




LABORATORY TESTS

Test for the diabetes

• Diagnostic Tests

- • usually diagnose type 1 diabetes in children and young adults. Because type 1 diabetes can run in families,.
- • Type 2 diabetic Experts recommend routine testing for type 2 diabetes if the patients are age 45 or older usually over weight or obese ,have one or more other diabetes risk factor
- Though type 2 diabetes most often develops in adults, children also can develop type 2 diabetes. Experts recommend testing children between the ages of 10 and 18 who are overweight or obese and have at least two other risk factors for developing diabetes.¹

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- **Gestational diabetes**
 - All pregnant women who do not have a prior diabetes diagnosis should be tested for gestational diabetes. pregnant will take a glucose challenge test between 24 and 28 weeks of pregnancy.
 - What tests are used to diagnose diabetes and prediabetes?
 - Health care professionals most often use the fasting plasma glucose (FPG) test or the A1C test to diagnose diabetes. In some cases, they may use a random plasma glucose (RPG) test.

- **1. Fasting plasma glucose (FPG) test**
- The FPG blood test measures blood glucose level at a single point in time. For the most reliable results, it is best to have this test in the morning, after you fast for at least 8 hours. Fasting means having nothing to eat or drink except sips of water.

- **2.A1C test**

- The A1C test is a blood test that provides average levels of blood glucose over the past 3 months. Other names for the A1C test are hemoglobin A1C, HbA1C, glycated hemoglobin, and glycosylated hemoglobin test. the patient can eat and drink before this test. When it comes to using the A1C to diagnose diabetes, age and ,anemia or another problem with blood. The A1C test is not accurate in people with anemia.
- The A1C test result as a percentage, such as an A1C of 7 percent. The higher the percentage, reflect the higher average blood glucose levels.
- People with diabetes also use information from the A1C test to help manage their diabetes
- NOTE
- The results can be affected by problems due to interactions with the investigative procedure used in the measurement such as in renal failure and disorders of hemoglobin, and conditions that affect lifespan of red blood cells such as iron deficiency anemia. Hence, in these conditions, alternative methods of monitoring glucose control such as capillary glucose monitoring is needed.

- **3. Random plasma glucose (RPG) test**

- The RPG test to diagnose diabetes when diabetes symptoms are present and we don't want to wait until you have fasted. do not need to fast overnight for the RPG test. this blood test can do at any time.

- **4. What tests are used to diagnose gestational diabetes?**

- Pregnant women may have the glucose challenge test, the oral glucose tolerance test, or both. These tests show how well the body handles glucose.

- **5. Glucose challenge test**

- Pregnantis checking for gestational diabetes, first receive the glucose challenge test. Another name for this test is the glucose screening test. In this test, draw blood 1 hour after drink a sweet liquid containing glucose. no need to fast for this test. If the blood glucose is too high—135 to 140 or more—we may need to return for an oral glucose tolerance test while fasting.

- **6.Oral glucose tolerance test (OGTT)**

- The OGTT measures blood glucose after fast for at least 8 hours. First, blood draw then will drink the liquid containing glucose. For diagnosing gestational diabetes, need blood drawn every hour for 2 to 3 hours.
- High blood glucose levels at any two or more blood test times during the OGTT—fasting, 1 hour, 2 hours, or 3 hours—mean gestational diabetes.
- The OGTT is used to diagnose type 2 diabetes and prediabetes in people who are not pregnant. The OGTT helps to detect type 2 diabetes and prediabetes better than the FPG test. However, the OGTT is a more expensive test and is not as easy to give. To diagnose type 2 diabetes and prediabetes, a health care professional will need to draw your blood 1 hour after you drink the liquid containing glucose and again after 2 hours.
- What test numbers tell me if the patient have diabetes or prediabetes?
- Each test to detect diabetes and prediabetes uses a different measurement. Usually, the same test method needs to be repeated on a second day to diagnose diabetes. the doctor may also use a second test method to confirm diabetes.

