

Glucose

Glucose

- Glucose (“sweet”) has the molecular formula $C_6H_{12}O_6$.
- It is found in fruits and honey.
- It is the major free sugar circulating in the blood of higher animals.
- Glucose is the primary fuel used by most cells in the body to generate the energy that is needed to carry out cellular functions.

Journey of Glucose

- Glucose mainly comes from foods rich in carbohydrates, like bread, potatoes, and fruit.
- As we consume food, food travels down the esophagus to stomach.
- In stomach, acids and enzymes break it down into tiny pieces.
- During this process, glucose is released.
- Glucose goes into the intestines where it is absorbed.
- From there, it passes into the bloodstream.
- Once in the blood, insulin helps glucose get in to the cells.

Blood Glucose Levels

- The blood sugar level normally rises after food is consumed.
- Then it dips a few hours later as insulin moves glucose into the cells.
- Between meals, the blood sugar should be less than 100 milligrams per deciliter (mg/dl).
- This is called fasting blood sugar level.

Methods to estimate glucose level

- Modified Folin-Wu method.
- King and Asatoor Method.
- O-Toluidine Method.
- Glucose Oxidase.

Deproteination of Blood

- 1 ml of blood is transferred to a boiling tube containing 7 ml of water then 1 ml of 10% sodium tungstate is added mixed well followed by 1 ml of $2/3$ N H_2SO_4 with shaking.
- It is allowed to stand for 10 minutes, and then filtered.
- This filtrate is called tungstic acid blood filtrate and is taken as a test sample.

King and Asatoor Method

- It is also called as alkaline copper reduction method.

Principle

- Glucose reduces the alkaline copper solution forming cuprous ions.
- The amount of cuprous formed is estimated colorimetrically by reacting with phosphomolybdic acid.
- The cuprous ions will be oxidized again to cupric and the molybdic acid will be reduced to molybdenum blue.
- The color intensity being proportional to the amount of glucose in the sample.

O-Toluidine Method

- The Orthotoluidine (O-toluidine) method is an older method of blood glucose estimation.
- This method is no longer used today because O-toluidine is believed to be a carcinogen and is replaced by enzymatic methods.

Principle

- The proteins are first precipitated by trichloroacetic acid.
- The glucose present in a protein free filtrate react with O-toluidine (primary aromatic amine) in a hot acidic medium to form a stable green colored complex, namely N-glycosamine.
- The presence of thiourea stabilizes the o-toluidine reaction.
- The intensity of the color developed is measured photometrically at 630nm, which is directly proportional to the concentration of the glucose present in the sample.

Glucose Oxidase

- It is also known as GOD-POD method.
- Glucose oxidase is an enzyme highly specific for glucose and is not react with blood saccharides.
- So it has been employed for the estimation of blood glucose.

Principle

- Glucose oxidase is an enzyme extracted from the growth medium of *Aspergillus niger*.
- Glucose oxidase (GOD) oxidizes the specific substrate β -D- glucose to gluconic acid and hydrogen peroxide (H_2O_2) is liberated.
- Peroxidase (POD) enzyme acts on hydrogen peroxide to liberate nascent oxygen (O_2), then nascent oxygen couples with 4- amino antipyrine and phenol to form red quinoneimine.
- The intensity of the colour is directly proportional to the concentration of glucose present in plasma.
- The intensity of colour is measured by colorimeter at 530 nm or green filter and compared with that of a standard treated similarly.
- Final colour is stable for at least 2 hours if not exposed to direct sunlight.