

Lab.

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DIABETIC PANEL



Diabetic Panel

Is a group of tests that are used to diagnose the diabetes mellitus or its complications, it include

- 1- Blood Glucose (4 types): FBS, PPBS, RBS and OGGT
- 2- Urine analysis: U sugar, U protein, U Microalbumin & Ketones
- 3- HBA1c 4- Insulin 5- ICA (islet cell antibody) 6- C- Peptide

*Diabetes Mellitus

Diabetes is a group of conditions linked by an inability to produce enough insulin and/or to respond to insulin. This causes high blood glucose levels (hyperglycemia).

People with diabetes are unable to process glucose, the body's primary energy source, effectively. Normally, after a meal, carbohydrates are broken down into glucose and other simple sugars. This causes blood glucose levels to rise and stimulates the pancreas to release insulin into the bloodstream.

Insulin is a hormone produced by the beta cells in the pancreas. It regulates the transport of glucose into most of the body's

cells and works with **glucagon**, another pancreatic hormone, to maintain blood glucose levels within a narrow range.

Type of Diabetes	Description
Type 1	Exact cause unknown; thought to be primarily an autoimmune disease that involves the destruction of the insulin-producing beta cells in the pancreas; can occur at any age but usually diagnosed in children and young adults.
Type 2	Most common type; associated with insulin resistance and with insulin production that is insufficient to meet the body's needs and to compensate for resistance. It develops most frequently in overweight middle-aged and elderly people. With increased obesity in children and adolescents, the condition is becoming more common at younger ages.
Gestational	Develops during a woman's pregnancy and affects both mother and developing baby; typically develops late in the pregnancy.
Prediabetes	Higher blood glucose than normal, but not considered diabetes; people with prediabetes are at an increased risk of developing diabetes.
Other	A group of less common types of diabetes. Any condition that damages the pancreas and/or affects insulin production or usage can cause diabetes.

****Blood Glucose:**

Glucose (commonly called "blood sugar") is the primary energy source for the body's cells.

A few different protocols may be used to evaluate glucose levels

- **Fasting blood glucose (FBS)** (commonly called fasting blood sugar)—this test measures the level after a fast of at least 8 hours.
- **Random blood glucose (RBS)**—sometimes your blood glucose will be measured when you have not fasted (randomly).

Fasting Blood Glucose

GLUCOSE LEVEL	INDICATION
From 70 to 99 mg/dL (3.9 to 5.5 mmol/L)	Normal fasting glucose
From 100 to 125 mg/dL (5.6 to 6.9 mmol/L)	Prediabetes (impaired fasting glucose)
126 mg/dL (7.0 mmol/L) and above on more than one testing occasion	Diabetes

*High levels of glucose (**Hyperglycemia**) most frequently indicate **diabetes**, but many other diseases and conditions can also cause elevated blood glucose such as:

- 1- Acromegaly
- 2-Acute stress (response to trauma, heart attack, and stroke for instance).
- 3- Cushing syndrome.

*A low level of glucose may indicate (**hypoglycemia**).

- 1-Adrenal insufficiency.
- 2-Severe liver disease.
- 3-Insulin overdose.

REFERENCE VALUES⁵

Serum, plasma (fasting)

Adults	70 - 105 mg/dL (3.89 - 5.83 mmol/L)
Children	60 - 110 mg/dL (3.33 - 6.11 mmol/L)
Newborns	40 - 60 mg/dL (2.22 - 3.33 mmol/L)

***Glycated Hemoglobin (HbA1c):**

Hemoglobin A1c, also called A1c or glycated hemoglobin, is hemoglobin with glucose attached. The A1c test evaluates the average amount of glucose in the blood over the last 2 to 3 months by measuring the percentage of glycated hemoglobin in the blood.

Hemoglobin is an oxygen-transporting protein found inside red blood cells (RBCs), as glucose circulates in the blood, some of it spontaneously binds to hemoglobin A

HbA1c is a more reliable method of monitoring long-term diabetes control than random plasma glucose. **Normal values range from 4.0% to 6.0%.**