The following table helps to understand what your test numbers mean if you are not pregnant

Diagnosis	A1C (percent)	Fasting plasma glucose (FPG)^a	Oral glucose tolerance test (OGTT)^{ab}	Random plasma glucose test (RPG)^a
Normal	below 5.7	99 or below	139 or below	
Prediabetes	5.7 to 6.4	100 to 125	140 to 199	
Diabetes	6.5 or above	126 or above	200 or above	200 or above

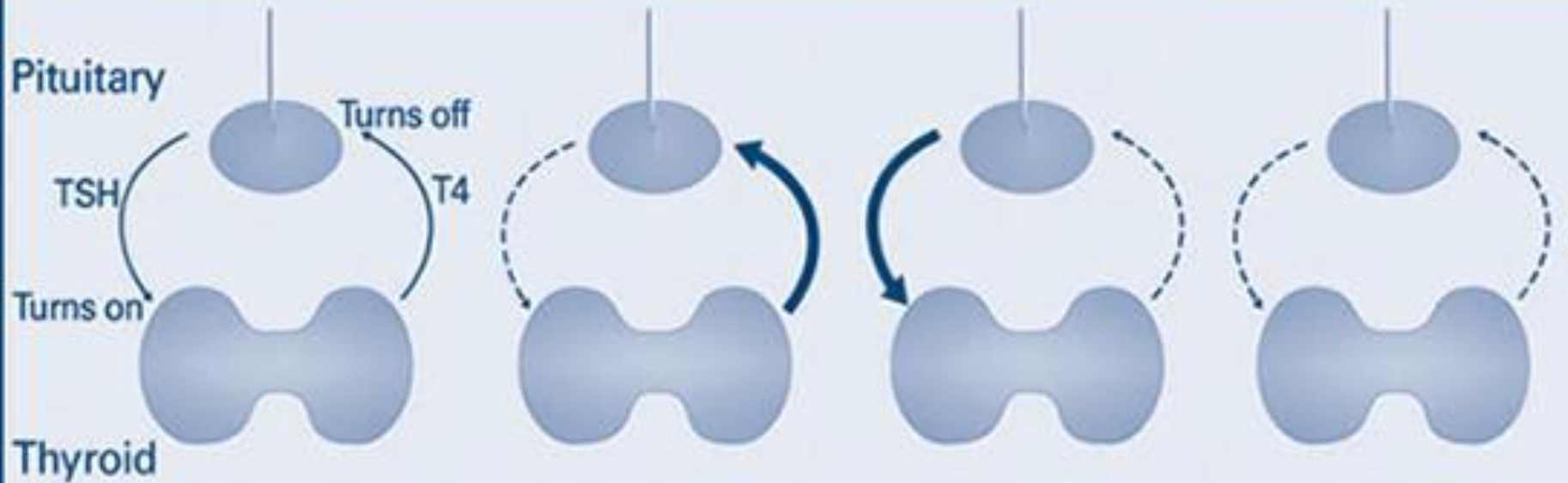
^aSource

^a Glucose values are in milligrams per deciliter, or mg/dL.

- Even though the tests described here can confirm that the patient have diabetes, but they can't identify what type. Some time unsure if diabetes is type 1 or type 2. A rare type of diabetes that can occur in babies, called **monogenic diabetes**, can also be mistaken for type 1 diabetes. Treatment depends on the type of diabetes, so knowing which type is important.
- **Note**
- To confirm diabetes is type 1, the presence of one or more of several types of autoantibodies specific to diabetes is common in type 1 diabetes, but not in type 2 or monogenic diabetes.
- If diabetes occur when the patient pregnant, get tested 6 to 12 weeks after baby is born to see if the patient have type 2 diabetes.

The test of the thyroid gland

- The major thyroid hormone secreted by the thyroid gland is thyroxine, also called T₄ because it contains four iodine atoms. To exert its effects, T₄ is converted to triiodothyronine (T₃) by the removal of an iodine atom.
- The amount of T₄ produced by the thyroid gland is controlled by another hormone, which is made in the pituitary gland located at the base of the brain, called thyroid stimulating hormone (abbreviated TSH).



CONDITION: Normal

Hyperthyroidism

**Hypothyroidism
Primary**

**Hypothyroidism
Secondary**

TSH Normal

Low

High

Low

T4 Normal

High

Low

Low

- T₄ and T₃ circulate almost entirely bound to specific transport proteins, and there are some situations which these proteins could change their level in the blood, producing also changes in the T₄ and T₃ levels (it happens frequently during pregnancy, women who take control birth pills, etc).

- **TESTS**

- Blood tests to measure TSH, T4, T3 and Free T4 are readily available and widely used. Tests to evaluate thyroid function include the following:

- **1.TSH TESTS**

- The best way to initially test thyroid function is to measure the TSH level in a blood sample. A high TSH level indicates that the thyroid gland is failing because of a problem that is directly affecting the thyroid (primary hypothyroidism). The opposite situation, in which the TSH level is low, usually indicates that the person has an overactive thyroid that is producing too much thyroid hormone (hyperthyroidism). Occasionally, a low TSH may result from an abnormality in the pituitary gland, which prevents it from making enough TSH to stimulate the thyroid (secondary hypothyroidism). In most healthy individuals, a normal TSH value means that the thyroid is functioning normally.

