

## Chapter– 4.3 DIABETES

### Topic: Diabetes

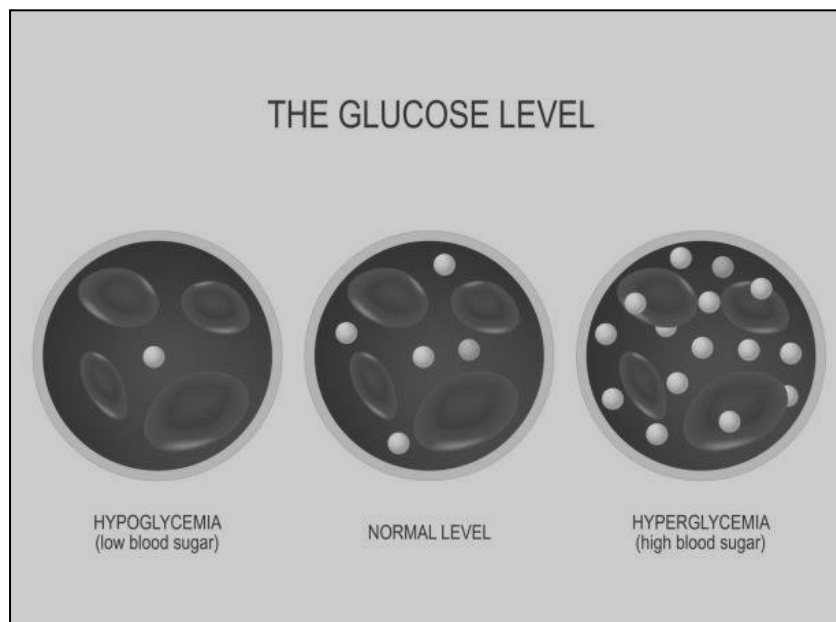
#### 4.1

#### Introduction

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia (high blood sugar levels) due to either insufficient insulin production, insulin resistance, or both.

**Etiopathogenesis:** The etiology of diabetes is multifactorial and involves genetic, environmental, and lifestyle factors. The primary mechanisms leading to hyperglycemia include:

- 1. Insulin deficiency:** In type 1 diabetes, pancreatic beta cells are destroyed by autoimmune processes, resulting in inadequate insulin production.
- 2. Insulin resistance:** In type 2 diabetes, cells become resistant to the action of insulin, leading to impaired glucose uptake and utilization.
- 3. Impaired insulin secretion:** In some cases of type 2 diabetes, pancreatic beta cells fail to produce sufficient insulin to overcome insulin resistance.



**Fig 4.1 Glucose level in blood**

## 4.2

## Types

1. **Type 1 diabetes:** Autoimmune destruction of pancreatic beta cells, leading to absolute insulin deficiency.
2. **Type 2 diabetes:** Insulin resistance and relative insulin deficiency due to a combination of genetic and environmental factors.
3. **Gestational diabetes mellitus (GDM):** Diabetes first diagnosed during pregnancy, usually resolving after childbirth.
4. **Other specific types:** Includes monogenic forms of diabetes, secondary diabetes due to other medical conditions (e.g., pancreatic diseases, endocrine disorders, drug-induced), and diabetes associated with genetic syndromes.

## 4.3

## Symptoms

Common symptoms of diabetes include:

- Polyuria (excessive urination)
- Polyphagia (excessive hunger)
- Polydipsia (excessive thirst)
- Weight loss (despite increased appetite)
- Fatigue and weakness
- Blurred vision
- Slow wound healing
- Recurrent infections, especially of the skin, gums, or urinary tract



**Fig 4.2 Glucose level measurement**

## 4.4

## Diagnostic Test

Measurement of blood glucose levels. Common diagnostic criteria include:

- **Fasting plasma glucose (FPG) test:** Blood glucose level  $\geq$  126 mg/dL after an overnight fast.
- **Oral glucose tolerance test (OGTT):** Blood glucose level  $\geq$  200 mg/dL two hours after ingestion of a standardized glucose solution.
- **Hemoglobin A1c (HbA1c) test:** Glycated hemoglobin level  $\geq$  6.5%, reflecting average blood glucose levels over the past 2-3 months.

