
Al-Rasheed University College
Pharmacy Department
2nd Stage / 2nd Course
(2019 – 2020)


# GLUCOSE METABOLISM & ORAL GLUCOSE TOLERANCE TEST (OGTT)

Physiology Lab.

2nd stage / 2nd course

Lab. (7)

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# Glucose Metabolism:

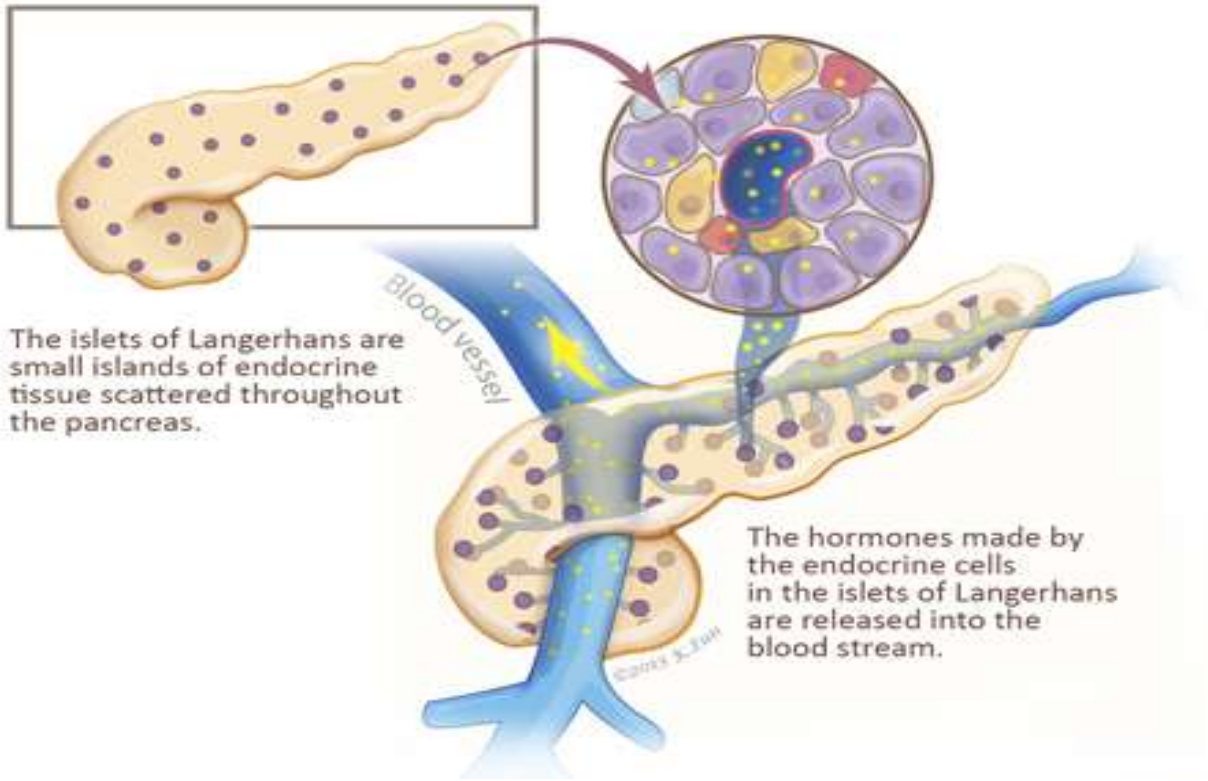
- Glucose is simple sugar or monosaccharide derived from breakdown of dietary carbohydrates
- Glucose is the primary source of energy for most body cells
- **Insulin;** a hormone secreted by pancreas, and promoting glucose entry into cells depending on the cells need.
- Glucose may undergo anaerobic or aerobic metabolism to yield energy as (ATP).
- Alternatively glucose may be converted to and stored as glycogen (Glycogenesis).
- liver and skeletal muscles store larger amounts of glycogen.
- Glucose also converted to protein and fat by action of insulin

