



Blood glucose

Glucose; the Greek word for sweet, the simple sugar that results from carbohydrates metabolism. When dietary sources of glucose are not available, the liver synthesizes glucose from glycogen (glycogenolysis) or from protein (gluconeogenesis). All cells use glucose as an important energy source.

Clinical significance of blood glucose

Blood sugar (glucose) measurements are used to diagnose diabetes. They are also used to monitor glucose control for those people who are already known to have diabetes.

If your glucose level remains high, then you have **diabetes (Hyperglycemia)**.
If the level goes too low then it is called **hypoglycemia**.

1. Hyperglycemia

- ▶ Diabetic mellitus: Diabetes is due to either the pancreas not producing enough insulin, or the cells of the body not responding properly to the insulin produced.
There are two main types of diabetes mellitus:
 - ▶ Type I: Insulin dependent diabetic mellitus, onset in childhood.
 - ▶ Type II: Non-insulin dependent diabetic mellitus, there is resistant to Insulin action by the target tissue.
- ▶ Cushing's syndrome.
- ▶ Acromegaly.
- ▶ Hyperadrenalinism.



2. Hypoglycemia: Occurs when glucose level decreased below 40 mg/dl.

Most frequently hypoglycemia happened as a result of:

- ▶ Starvation.
- ▶ Myxedema: hypothyroidism
- ▶ Hypopituitarism.
- ▶ Over dosage of insulin in the treatment of diabetes type I.
- ▶ Drug overdose by oral hypoglycemic drug in the treatment of diabetes type II.
- ▶ Alcohol ingestion.

Hormones affected on blood sugar level

1. **Insulin:** reduce blood glucose by facilitating its entry into the cells.
2. **Glucagon:** stimulates glycogenolysis and gluconeogenesis.
3. **Growth hormones and adrenocorticotrophic hormones:** These hormones are produced by anterior pituitary gland and cause increase in blood sugar.
4. **Hydrocortisone hormone:** Secreted by adrenal cortex and stimulates gluconeogenesis.
5. **Epinephrine and thyroxin:** Both stimulate glycogenolysis.

The main tests for measuring the amount of glucose in the blood are:

1. **Random blood glucose level:** A sample of blood taken at any time can be a useful test if diabetes is suspected
2. **Fasting blood glucose level:** A blood test taken in the morning before you eat anything is a more accurate test. Do not eat or drink anything except water for 8-10 hours before a fasting blood glucose test.
3. **The HbA1c blood test:** If you have diabetes, your HbA1c level may be done every 2-6 months by your doctor or nurse. This test measures your recent average blood sugar (glucose) level. Because it is an average measurement you do NOT need to fast on the day of the test. The test measures a part of



the red blood cells. Glucose in the blood attaches to part of the red blood cells. This part can be measured and gives a good indication of your average blood glucose over the previous 2-3 months

4. **Oral glucose tolerance test**: This test is not now usually used to diagnose diabetes. However, the test may be done if it is thought your body doesn't control glucose levels normally but not badly enough to be called diabetes. This is referred to as pre-diabetes.

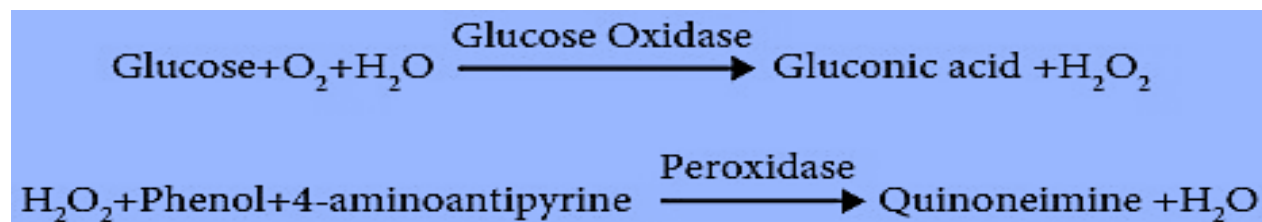
For this test, you fast overnight. In the morning you are given a drink which contains 75 g of glucose. A blood sample is taken two hours later. Normally, your body should be able to deal with the glucose and your blood level should not go too high.

5. **Capillary blood glucose (home monitoring)**: By using a small glucose meter machine, the blood level of glucose can be measured quickly. Home monitoring is very important for any person with diabetes who needs insulin treatment.
6. **Urine test for blood sugar (glucose)**: kidneys constantly reabsorb glucose so that it doesn't enter your urine. However, if the glucose level goes above a certain level, the kidneys can't reabsorb all of the glucose. This means that some glucose will 'spill' through the kidneys into the urine.

Determination of blood glucose

Enzymatic method (glucose oxidase method) for blood glucose determination :

Principle : Glucose is oxidized by glucose oxidase to gluconate and hydrogen peroxide according to the following equation :



**Procedure :**

	Standard	Sample	Blank
Working solution	1000 μ l	1000 μ l	1000 μ l
Sample	-	10 μ l	-
Standard	10 μ l	-	-

Mix, incubate 10 minutes at 37°C or 30 min. at room temperature (20-25) Read absorbance (Abs. Absorbance) at 505 nm.

Calculation :

$$\text{Glucose concentration} = \frac{\text{Abs. sample} - \text{Abs. blank}}{\text{Abs. standard} - \text{Abs. blank}} \times n$$

n = conc. Of standard n = 100 mg/dl , n = 5.58 μ mol/l

The normal range of blood glucose is 80-120 mg/dl.