

*Al-Rasheed University College
Department of Dentistry*



practical Biochemistry

For the second class

Lab 2

Estimation of Glucose



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lab 2

Estimation of Glucose

Glucose is a simple sugar which is a permanent and immediate primary source of energy to all of the cells in our body. The glucose in blood is obtained from the food that you eat. This glucose gets absorbed by intestines and distributed to all of the cells in body through bloodstream and breaks it down for energy.

Body tries to maintain a constant supply of glucose for your cells by maintaining a constant blood glucose concentration. The concentration of glucose in blood, expressed in mg/dl, is defined by the term glycemia. **The value of blood sugar in humans generally ranges from 70 - 100 mg/dl.** Blood sugar levels are regulated by the hormones insulin and glucagon which act antagonistically.

These two hormones are secreted by the islet cells of the pancreas, and thus are referred to as pancreatic endocrine hormones. When the blood glucose levels are high, insulin hormone secreted which causing liver to convert more glucose molecules into glycogen and when the blood glucose levels are low glucagon secreted and act on liver cells to promote the breakdown of glycogen to glucose and increases the blood glucose concentrations. Essentially blood glucose levels determine the time of secretion of these hormones.

The blood glucose level is easily changed under the influence of some external and internal factors such as body composition, age, physical activity and sex.

Diabetes is a disease related by the abnormal metabolism of blood sugar and defective insulin production. So blood sugar levels are an important parameter for the study of diabetes. The level of glucose circulating in blood at a given time is called as blood glucose level. The blood glucose level varies at different time on various part of the day.