- **2.T4 TESTS**

- T4 circulates in the blood in two forms:
- A.) T4 bound to proteins that prevent the T4 from entering the various tissues that need thyroid hormone.
- B.) Free T4, which does enter the various target tissues to exert its effects. The free T4 fraction is the most important to determine how the thyroid is functioning, and tests to measure this are called the Free T4 (FT4) and the Free T4 Index (FT4I or FTI). Individuals who have hyperthyroidism will have an elevated FT4 or FTI, whereas patients with hypothyroidism will have a low level of FT4 or FTI.
- Combining the TSH test with the FT4 or FTI accurately determines how the thyroid gland is functioning.

- The finding of an elevated TSH and low FT4 or FTI indicates primary hypothyroidism due to disease in the thyroid gland. A low TSH and low FT4 or FTI indicates hypothyroidism due to a problem involving the pituitary gland. A low TSH with an elevated FT4 or FTI is found in individuals who have hyperthyroidism.

- **3.T3 TESTS**

- T3 tests are often useful to diagnosis hyperthyroidism or to determine the severity of the hyperthyroidism. Patients who are hyperthyroid will have an elevated T3 level. In some individuals with a low TSH, only the T3 is elevated and the FT4 or FTI is normal. T3 testing rarely is helpful in the hypothyroid patient, since it is the last test to become abnormal.
- Patients can be severely hypothyroid with a high TSH and low FT4 or FTI, but have a normal T3. In some situations, such as during pregnancy or while taking birth control pills, high levels of total T4 and T3 can exist. This is because the estrogens increase the level of the binding proteins. In these situations, it is better to ask both for TSH and free T4 for thyroid evaluation.

- **4. THYROID ANTIBODY TESTS.**

- Two common antibodies that cause thyroid problems are directed against thyroid cell proteins: thyroid peroxidase and thyroglobulin. Measuring levels of thyroid antibodies may help diagnose the cause of the thyroid problems. For example, positive anti-thyroid peroxidase and/or anti-thyroglobulin antibodies in a patient with hypothyroidism make a diagnosis of Hashimoto's thyroiditis. If the antibodies are positive in a hyperthyroid patient, the most likely diagnosis is autoimmune thyroid disease

- **NON-BLOOD TESTS**

- **RADIOACTIVE IODINE UPTAKE.** By measuring the amount of radioactivity that is taken up by the thyroid gland (radioactive iodine uptake, RAIU), doctors may determine whether the gland is functioning normally. A very high RAIU is seen in individuals whose thyroid gland is overactive (hyperthyroidism), while a low RAIU is seen when the thyroid gland is underactive (hypothyroidism).
- In addition to the radioactive iodine uptake, a thyroid scan may be obtained.

Tests for the liver:

- ❓ **Alanine transaminase (ALT) test.** ALT is an enzyme that helps break down proteins and is found mainly in the liver. High levels in blood could mean liver damage.
- ❓ **Alkaline phosphatase (ALP) test.** ALP is an enzyme have in the liver, bile ducts, and bone. the patient might have high levels if have liver damage or disease, a blocked bile duct, or bone disease.
- ❓ **Albumin and total protein test.** Two main proteins: albumin and globulin. Low levels can mean damage or disease.
- ❓ **Aspartate transaminase (AST) test.** AST is another enzyme found in the liver. High blood levels could be a sign of damage or disease.
- ❓ **Bilirubin test.** Bilirubin is made when red blood cells break down. Usually, the liver cleans bilirubin out of the body. If high levels in blood, a problem called jaundice, mean liver damage.
- ❓ **Gamma-glutamyltransferase (GGT) test.** High levels of the GGT enzyme could point to liver or bile duct damage.
- ❓ **L-lactate dehydrogenase (LD) test.** LD is another enzyme that's high when have liver damage, but other conditions can raise its level, as well.
- ❓ **Prothrombin time (PT) test.** This test measures how long it takes blood to clot. If it takes a long time, that could be a sign of liver damage. Medications that thin blood, such as warfarin (Coumadin), can also lead to a longer PT.

