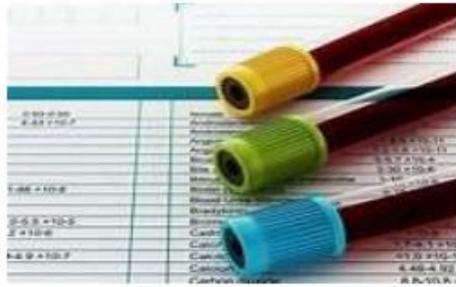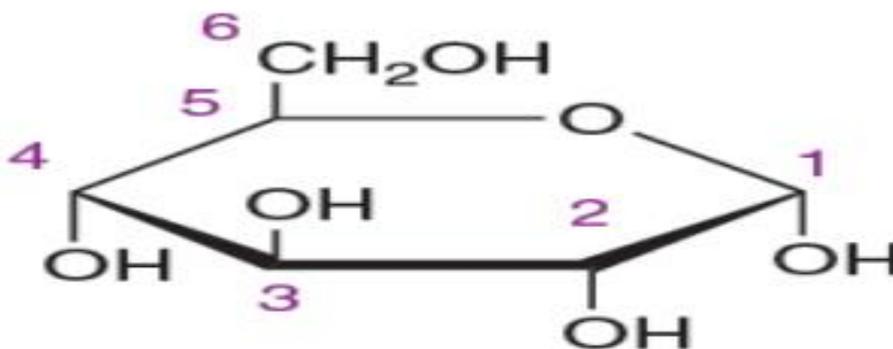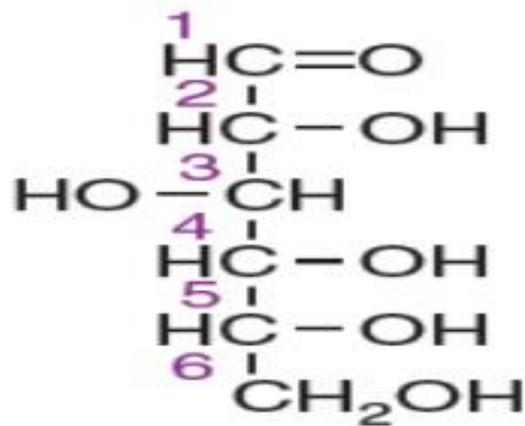# Determination of blood glucose

Blood glucose determination is one of the most common clinical diagnostic tests, measures the amount of glucose in blood.

The Structure of Glucose

Monosaccharides, hexoses, glucose found as a chain structural formula and cyclic structure.

Glucose, a type of simple sugar, is main source of energy. Glucose is the most important carbohydrate; most dietary carbohydrate is absorbed into the bloodstream as glucose formed by hydrolysis of dietary starch and disaccharides, and other sugars are converted to glucose by digestive enzymes and by the liver, When dietary sources of glucose are not available, the liver synthesizes glucose from glycogen (glycogenolysis) or protein (gluconeogenesis).

It is the precursor for synthesis of all the other carbohydrates in the body, including glycogen for storage; ribose and deoxyribose in nucleic acids; galactose for synthesis of lactose in milk

Clinical significance

Measurement of blood glucose is important in diagnosis and follow up of diseases associated with carbohydrate metabolism as :

1- **Hypoglycemia:** Different conditions are associated with decreasing of blood glucose levels, these include;

- (insulinoma) of the pancreas, liver cirrhosis and other liver diseases.

- The Hypoglycemia may be considered to be present when the blood glucose is below 1.2 mmol/liter (40 mg/100 ml).

- Hypoglycemia occurs with insulin in the treatment of diabetes, starvation.

2- **Hyperglycemia:** included
- Diabetes mellitus, gestational diabetes mellitus
- hydrocortisone which increased gluconeogenesis.
- Hyperadrenalinism caused a rise in blood glucose adrenalin causes the conversion of glycogen to glucose by the liver.

Diabetes mellitus

Diabetes mellitus (DM) is a group of metabolic disorders of carbohydrate metabolism characterized by an elevation of fasting blood glucose caused by with two major causes:
- Absolute deficiency of insulin
- Resistance to insulin (tissues do not respond to the action of insulin)
other hormones raise blood sugar, included adrenalin, hydrocortisone, glucagon, thyroxin and growth hormone.
Most cases of diabetes mellitus can be separated into two groups
type 1 (formerly called insulin-dependent diabetes mellitus)
type 2 (formerly called non-insulin-dependent diabetes mellitus).
Other type of DM is gestational diabetes mellitus is also a disease of insulin resistance. Signs of gestational diabetes usually appear around the second trimester of pregnancy, and frequently gestational diabetes will resolve upon completion of

the pregnancy. Although gestational diabetes will resolve for some, it does carry a risk that type 2 diabetes may develop at a later time

Criteria for the Diagnosis of Diabetes Mellitus

Any one of the following is diagnostic:

A. Glucose

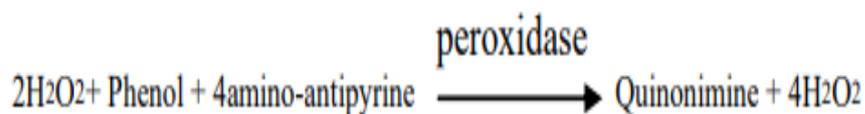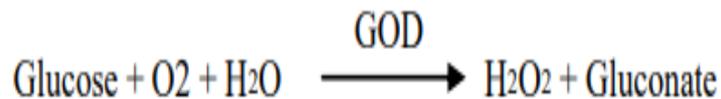**1. Fasting blood sugar (FPS)** ≥7.0 mmol/L (126 mg/dL) FBS is defined as no caloric intake for at least 8 h.

2. Random blood sugar (RBS) ≥11.1 mmol/L (200 mg/dL), RBS defined as without regard to time since the last meal.

3. Oral glucose tolerance test (OGTT) The test should be performed using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water and measures blood glucose exactly after 2 hour, plasma glucose ≥11.1 mmol/L (200 mg/dL).

B. Hemoglobin A1c (HbA1c) It is important because it gives an idea to the risk of illness and the complication of diabetes. HbA1c ≥ 6.5%, but this is not universally agreed as other factors such as haemoglobin variants and abnormal erythrocyte lifespan may affect HbA1c levels.

Principle :

Glucose is oxidized by glucose-oxidase (GOD) to gluconate and hydrogen peroxide (H2O2) according to the following equation.

$$Glucose + O_2 + H_2O \xrightarrow{\text{GOD}} H_2O_2 + Gluconate$$

$$2H_2O_2 + Phenol + 4amino\text{-}antipyrine \xrightarrow{\text{peroxidase}} Quinonimine + 4H_2O_2$$

Calculation:

$$C_{(glucose)} = \frac{A(sample)}{A(standard)} * n$$

n= 5.56 mmol/L   or   n=100 mg/dl

Normal Value :

3.89-5.84 mmol/L or 70-105 mg/dl