

Diabetes Mellitus

PART 1

It is an absolute or relative defect in insulin action and or insulin secretion. This causes a rise in blood glucose.

The three main types of diabetes are:

1-Type 1 diabetes:

Type 1 diabetes is believed to be an autoimmune condition. This means your immune system mistakenly attacks and destroys the beta cells in your pancreas that produce insulin. The damage is permanent.

2-Type 2 diabetes:

Type 2 diabetes starts out as insulin resistance. This means your body cannot use insulin efficiently, which causes your pancreas to produce more insulin until it cannot keep up with demand. Insulin production then decreases, which causes high blood sugar.

3-Gestational diabetes:

Gestational diabetes is caused by insulin-blocking hormones that are produced during pregnancy.

What is prediabetes ? Prediabetes mean the amount of glucose in the blood is above normal yet not high enough to be called diabetes. With prediabetes, the chances of getting type 2 diabetes, heart disease, and stroke are higher in the future. With some weight loss and moderate physical activity, you can delay or prevent type 2 diabetes. You can even return to normal glucose levels, possibly without taking any medicines.

Hyperglycemia

Hyperglycemia is a defining characteristic of diabetes-when the blood glucose level is too high because the body isn't properly using or doesn't make the hormone insulin.

Signs and Symptoms

- Frequent urination.
- Excessive thirst.
- Unexplained weight loss.
- Extreme hunger.
- Sudden vision changes.
- Tingling or numbness in the hands or feet.
- Feeling very tired much of the time.
- Very dry & itchy skin.

What increases my risk for non diabetic hyperglycemia?

- A medical condition such as Cushing syndrome or polycystic ovarian syndrome.
- Pancreatic diseases such as pancreatitis, pancreatic cancer.
- Surgery or trauma, such as a burn or injury.
- Infections, such as pneumonia or a urinary tract infection.
- Certain medicines, such as steroids or diuretics.

Long-term complications of hyperglycemia that isn't treated include:

- Cardiovascular disease.
- Nerve damage (neuropathy)
- Kidney damage (diabetic nephropathy) or kidney failure.

- Damage to the blood vessels of the retina (diabetic retinopathy) that could lead to blindness.

Hypoglycemia

Hypoglycemia is a condition in which your blood sugar (glucose) level is lower than the standard range.

What is the main cause of hypoglycemia?

Common causes of diabetic hypoglycemia include: Taking too much insulin or diabetes medication. Not eating enough, Postponing or skipping a meal or snack.

Signs and Symptoms

- Looking pale.
- Shakiness.
- Sweating.
- Headache.
- Hunger or nausea.
- An irregular or fast heartbeat.
- Fatigue.
- Irritability or anxiety.

Severe hypoglycemia can cause accidents, injuries, coma, and may even prove fatal. Recent studies have associated severe hypoglycemia as a risk factor for dementia, falls, fractures, and heart attacks.

Diagnostic tests of Diabetes mellitus

1. Fasting Blood Sugar (FBS).
2. Random Blood Sugar (RBS).
3. Oral Glucose Tolerance Test (OGTT).

4. Glycosylated Hemoglobin (HbA1c) Test.

5. Fructosamine Test.

1-Fasting Blood Sugar (FBS)

This test checks the fasting blood glucose levels. Fasting means after not having anything to eat or drink (except water) for at least 6 hours before the test. This test is usually done first thing in the morning, before breakfast.

WHO diagnostic criteria for diabetes: -

	FBS
Diabetes	≥ 126 mg/dl (≥ 7 mmol/l)
Prediabetes	110 to < 126 mg/dl
Normal	< 110 mg/dl (< 6.1 mmol/l)

2-Random Blood Sugar (RBS)

This test is a blood check at any time of the day when a patient has severe diabetes symptoms. Diabetes is diagnosed at blood glucose of ≥ 200 mg/dl (≥ 11.1 mmol/l).