# Important Terms:

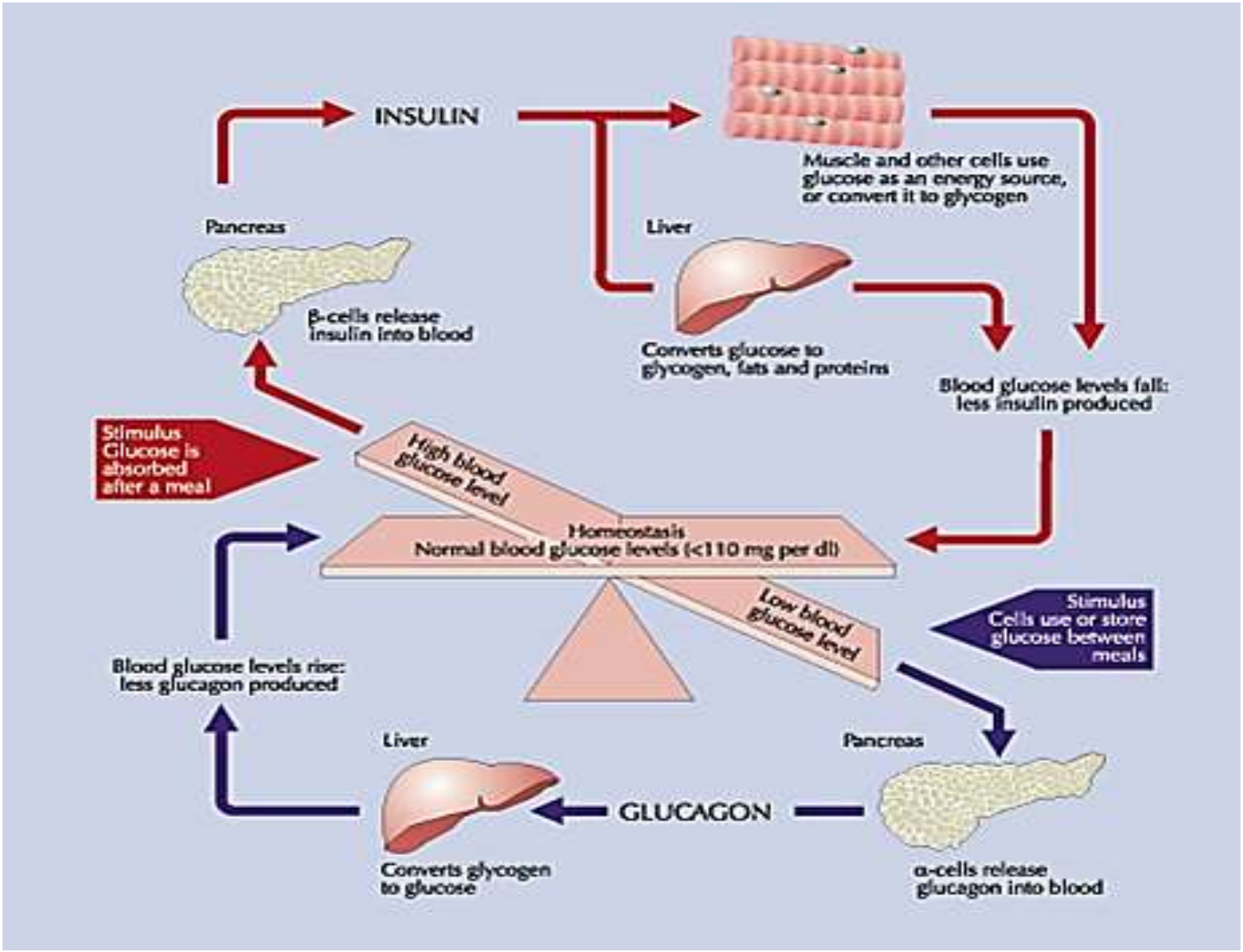
- **Glycolysis:** is the metabolism of glucose to obtain energy in the form of ATP and pyruvate
- **Glycogenesis:** is the conversion of glucose into glycogen which is then to be stored in the liver and muscle tissues
- **Glycogenolysis:** is the breakdown and conversion of glycogen into glucose which is then utilized by cells as a source of energy
- **Gluconeogenesis:** is the synthesis of glucose molecules from sources other than carbohydrates like proteins, amino acids and lipids.