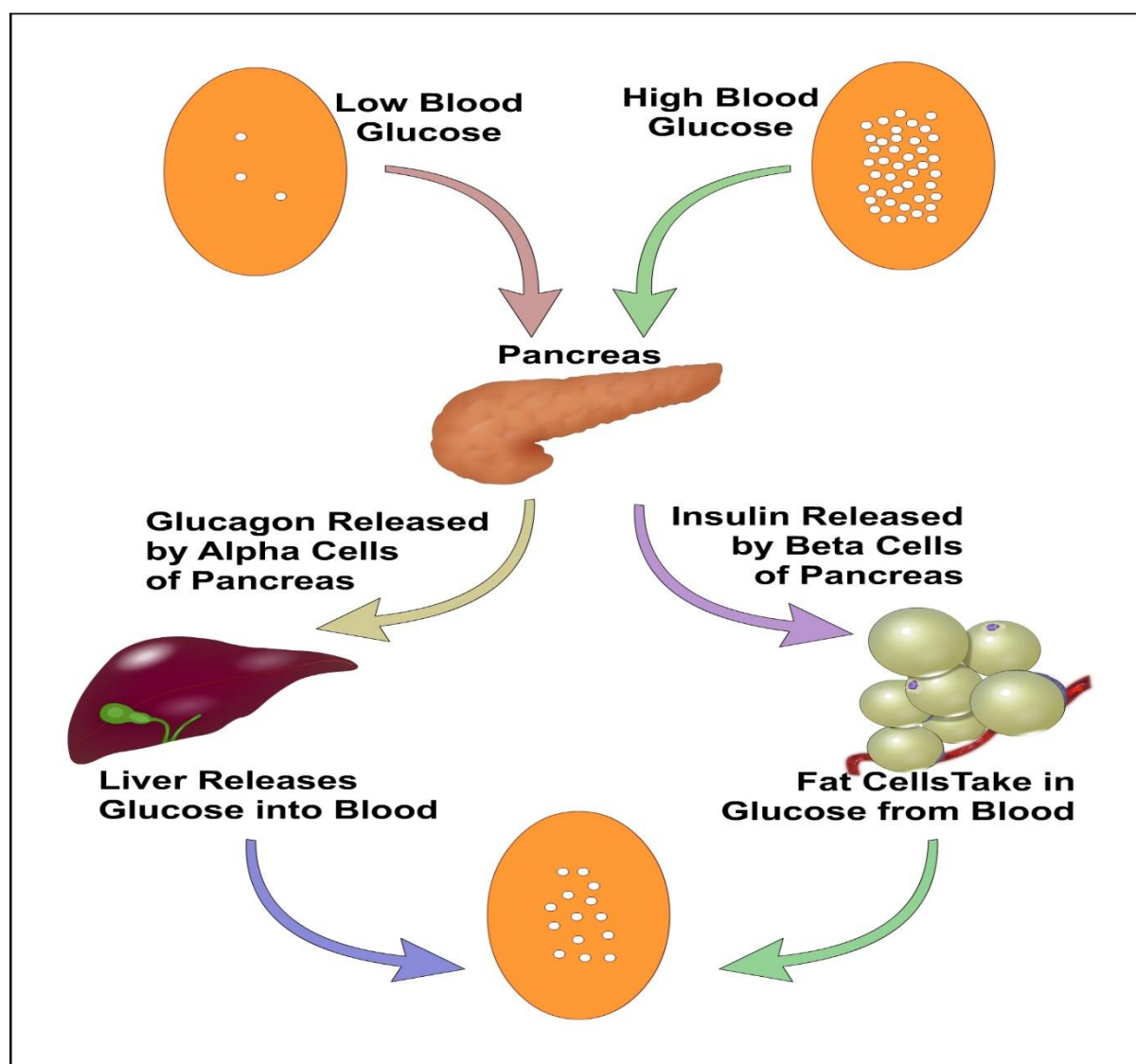


Fig (1): Homeostasis of blood glucose

Normal ranges:

Normal value ranges may vary slightly among different laboratories. Many factors affect a person's blood sugar level. A body's homeostatic mechanism, when operating normally, restores the blood sugar level to a narrow range of about 4.4 to 6.1 mmol/L (79.2 to 110 mg/dL) (as measured by a fasting blood glucose test). Blood sugar levels for those without diabetes and who are not fasting should be below 125 mg/dL.

Fasting is defined as no caloric intake for the least 8 hours or usually an overnight fasting for (8-10) hrs fasting glucose level because red cell membrane is freely permeable to glucose and RBC contain less free water than serum and so glucose which is dissolved in free water will be more in serum than in whole blood .

Random blood glucose: In young adults (even after a meal) the blood glucose rarely exceeds 150 mg/dl(8.3mmol)but to include the normal older age people it is usually to consider only a random blood glucose level of 180 mg/dl(10 mmol/l)and more as abnormal.

Blood glucose tests are done to:

- Check for and monitor the treatment of diabetes.
- Check for diabetes that occurs during pregnancy gestational diabetes.
- Determine if an abnormally low blood sugar level hypoglycemia is present.

Hyperglycemia: a state of increased blood glucose above the normal range. It is seen in: 1-diabetes mellitus.

2-In condition of increased insulin antagonizing hormones like Cushing's syndrome, acromegaly.

Hypoglycemia: is present if the plasma glucose concentration is less than 45 mg/dl (2.5 mmol/l),it may occur in:-

1. Hypoglycemia in diabetic patient may be caused by accidental insulin over dosage by changing insulin requirements, or by failure to eat after insulin has been given .
2. Cases of deficiency of insulin –antagonizing hormones like pituitary insufficiency and hypothyroidism
3. During prolonged fasting:-when glycogen stores are depleted.

Brain cells are very dependent on the extracellular glucose concentration for their energy supply, hyperglycemia, especially of rapid onset, can also cause cerebral dysfunction by increasing extracellular osmolality, resulting in a shift of fluid out of cells.

. Glucose renal threshold:

The renal tubules reabsorb almost all glucose from the glomerular filtrate up to 180 mg/dl(the threshold) so normal urine is nearly glucose- free even after a carbohydrate meal

Diabetes mellitus:- is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.

