

Serum Tests (Serological Tests)

Serum is the yellow liquid remaining from blood after a clot forms. It contains high levels of protein, but serum does not contain white, red blood cells, clotting factors, it includes all blood proteins (even clotting proteins because they are not used in blood clotting or coagulation), and all the electrolytes (salts and ions), antibodies Ab, antigens Ag, hormones, vitamins, cytokines, inflammatory mediators, complement proteins and any exogenous substances (e.g., drugs, antibiotics and microorganisms).

A study of serum is called serology. To obtain serum, after blood collection, blood is left to form a clot. Coagulated blood (clotted blood) yields serum without fibrinogen.

Serum is used for many diagnostic tests;

- 1. Serum for Biochemical tests.**
- 2. Serological Tests.**
- 3. Serum for hormones and enzymes.**

1. Serum for Biochemical Tests:

1) Blood Sugar:

Detecting sugar level in serum by two means;

- **Fasting blood sugar (FBS or Fasting Glucose):**

This test measures blood sugar levels. Elevated levels are associated with diabetes and insulin deficiency, in which the body cannot properly handle sugar (e.g. obesity). Less than 100 mg/dL = normal
Between 110–125 mg/dL = impaired fasting glucose (i.e., prediabetes)
Greater than 126 mg/dL on two or more samples = diabetes.

This test requires a 12-hour fast. Medications e.g. hypoglycemic agent (insulin or oral medication) should not be taken. Eating and digesting foods called carbohydrates forms glucose (blood sugar).

Insulin is needed by the body to allow glucose to get inside the cells and to be used as energy. Without insulin, the levels of glucose in the blood will rise. Diabetes is a disease that occurs when either the pancreas is not able to produce insulin or the pancreas makes insulin, but it does not work properly. Fasting blood sugar is a part of diabetic evaluation and management. An FBS greater than 126 mg/dL, on more than one estimation or testing usually indicates diabetes.

- **Random blood sugar (RBS or Random Glucose):**

This test can be done during any time of day (not fasting). Levels obtained are usually higher than fasting blood sugar, The normal values for normal peoples in adult between 79 - 140 mg/dl, between 140 - 200mg/dl is considered pre-diabetes, and over 200 mg/dl is considered diabetes.

2) Liver Function Tests:

They are group of clinical biochemistry laboratory methods give information about the state of a patient's liver. The parameters measured include:

- Prothrombin time (this test use whole blood)
- Serum albumin.
- Serum bilirubin (direct and indirect).
- Serum transaminase.
- Serum Lactate dehydrogenase (LDH)

These tests can be used to:

- (1) Detect the presence of liver disease.

(2) Distinguish among different types of liver disorders.

(3) As soon as possible treatment.

(4) For routine checkup (usually about twice a year) mainly for individuals taking certain medications in order to ensure that these medications are not damaging the person's liver.

3) Tests to Determine Risk of Coronary Artery Disease:

Usually needs serum from fasting persons for at least 12 hours before taking samples, the most important tests include:

- Total Cholesterol (TC), directly linked to risk of heart and blood vessel disease. Cholesterol is a type of fat, found in blood. It is produced by the body and comes from the foods of animal products. Cholesterol is needed by human body to maintain the health of cells. Too much cholesterol leads to coronary artery disease. This test may be measured any time of the day without fasting, but if the test is needed as part of a total lipid tests, it requires a 12-hour fast.
- Low density lipoprotein (LDL). It is a lipoprotein (a combination of fat and protein), high levels are linked with increased risk of heart and blood vessel disease.
- High Density Lipoprotein (HDL). High levels linked to a reduced risk of heart and blood vessel disease. The higher HDL level, it is better.
- Triglycerides (TG). Elevated in obese or diabetic patients. Level increases from eating simple sugars or drinking alcohol. Associated with heart and blood vessel disease.
- Lipoprotein a (Lpa).
- Lactate dehydrogenase (LDH) it is an enzyme released in the blood with cell injury. It is often used as a late marker to detect a heart attack. It is also elevated with liver and kidney disease.

4) Renal and Kidneys function Tests:

- Blood Urea or Serum Urea:

Urea is waste product for protein digestion formed in the liver from amino acids and from ammonia compounds the normal range between 6–20 mg/dL, it is an important indicator for renal function. Fever can cause elevation in its levels.

- Serum Electrolytes:

Including Sodium, Magnesium and Potassium estimation in serum. These electrolytes concentrations have direct link with renal and kidneys function, also for diarrhea cases.

- Serum Creatinine (SCr)

Metabolic product, removed mainly by kidneys. It becomes elevated during kidney disease, muscle injury and some medications, normal values between 0.7 – 1.4 mg/dL.

2. Serological Tests.

These tests are called serological tests because they use Antibodies (Ab) or Antigens (Ag) found in serum as a tool for detection, a huge number of tests are listed under this title, and in continuous developing with time due to improving techniques. Several tests are very common in clinical laboratories which need special kits:

- **Rose Bengal Test;** detects the presence of *Brucella spp.* (Malta fever bacteria) infections by detecting specific Ab against this bacteria in patient serum.
- **Widal Test,** detects the presence of *Samonella typhi* (Typhoid fever bacteria) infections by detecting specific Ab against this bacteria in patient serum.
- **Anti-Streptolysin Test (ASOT),** this test use serum to detect the presence of streptolysin-O Ab in serum samples. Streptolysin-O is a toxin produced by *Streptococcus pyogenes* during tonsillitis infections. If the test showed high levels of Ab produced against this toxin in serum then there is an infection with these bacteria.
- **Rheumatoid Factor (RF),** detects the presence of auto-Antibodies in cases like rheumatoid arthritis.

- **Detection of Sexual Transmitted Diseases (STD)**, the most common tests are;

- a. AIDS, caused by HIV (Human Immunodeficiency Virus).
- b. Toxoplasmosis caused by the parasite *Toxoplasme gondii*.
- c. Syphilis, caused by the bacteria *Treponema pallidum*.
- d. Trichomoniasis, caused by the parasite *Trichomonas vaginalis*.

- **Detection of viral infections** like Hepatitis A, B and C.
- **Detection of Cancer Ab or Ag.**

Other serological tests are used in scientific research laboratories, like ELISA (Enzyme Linked Immunosorbant Assay), serum protein electrophoresis and others.

3. Serum for Hormones and Enzymes.

Many hormones and enzymes can be estimated using serum, for example Thyroid Blood Tests involve estimation of three hormones used to detect thyroid gland function, hormones to be tested are; Thyroid Stimulating Hormone (TSH), Thyroxine (T4) and Tri-iodothyronine (T3). Special kits are used to do these tests.