 40 mIU/ml (24 – 36 hours before ovulation)</p>                         |   |
| <p><b>Prolactin</b></p>   | <p>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</p> | <p>Non pregnant females: <b>2 to 29 ng /mL.</b><br/>Pregnant females: <b>10 to 209 ng/mL.</b></p> |   |
| <p><b>Ovarian Reserve (AMH) Test</b><br/>Anti-Mullerian Hormone</p> | <p>The level of AMH in a woman's blood is generally a good indicator of her ovarian reserve.</p>  | <p>High (often PCOS)<br/>Normal<br/>Low normal range<br/>Low</p>                                  | <p>Over 4.0 ng/ml<br/>1.5-4.0 ng/ml<br/>1.0-1.5 ng/ml<br/>0.5-1.0 ng/ml</p> |

# Blood Tests for Infertility

|                          |   |  |
|--------------------------|---|--|
| <b>Vitamin B12</b>       | <b>Vitamin B12</b> , 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  |
| <b>Vitamin D</b>         | <b>Vitamin D</b> is a nutrient essential for proper growth and formation of teeth and bones. A <b>vitamin D</b> test measures the level of <b>25-hydroxyvitamin D</b> and/or 1,25-dihydroxyvitamin D in the blood to detect a deficiency or excess. | 20 nanograms/milliliter to 50 ng/mL  |
| <b>Serum Calcium</b>     | All cells need <b>calcium</b> in order to work. <b>Calcium</b> 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   |
| <b>Bone density test</b> | A <b>bone density test</b> 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

|                                    |  |   |
|------------------------------------|--|---|
| <b>Volume</b>                      | The average volume of semen produced at Ejaculation.   | 1.5 – 5 mL  |
| <b>Concentration (sperm count)</b> | sperm per milliliter   | 50 to 150 million                                       |
| <b>Motility</b>                    | How many moving sperm are present. Low motility can also indicate hormonal problems or a varicocele.   | 50 – 60%  |
| <b>Morphology</b>                  | What percentage of sperm are normally shaped?  | more than 50 percent                                    |
| <b>Liquefaction</b>                | 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. |
| <b>pH level</b>                    | A pH level higher than 8.0 could indicate the donor has an infection   | between 7.2 - 7.8                                       |

# Tumor marker

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

| Tumor marker                                | Associated tumor types   |                          |                        |
|---|--|--------------------------|------------------------|
| <b>Neuron-specific enolase (NSE)</b>        | It is a substance that has been detected in patients with certain tumors, namely: <b>neuroblastoma</b> , small cell <b>lung cancer</b> , medullary <b>thyroid cancer</b> , carcinoid tumors, endocrine tumors of the <b>pancreas</b> , and melanoma. |                          |                        |
| <b>CEA: Carcinoembryonic antigen</b>        | is a protein found in many types of cells but associated with <b>tumors</b> and the developing fetus. <b>CEA</b> is tested in blood. CEA level is the <b>tumor marker</b> most often used in <b>colorectal cancer</b> .                              |                          |                        |
| <b>Prostate-specific antigen (PSA) test</b> | 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 .  | <b>Age Range (Years)</b> | <b>Asian Americans</b> |
| 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

|   |  |                          |
|---|--|--------------------------|
| <b>Rheumatoid factor (RF)</b>                       | RF are proteins produced by your immune system that can attack healthy tissue in your body.  | Less than 15 IU/mL       |
| <b>Antinuclear antibody (ANA)</b>                   | It detects antinuclear antibodies ( <b>ANA</b> ) in your blood. Your immune system normally makes antibodies to help you fight infection.                      | Positive or negative     |
| <b>Anti-cyclic citrullinated peptide (anti-CCP)</b> | <b>Anti-cyclic citrullinated peptide (anti-CCP)</b> is an antibody present in most rheumatoid arthritis patients.  | Less than <b>20 u/ml</b> |
| <b>HLA-B27</b>                                      | Human leukocyte antigen <b>B27</b> is a major histocompatibility complex class 1 molecule that is strongly associated with the disease ankylosing spondylitis. | Positive or negative     |
| <b>C-reactive protein</b>                           | – 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 : Shows materials for examination at different phases of enteric fever**

| <i>Stage</i>    | <i>Examination</i>                                     | <i>Result (% positive)</i>                   |
|-----------------|--|--|
| <b>1st week</b> | Blood culture<br>Blood picture                         | 95<br>Leucopenia with relative lymphocytosis |
| <b>2nd week</b> | Blood culture<br>Widal test                            | 40-50<br>Low titre antibody                  |
| <b>3rd week</b> | Widal test<br>Blood culture<br>Stool and urine culture | 100<br>15-20<br>80                           |
| <b>4th week</b> | Widal test<br>Stool and urine culture<br>Blood culture | 100<br>90<br>5-10                            |

**Table of differences between the various types of parasites that cause malaria**

| <b>Plasmodium type</b> | <b>Type that causes malaria</b> | <b>Endemic area</b>    | <b>Febrile seizures period</b> | <b>Involvement and severity</b>  |
|------------------------|---------------------------------|------------------------|--------------------------------|--|
| <b>Falciparum</b>      | tropical malaria                | In all endemic areas   | Irregular Crisis               | Very serious<br>It can cause death if not treated quickly and effectively. |
| <b>Vivax</b>           | tertian malaria                 | South America and Asia | Every 2 days                   | Grave, but with a delayed onset.   |
| <b>malariae</b>        | quartan malaria                 | South America and Asia | Every 3 days                   | Moderate, less frequently.   |
| <b>Ovale</b>           | 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  |
|--------------------|---|
| <b>Hepatitis A</b> | 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. |
| <b>Hepatitis B</b> | HBsAg (also known as the Australia antigen) is the surface antigen of the hepatitis B virus (HBV). It indicates current hepatitis B infection.  |
| <b>Hepatitis C</b> | 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/mm<sup>3</sup> to 1000 cells/mm<sup>3</sup>.**
- **In HIV-positive people- CD4 count below 200 cells/μL**

Thank  
you