Classification of Diabetes :

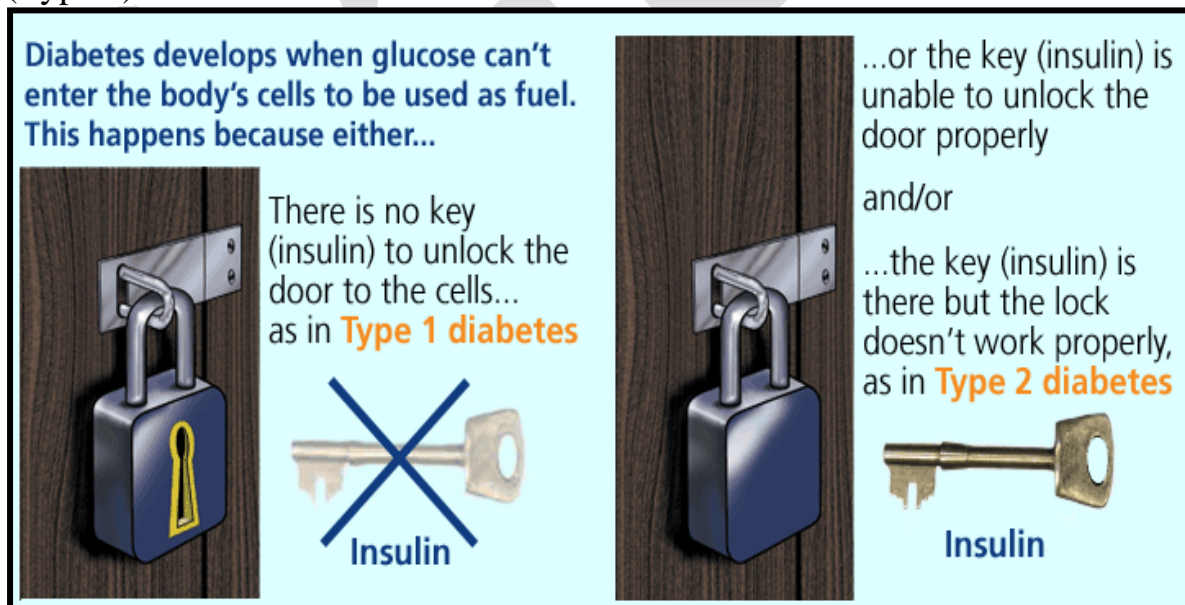
There are two main types of diabetes:

- **Type 1 diabetes** {insulin –dependent diabetes mellitus (IDDM) or Juvenile onset diabetes}:-children and young patients who present with rapid onset of symptoms(eg.polyuria, polydipsia, and rapid weight loss).

- **Type 2 diabetes**{non-insulin-dependent diabetes mellitus(NIDDM) or adult-onset diabetes }:-most patient over 40 years of age but may occur in young obese person.

Diabetes develops when glucose can't enter the body's cells to be used as fuel, this happens when either:

- There is no insulin to unlock the cells (Type 1)
- There is not enough insulin or the insulin is there but not working properly (Type 2)



Diabetes develops when glucose can't enter the body's cells to be used as fuel. This happens because either...

There is no key (insulin) to unlock the door to the cells... as in **Type 1 diabetes**

...or the key (insulin) is unable to unlock the door properly and/or ...the key (insulin) is there but the lock doesn't work properly, as in **Type 2 diabetes**

Insulin

Insulin

-There is a wide variety of other types of diabetes.

- Maturity onset diabetes of the young (MODY)
- Gestational diabetes
- Neonatal diabetes
- Wolfram Syndrome
- Alstrom Syndrome

Maturity onset diabetes of the young (MODY): is a rare form of diabetes which is different from both Type 1 and Type 2 diabetes, and runs strongly in families. MODY is caused by a mutation (or change) in a single gene. If a parent has this gene mutation, any child they have, has a 50% chance of inheriting it from them. If a child does inherit the mutation they will generally go on to develop MODY before they're 25, whatever their weight, lifestyle, ethnic group etc.

Gestational diabetes mellitus (GDM): is a type of diabetes that arises during pregnancy (usually during the second or third trimester). In some women, GDM occurs because the body cannot produce enough insulin to meet the extra needs of pregnancy.

Neonatal diabetes: is a form of diabetes that is diagnosed under the age of six months. It's a different type of diabetes than the more common Type 1 diabetes as it's not an autoimmune condition (where the body has destroyed its insulin producing cells).

Wolfram Syndrome: is a rare genetic disorder which is also known as DIDMOAD syndrome after its four most common features (Diabetes Insipidus, Diabetes Mellitus, Optic Atrophy and Deafness).

Alström Syndrome: is a rare genetically inherited syndrome which has a number of common features.