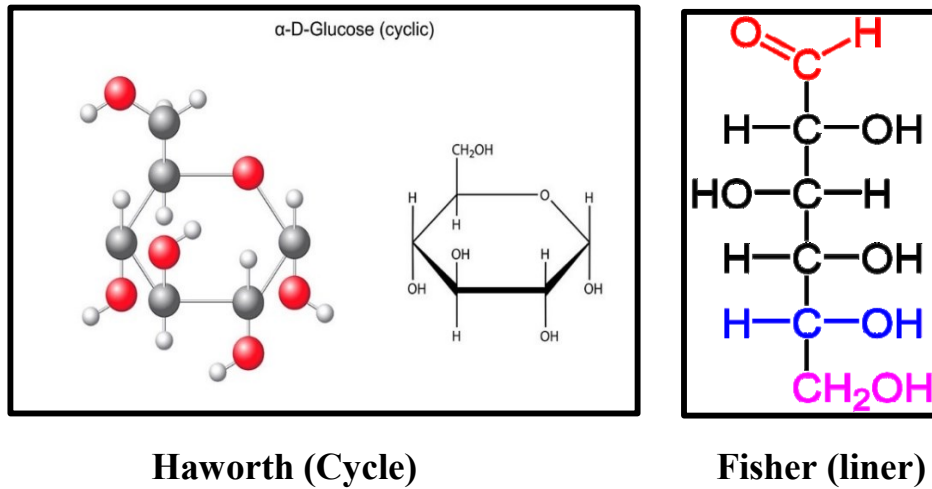


Serum Glucose

Glucose is the most important of carbohydrates known as simple sugars (monosaccharides). It has the molecular formula $C_6H_{12}O_6$. Starch, the major energy-supplying carbohydrate in human diet is consisting of glucose units. Glucose is the major free sugar circulating in the blood and the regulation of its metabolism is of great importance.



Structure of glucose

Blood glucose is derived from two main sources:

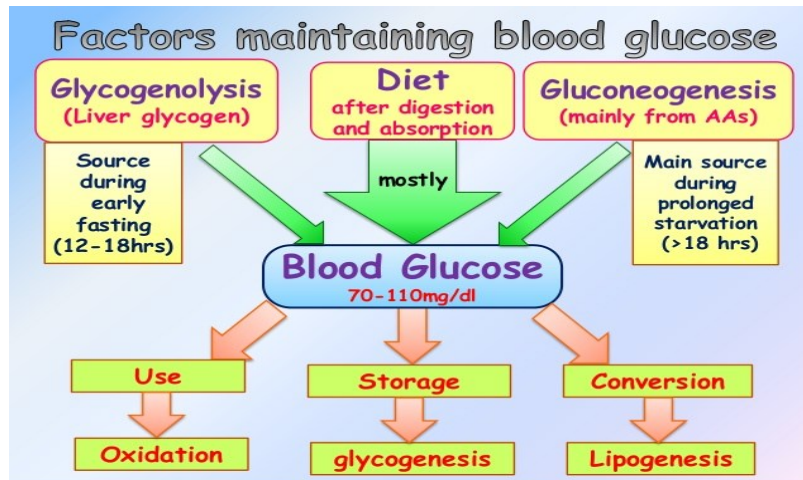
1- Intestinal absorption

Glucose is the end-product of many digestible carbohydrates and enters circulation after intestinal absorption. Blood glucose concentration rises about 2 hours after a meal.

2- Hepatic production

Hydrolysis of stored glycogen in hepatic cells (glycogenolysis) produces glucose when metabolically necessary.

Gluconeogenesis in the liver converts non-carbohydrate molecules, primarily amino acids (of proteins) and glycerol (of lipids) to glucose.



Role of hormones in regulation of blood glucose:

1- Insulin:

Insulin is a peptide hormone produced by beta cells of the pancreatic islets.

Function of insulin:

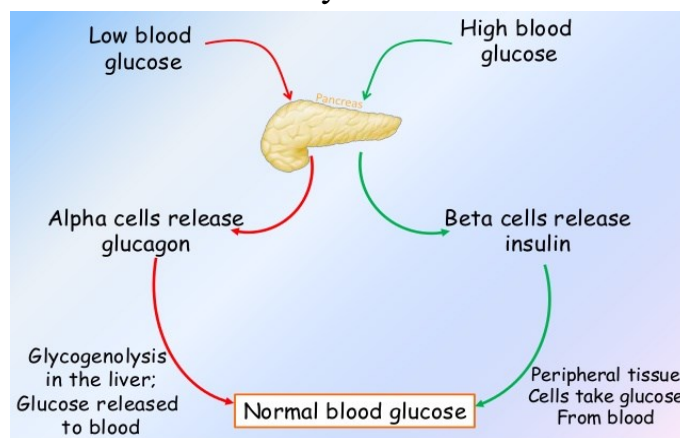
Insulin is a hormone that decreases the level of glucose by allowing glucose in the blood to enter cells. It is the main **anabolic hormone** of the body. A lack of effective insulin plays a key role in the development of diabetes mellitus.

2-Glucagon:

Glucagon is a peptide hormone, produced by alpha cells of the pancreas.

Function of glucagon:

It increases the concentrations of glucose and fatty acids in the bloodstream and is the main **catabolic hormone** of the body.