# Function of Pancreas:

- **Exocrine function:** important in digestion
- **Endocrine function:** secretion of different hormones
  - Insulin
  - Glucagon
  - Somatostatin



# Glucose Homeostasis



# Notes:

- Many diseases alter normal glucose metabolism, the most frequent cause of an increase in blood glucose (hyperglycemia) is **diabetes**.
- Hypoglycemia defined as a blood glucose level less than 50mg/dl; and may have severe consequences;
- one cause of hypoglycemia in-diabetic patients is an excessive dose of insulin.

# Diabetes Mellitus:

- Is defined as an elevated blood glucose associated with absent or inadequate pancreatic insulin secretion, with or without impaired insulin action.
- Diagnosis of diabetes:

| Type of test | Normal Range |
|---|---|
| Fasting glucose | 90 – 110mg/dl |
| 2hr post prandial | <140mg/dl |
| Oral glucose tolerance | <140mg/dl |
| Glycated hemoglobin Hb A1c | 4-6% |

# Types of Diabetes:

### Type 1 DM

- Also called insulin dependent diabetes, or juvenile diabetes
- Happen in young age
- Usually there is no family history
- Caused by autoimmune disorders
- There is a complete absence of insulin secretion due to complete destruction of beta cells of the pancreas
- Short duration of symptoms (few weeks)
- There is a risk of diabetic ketoacidosis
- Treated only with insulin injections

### Type 2 DM

- Also called non-insulin dependent diabetes
- Happen in older age and obese people
- Usually there is a strong family history
- There is insufficient insulin secretion or increased peripheral resistance to insulin action
- Long duration of symptoms (months or years)
- No diabetic ketoacidosis
- Treated with oral anti-diabetic medications
- In severe cases, insulin injections

### Type 3 DM

- Also called gestational diabetes
- Usually happen during pregnancy
- Usually there is family history
- There is insufficient insulin secretion or increased peripheral resistance to insulin action due to hormonal factors
- May develop to type 2 DM years after delivery
- Treated with some oral anti-diabetic medication, but mostly insulin injections

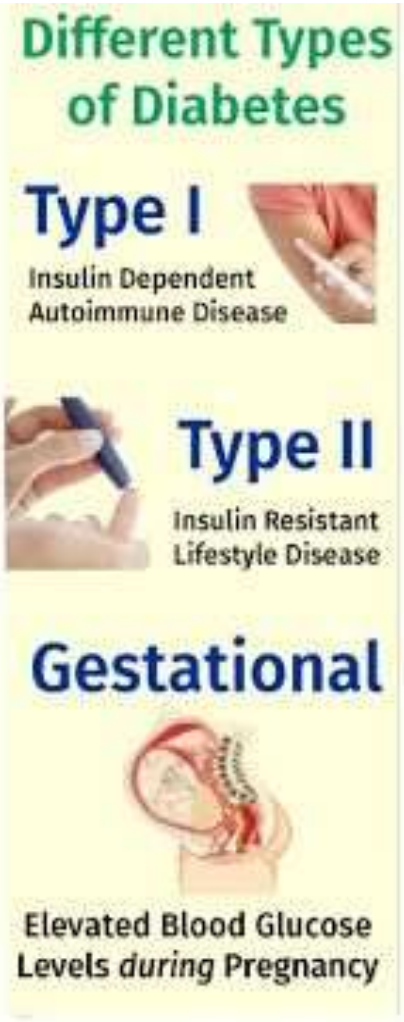
# Types of Diabetes Mellitus:

## Differences between type-1 and type-2 Diabetes Mellitus

- Type 1
- Young age
- Normal BMI, not obese
- No immediate family history
- Short duration of symptoms (weeks)
- Can present with diabetic coma (diabetic ketoacidosis)
- Insulin required

- Type 2
- Middle aged, elderly
- Usually overweight/obese
- Family history usual
- Symptoms may be present for months/years
- Do not present with diabetic coma
- Insulin not necessarily required
- Previous diabetes in pregnancy

These differences are not absolute



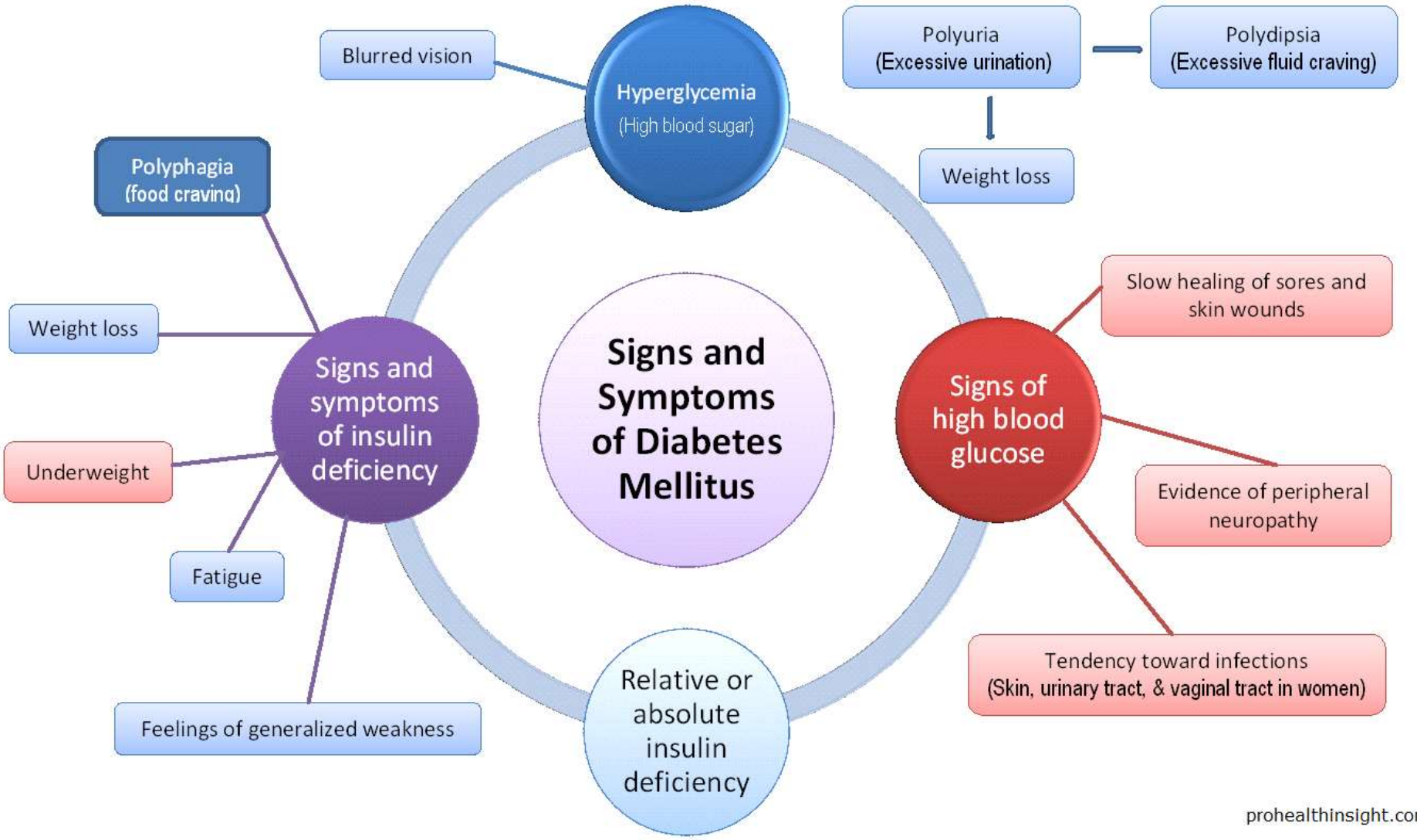
# Other Causes of Hyperglycemia:

- In some cases high blood glucose values are caused by conditions other than diabetes.
- Hyperglycemia can be secondary to:
  - traumatic brain injury
  - febrile disease
  - certain liver diseases
  - over activity of adrenal, pituitary or thyroid Gland
  - certain drugs like doxazocin (anti-hypertensive).

# Notes:

- These symptoms are caused by the body's inability to metabolize glucose levels
- glycosuria is a consequence of hyperglycemia when the blood glucose exceeds 160 -170mg/dl (the renal threshold for glucose), so glucose appears in the urine.

# Signs and Symptoms of Diabetes Mellitus

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# Long Term Complications of DM:

- **Cardiovascular Disturbance**
- **Diabetic macro-angiopathy:** like myocardial infarction, stroke, and peripheral vascular disease
- **Diabetic micro-angiopathy:** like peripheral vascular disease (Diabetic foot), diabetic retinopathy, diabetic nephropathy and peripheral neuropathy
- **Infection**
- **Renal failure**
- **Blindness**

# Hypoglycemia:

- Hypoglycemia is a blood glucose concentration below the fasting value with a transient decline in blood sugar 2 hours after a meal. It could be caused by one of the followings:
  - Glycogen storage disease
  - Insulinoma

- **Note: A decrease in blood glucose is life threatening because *the brain and cardiac cells depend on glucose in the blood and interstitial fluids*.**

# Oral Glucose Tolerance Test (OGTT)

- **Principle of The Experiment:**

Evaluate the insulin response to a large oral glucose dose. It peaks in 30 to 60 minutes and returns to normal levels within 3 hours when sufficient insulin is present to metabolize the glucose ingested at the beginning of the test.

# Indications for OGTT:

- Patient has symptoms suggestive of diabetes mellitus
- Fasting blood sugar value is inconclusive (between 110 – 126mg/dl)
- During pregnancy, excessive weight gaining is noticed with a past history of big baby (more than 4 kg) or past history of miscarriage
- To rule out benign renal glycosuria
- Patients with neuropathies, retinopathies, nephropathies and hypertriglyceridemia of unknown origin

# Basic Requirements:

- 75gm glucose solution
- 70% alcohol
- Sterile blood lancet
- Test tubes
- Self glucose meter, or spectrophotometer