Another name for AST is **serum glutamic oxaloacetic transaminase (SGOT)**. Similarly another name for ALT is serum glutamic pyruvic transaminase (SGPT). Hence, AST is also referred to as SGOT and ALT is also referred to as SGPT

The Diagnosis of Hepatitis

- There are a number of reasons why people may want to consider talking to their doctors about a hepatitis screening, which includes:
 - Being born to a mother who has hepatitis.
 - Any emergency or health care providers who may have come into contact with contaminated blood or accidentally pricked with a needle
 - Anyone who has undergone long term hemodialysis treatment
 - Any individual who has ever used a needle to inject illegal drugs
 - Anyone who received a organ transplant or blood diffusion before
 - Anyone who has had sexual intercourse with a HCV infected person

- Clinical manifestations vary widely between different forms of viral hepatitis, as summarized below.
- [?] HAV is highly contagious and usually manifests as acute infection in adults but is usually asymptomatic in children. It is a self-limiting disease, has no chronic carrier state, and seldom causes serious sequelae, although some patients may develop acute fulminant liver failure.
- [?] HBV and HCV manifest as acute or asymptomatic disease, but often establish chronic infection resulting in substantial morbidity and mortality. Chronic infection with HBV or HCV may lead to liver cirrhosis and hepatocellular carcinoma (HCC).
- HDV is a "defective" virus in that it can replicate only in the presence of HBV. HBV/HDV coinfection (simultaneous acquisition of HBV and HDV) and superinfection (acquisition of HDV by a person with chronic HBV infection) significantly increase the severity of disease relative to HBV infection alone
- Acute HBV/HDV coinfection may be severe, but it tends to resolve spontaneously. In contrast, HBV/HDV superinfection has a high likelihood of progressing to chronic infection

Interpretation of Individual Test Results in the Diagnosis of Acute and Chronic Viral Hepatitis

Marker	Interpretation
HAV	
HAV IgM	<ul style="list-style-type: none"> • Presence indicates current or recent infection. A negative result indicates absence of infection.
HAV total Ab	<ul style="list-style-type: none"> • Presence of total (IgM and IgG) HAV antibody in the absence of HAV IgM antibody indicates immunity against HAV infection.
HBV	
HBsAg	<ul style="list-style-type: none"> • Presence indicates that a person has HBV infection and is infectious.
HBcAb, total	<ul style="list-style-type: none"> • Presence indicates past or current HBV infection.
HBcAbIgM	<ul style="list-style-type: none"> • Presence usually indicates HBV infection within the preceding 4 to 6 months (ie, acute infection).
HBeAb	<ul style="list-style-type: none"> • Presence indicates resolving infection or response to therapy.
HBeAg	<ul style="list-style-type: none"> • Presence indicates active viral replication and high infectivity
HBsAb	<ul style="list-style-type: none"> • Presence indicates resolution and immunity against HBV infection or response to vaccination.
HBV DNA	<ul style="list-style-type: none"> • Presence indicates current infection.

HDV

HDV Ab, total • Presence coincident with the presence of HBsAg indicates past or current HBV/HDV coinfection or superinfection.

HDV IgM • Presence coincident with the presence of HBsAg indicates past or current HBV/HDV coinfection or superinfection. A negative result coincident with the presence of HDV total antibody indicates resolved infection.

HCV

HCV Ab • Presence (with detectable HCV RNA) indicates current infection. A positive result coincident with a negative HCV RNA test may indicate a resolved infection or a false-positive antibody screening test.

HCV RNA • Presence indicates current infection. A negative result indicates absence of current infection.

Routine blood test of kidney function

- The usual blood test which checks that the kidneys are working properly measures the level of urea, creatinine and certain dissolved salts.
- **1. Urea** is a waste product formed from the breakdown of proteins. Urea is usually passed out in the urine. A high blood level of urea ('uraemia') indicates that the kidneys may not be working properly, or that you have a low body water content (are dehydrated).
- **2. Creatinine** is a waste product made by the muscles. Creatinine passes into the bloodstream, and is usually passed out in urine. A high blood level of creatinine indicates that the kidneys may not be working properly. Creatinine is usually a more accurate marker of kidney function than urea. The effect of muscle mass needs to be taken into account. A person with a lot of muscle and little fat on their body is likely to have a higher creatinine than a person who has a lot of fat and little muscle.

- **3. Estimated glomerular filtration rate (eGFR)** provides a guide to kidney function. Although the level of creatinine in the blood is a useful guide to kidney function, the eGFR is a more accurate measure. Blood creatinine can be used to estimate the eGFR using age, sex and race.. The normal value for eGFR is 90-120 ml/min. An eGFR below 60 ml/min suggests that some kidney damage has occurred. The value becomes lower with increasing severity of kidney damage.
- **4. Dissolved Salts** that are routinely measured are sodium, potassium, chloride and bicarbonate. They are sometimes referred to as 'electrolytes'. Abnormal blood levels of any of these may be due to a kidney problem. (Some other conditions may also alter the salt balance in the blood).