Fasting glucose levels :

Normal fasting blood glucose 70- 99 mg/dl

Impaired fasting glucose (pre-diabetes) 100-125 mg/dl

Diabetes mellitus fasting level > 125 mg/dl

Disorders of blood glucose concentrations:

1- Hyperglycemia or high blood glucose: is an abnormally high blood glucose level (**fasting blood glucose more than 125mg/dl, random blood glucose more than 150 mg/dl**). Hyperglycemia is a hallmark sign of diabetes mellitus (both type 1 diabetes and type 2 diabetes).

Note: In healthy people glucose does not appear in urine due to complete reabsorption of glucose by renal tubules. However, when blood glucose increases more than 180 mg/dl (over renal threshold) the proximal tubules begins to excrete glucose in urine (glycosuria).

Causes:

- **Diabetes mellitus type 1 and 2.**
- **Dawn phenomenon:** in patient with diabetes which occur in the early morning when certain hormones such as epinephrine, glucagon or cortisol cause the liver to release glucose into the blood.
- **Gestational diabetes:** in 2_10 % pregnant women.
- **Hyperthyroidism** (overactive thyroid gland).
- **Cushing`s syndrome:** elevated blood cortisol level.
- **Severe stress:** such as heart attack, stroke, trauma.
- **Certain medications:** such as steroids.

Clinical features of diabetes mellitus

Large volume of urine (polyuria) , thirst (polydipsia) , dry mouth ,urination at night , fatigue ,loss of weight ,increase in appetite (polyphagia) , slow healing of wounds , blurred vision .

Complications of diabetes mellitus:

Atherosclerosis, retinopathy, nephropathy, neuropathy.

2- Hypoglycemia: refers to a low level of glucose in the blood.

Causes of hypoglycemia:

- **In people with type 1 diabetes and some people with type 2** who need to take insulin or other drugs to reduce their blood glucose levels. If the dose is too high, blood glucose level may decrease and cause hypoglycemia.
- **Alcohol consumption:** Drinking large amounts of alcohol can impede the liver ability to release glucose into bloodstream.
- **Some liver diseases.**
- **Insulinoma:** A benign tumor in the pancreas that can cause the pancreas to produce too much insulin.
- **Von Gierke's Disease (Glycogen Storage Disease Type I):** is due to glucose-6-phosphatase deficiency leading to severe hypoglycemia between meals.
- **Medium-chain acyl-CoA dehydrogenase deficiency :** causes hypoketotic hypoglycemia due to low ability to break down fatty acids into acetyl-CoA.

Clinical feature of hypoglycemia:

Hunger , tremor , sweating , pallor , palpitations , ,dizziness , blurred vision ,confusion .

Complications:

Seizures, coma, and a severe hypoglycemia can be life-threatening.

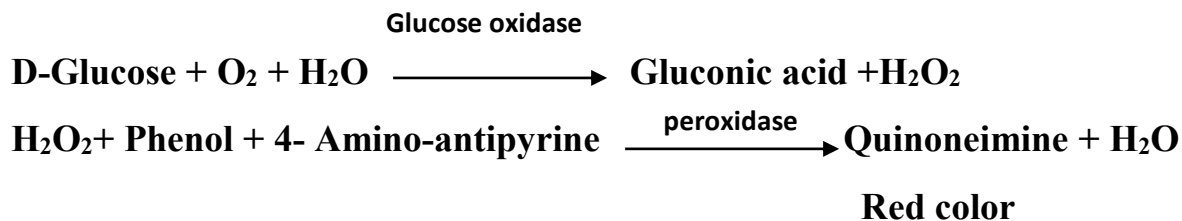
Equation to convert glucose level from mmole to mg:

$$\text{Glucose level (mmol/l)} * 18 = \text{Glucose level (mg/dl)}$$

Measurement of glucose in blood , serum, or plasma:

Principle :

Fasting serum glucose is estimated by an enzymatic colorimetric method. Glucose in the sample is oxidized to gluconic acid and hydrogen peroxide by glucose oxidase. **Hydrogen peroxide** reacts with the indicator reagent; 4- aminoantipyrine, in the presence of peroxidase enzyme to form a stable red Quinone compound:



The intensity of the color formed is proportional to the glucose concentration in the sample.

Procedure:

1- Pipette into test tube :

	Blank	Standard	Sample
Working reagents (ml)	2.0	2.0	2.0
Standard (μL)	-----	20	-----
Sample (μL)	-----	-----	20

2- Mix and incubate for 10 min. at 37 °C or 20 min. at room temperature. Read the absorbance of the samples and standard against Blank at 505 nm wavelength. Conc. of standard = 100 mg/dl

Calculation:

$$\text{Glucose conc. mg/dl} = (\text{Absorbance of sample} / \text{absorbance of standard}) \times \text{conc. of standard}$$

Prepared by: Ali Abdulrasool Hussein

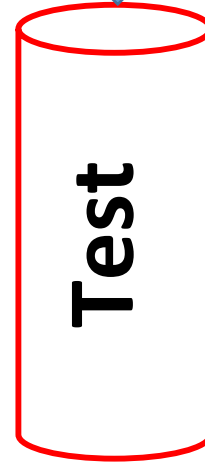
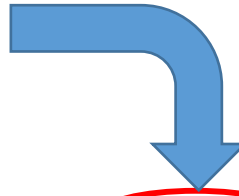
Reviewers: Walaa A. Abdulrahman

Abdulkareem H. Issa

2 ml Working Reagent

+

20 μ l Serum



2 ml Working Reagent

+

20 μ l Standard