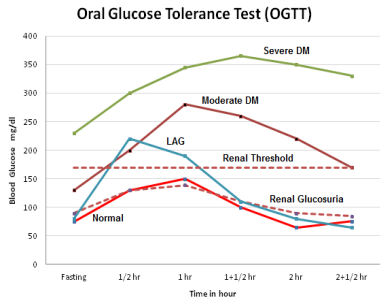

# Procedure:

Fasting for 8 – 12 hours

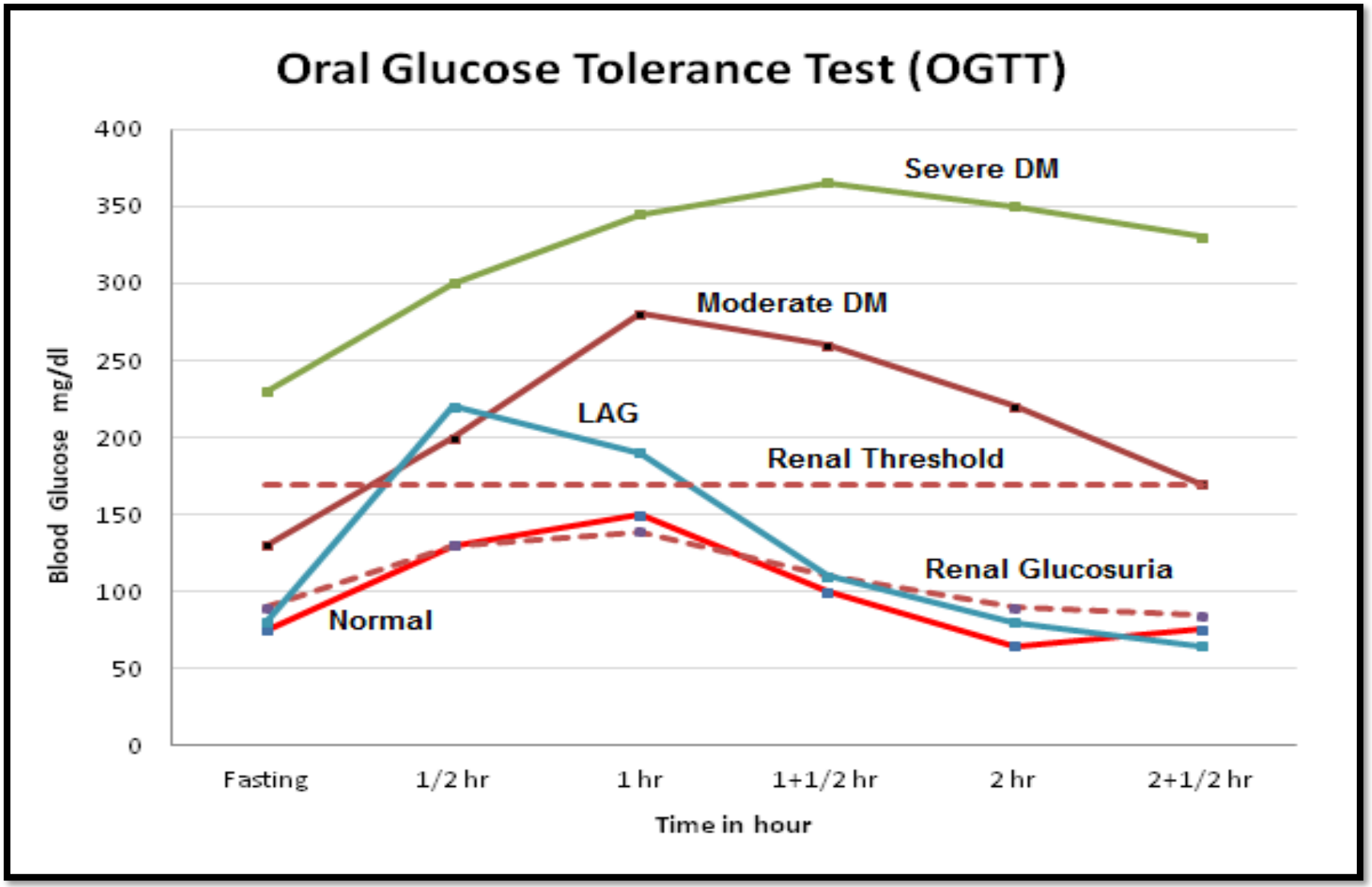
Take blood sample for measuring fasting glucose level (zero time)

Give oral glucose solution (75 gm glucose is the best)

Measure blood glucose every 30 min for 2 hours




Record your results in a chart and draw a figure




**Oral Glucose Tolerance Test Curve of Normal and Diabetic Patients**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fast, 5-second test time
simple to use
optional advanced functions
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ACCU-CHEK
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PRODIGY
AutoCode
Blood Glucose Monitoring System
NO CODING
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# END OF SEMESTER