Practical

Types of specimens

1-Blood (Arterial blood, Venous blood, Capillary blood)

Venous blood (whole blood, serum, plasma) Serum 5 % > plasma

2-Urine

3-Body fluid (CSF, saliva,)

Types of tubes

- **Gel tube (serum)**
- **EDTA tube (plasma)**
- **Heparin tube (plasma)**
- **Citrate tube (plasma)**
- **Sodium fluoride (plasma)** It is usually considered as a preservative for blood glucose, fluoride ions prevent glycolysis by inhibiting enolase, an enzyme that requires magnesium. The inhibition is due to formation of an ionic complex consisting of magnesium, inorganic phosphate, & fluoride ions $Mg_2(PO_4F)$; this complex interferes with the interaction of enzyme & substrate.

SAMPLE COLLECTION AND STORAGE

Glucose is stable for 24 hours at +2 to +8°C if the serum is prepared within 30 min after collection. By adding a glycolysis inhibitor (NaF, KF) the sample can be stored up to 24 hours at +15 to +25 °C or 3 days at +2 to +8°C. For long term storage the samples should be placed in sealed containers and frozen at -20 °C.

Haemolysed samples must not be used since haemolysis interferes with this test.

Methods

1-Quantitative (kit)

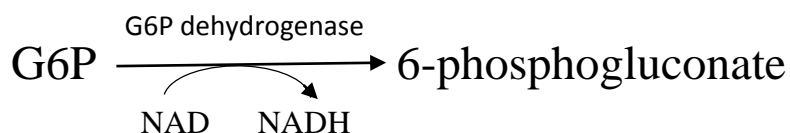
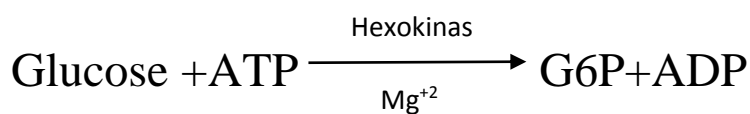
2-Qualitative (+ or -)

3-semi quantitative

1-Quantitative (kit)

- a- Hexokinase (Reference method)
- b- Glucose dehydrogenase
- c- Glucose oxidase-peroxidase method

Hexokinase method

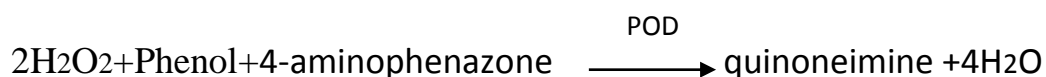
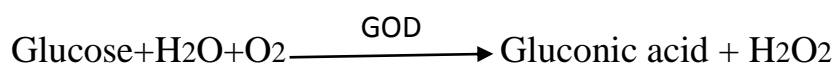


Disadvantage this method, effected by hemolysis sample.

Glucose oxidase-peroxidase method

Principle :

Glucose oxidase (GOD) catalyzes the oxidation of glucose to give hydrogen peroxide (H₂O₂) and gluconic acid. In the presence of the enzyme peroxidase (POD), the hydrogen peroxide is broken down and the oxygen released reacts with 4- aminophenazone (4-aminoantipyrine) and phenol to give a pink color. The absorbance of the color produced is measured in a colorimeter using a green filter 520 nm or in a spectrophotometer at 510 nm.



Procedure

	Blank	Standard	Assay
Working reagent	1.0 ml	1.0 ml	1.0 ml
Standard	10 µl
Sample	10 µl

Mix, incubate 10 min at 37oC or for 25 min at 15-25oC at room temperature. Measure the absorbance of assay and standard at 510 nm (480-520) against reagent blank.

Calculation

$$\text{Glucose conc.} = \frac{\text{Abs (sample)}}{\text{Abs (standard)}} \times \text{standard concentration}$$

standard concentration=100 mg/l or 5.56 mmol/l

GOOD LUCK