Studies have shown that there is a strong linear relationship between average blood glucose and HbA1c. (eAG) can be calculated from the HbA1c reported value using the equation:

$$eAG (mg/dL) = 28.7 \times HbA1c - 46.7.$$

TABLE 14-11		TRANSLATING THE A ₁ C ASSAY INTO ESTIMATED AVERAGE GLUCOSE VALUES GLUCOSE LEVELS AND A ₁ C LEVELS ¹
AVERAGE PLASMA GLUCOSE	A ₁ C (%)	
97 mg/dL (5.4 mmol/L)	5	
126 mg/dL (7.0 mmol/L)	6	
154 mg/dL (8.6 mmol/L)	7	
183 mg/dL (10.2 mmol/L)	8	
212 mg/dL (11.8 mmol/L)	9	
240 mg/dL (13.4 mmol/L)	10	
269 mg/dL (14.9 mmol/L)	11	
298 mg/dL (16.5 mmol/L)	12	

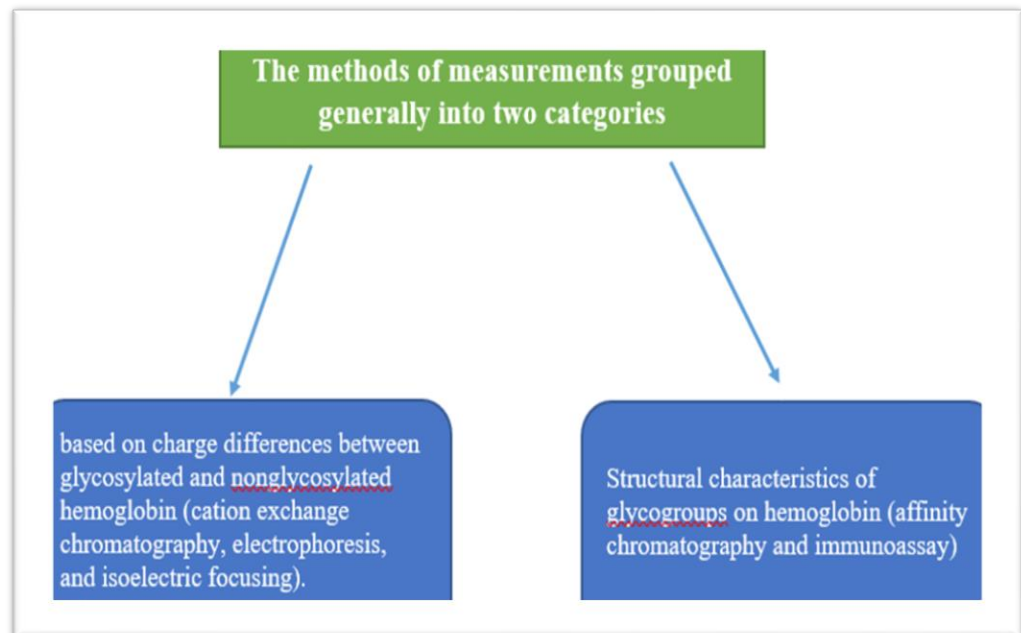
Source: Nathan DM, Kuenen J, Borg R, Zheng H, Schoenfeld D, Heine RJ. Translating the A1C assay into estimated average glucose values. *Diabetes Care*. August 2008;31(8):1473-1478.

Notes:

- 1- The specimen requirement for HbA1c measurement is an EDTA whole blood sample.

2- It is also important to remember that two factors determine the glycosylated hemoglobin levels: the average glucose concentration and the red blood cell life span.

Methods for measurements:



Advantage of HbA1c:

- 1- The sample can be drawn at any time.
- 2- This test is not affected by short-term variation like:
 - a- Food.
 - b- exercise.
 - c- Hypoglycemic agents.
 - d- Stress.
 - e- Patient attitude or cooperation.
- 3- It differentiates short-term hyperglycemia in nondiabetic patients like:
 - a- Recent stress.
 - b- Myocardial infarction.
- 4- Gives information on glucose imbalance in a patient with mild diabetes mellitus.

5-Evaluating the success of diabetic treatment and patient compliance.

Limitation of HbA1c

1- This cannot be used to find a day to day fluctuation of glucose to adjust the insulin dose.

2- It cannot find a day to day presence of hypo or hyperglycemia.

Clinical significance: -

The HbA1c Increased level is seen in:

1- Newly diagnosed diabetic patient.

2- Uncontrolled diabetic patient.

3- Nondiabetic hyperglycemia is seen in: a-Cushing's syndrome.

b. Acromegaly. C- Corticosteroids therapy. D- Acute stress.

4- Patient with splenectomy.

The decreased HbA1c level is seen in:

1- Hemolytic anemia. 2- Chronic blood loss. 3- Chronic renal failure.

HbA1c can be controlled or lowered by:

1- Exercise. 2- Diet control. 3- Medication. 4- Or a combination of these.