## 4.5

## Management

The management of diabetes involves:

**A. Pharmacological Management:** Pharmacological treatment of diabetes aims to achieve and maintain glycemic control, prevent complications, and improve quality of life. Common medications used in the management of diabetes include:

**1. Insulin: e.g.** Regular insulin, NPH insulin, insulin lispro, insulin aspart, insulin glulisine, insulin detemir, insulin glargine, insulin degludec; Insulin is a hormone that regulates blood sugar levels by facilitating the uptake of glucose into cells for energy or storage. It is essential for individuals with type 1 diabetes who do not produce insulin and may also be used in type 2 diabetes when other medications are not sufficient to control blood sugar levels.

**2. Oral Antidiabetic Medications:**

- **Biguanides: e.g.** Metformin,
- **Sulfonylureas: e.g.** Glipizide, Glyburide
- **Meglitinides: e.g.** Repaglinide, Nateglinide
- **Thiazolidinediones: e.g.** Pioglitazone, Rosiglitazone
- **Dipeptidyl peptidase-4 (DPP-4) inhibitors: e.g.** Sitagliptin, Saxagliptin
- **Sodium-glucose cotransporter-2 inhibitors: e.g.** Dapagliflozin
- **Glucagon-like peptide-1 receptor agonists: e.g.** Liraglutide, Exenatide

**Note:-** These medications work through various mechanisms to lower blood sugar levels. For example;

- **Metformin** decreases glucose production in the liver and improves insulin sensitivity in peripheral tissues.
- **Sulfonylureas** and **meglitinides** stimulate insulin release from pancreatic beta cells.

- **Thiazolidinediones** enhance insulin sensitivity in adipose tissue and muscles.
- **DPP-4 inhibitors** prolong the action of incretin hormones, which stimulate insulin release and inhibit glucagon secretion.
- **SGLT2 inhibitors** reduce glucose reabsorption in the kidneys, leading to increased urinary glucose excretion.
- **GLP-1 receptor agonists** stimulate insulin secretion, inhibit glucagon release, slow gastric emptying, and promote satiety.

**3. Combination Therapy:** Fixed-dose combinations of different classes of antidiabetic medications (e.g., metformin with sulfonylureas, metformin with DPP-4 inhibitors, metformin with SGLT2 inhibitors).

- **Mechanism:** Combination therapy allows for the synergistic effects of multiple antidiabetic medications to improve glycemic control while minimizing side effects and simplifying treatment regimens.

**B. Non-Pharmacological Management:** Non-pharmacological interventions for diabetes focus on lifestyle modifications to control blood sugar levels, prevent complications, and improve overall health. These may include:

- **Dietary modifications:** Following a balanced diet with controlled carbohydrate intake, emphasis on whole grains, fruits, vegetables, and lean proteins.
- **Regular physical activity:** Engaging in regular exercise to improve insulin sensitivity, promote weight loss, and reduce cardiovascular risk.
- **Blood glucose monitoring:** Regular self-monitoring of blood glucose levels to track response to treatment and identify trends.
- **Weight management:** Achieving and maintaining a healthy weight through calorie control, portion control, and regular exercise.

## 4.6

**Complications**

Untreated or poorly controlled diabetes can lead to acute and chronic complications:

- Increased risk of heart attack, stroke, peripheral arterial disease and heart failure.
- Impaired blood flow to the extremities, increasing the risk of ulcers, infections and amputations.
- Kidney damage leading to chronic kidney disease and eventual kidney failure.
- Damage to the blood vessels of the retina, leading to diabetic retinopathy and vision loss.
- Nerve damage resulting in sensory disturbances, pain, numbness and impaired wound healing.
- Life-threatening metabolic complications characterized by severe hyperglycemia, dehydration and electrolyte imbalances.