

Anti-Diabetic Agents

Diabetes Mellitus

- Also known as Diabetes, diabetes mellitus is a group of metabolic diseases characterized by chronically high blood sugar levels.
- In this condition, the body cannot effectively regulate blood sugar levels.

Symptoms

- Excessive urination
- Glucose present in urine
- Increased thirst
- Increased appetite
- Feeling weak and tired

Causes

- Defects in insulin formation, secretion, or action
- Obesity and inactive lifestyle
- Family history and genetic factors
- High carbohydrate (glucose) diet
- Heart and blood vessel diseases

Types of Diabetes Mellitus



Types of Diabetes Mellitus

----- Type I Diabetes Mellitus

----- Type II Diabetes Mellitus

A. Type I Diabetes Mellitus

- Known as insulin-dependent diabetes mellitus.
- Pancreatic beta-cells are destroyed, leading to little or no insulin production.
- It is a chronic condition typically found in children.
- Insulin injections are required as treatment.

B. Type II Diabetes Mellitus

- Known as non-insulin dependent diabetes mellitus.
- A chronic condition in which the body's cells in the liver, muscle, and fat become resistant to insulin.

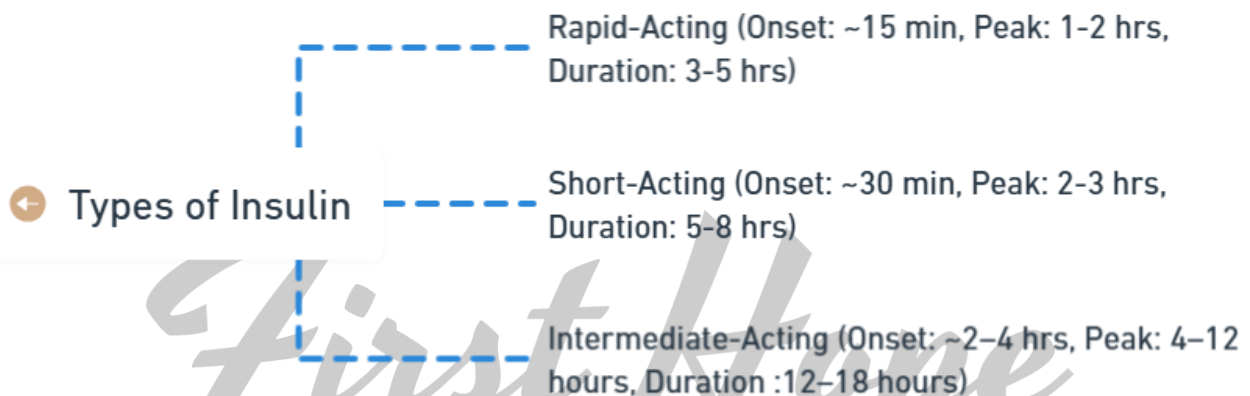
- Glucose uptake by the cells is reduced.
- Oral hypoglycemic agents are used as treatment.

Insulin

Introduction:

- Insulin is a peptide hormone produced by beta cells in the pancreas.
- It regulates blood glucose levels by facilitating glucose uptake into cells (liver, fat, and muscle tissues) and aids in the metabolism of carbohydrates, fats, and proteins.
- In diabetes, impaired insulin production or function necessitates external administration.

Types of Insulin



- 1. Rapid-Acting** (Onset: ~15 min, Peak: 1-2 hrs, Duration: 3-5 hrs)
 - **Examples:** Lispro, Aspart, Glulisine
 - **Uses:** Mealtime glucose control.
- 2. Short-Acting** (Onset: ~30 min, Peak: 2-3 hrs, Duration: 5-8 hrs)
 - **Examples:** Regular Insulin (Humulin R, Novolin R)
 - **Uses:** Pre-meal and basal needs.
- 3. Intermediate-Acting** (Onset: ~2-4 hrs, Peak: 4-12 hrs, Duration: 12-18 hrs)
 - **Examples:** NPH Insulin (Humulin N, Novolin N)
 - **Uses:** Basal coverage.
- 4. Long-Acting** (Onset: ~1-2 hrs, Peak: Minimal, Duration: ~24 hrs)
 - **Examples:** Glargine, Detemir, Degludec
 - **Uses:** Basal insulin, once/twice daily.
- 5. Ultra-Long-Acting** (Onset: ~30-90 min, Peak: None, Duration: >24 hrs)
 - **Examples:** Degludec
 - **Uses:** Extended basal needs.

Mechanism of Action

Insulin lowers blood glucose by:

- **Facilitating Glucose Uptake:** Promotes entry of glucose into muscle and fat cells.
- **Inhibiting Gluconeogenesis:** Reduces glucose production in the liver.
- **Promoting Glycogen Synthesis:** Enhances storage of glucose as glycogen in the liver and muscles.
- **Stimulating Lipogenesis:** Encourages fat storage and inhibits lipolysis.

Uses

- **Type I Diabetes Mellitus:** Essential for survival due to absolute insulin deficiency.
- **Type II Diabetes Mellitus:** Used when oral antidiabetics are insufficient to control blood glucose levels.
- **Gestational Diabetes:** Manages elevated blood sugar levels during pregnancy.
- **Hyperkalemia:** Insulin shifts potassium into cells, lowering blood potassium levels.

Side Effects

- **Hypoglycemia:** Low blood sugar levels, presenting as dizziness, sweating, confusion, and in severe cases, loss of consciousness.
- **Weight Gain:** Increased fat storage due to insulin's anabolic effects.
- **Injection Site Reactions:** Redness, swelling, or itching at the injection site.
- **Allergic Reactions:** Rare but may include rash or anaphylaxis.
- **Lipodystrophy:** Changes in fat tissue at injection sites from repeated use.

Preparation of Insulin

1. Formation of Preproinsulin:

- Insulin synthesis begins with **preproinsulin** (110 amino acids), synthesized in the rough endoplasmic reticulum.

2. Conversion to Proinsulin:

- Preproinsulin is processed in the Golgi apparatus to form **proinsulin**, an inactive precursor.

3. Folding and Bond Formation:

- Proinsulin folds to form three disulfide bonds, linking the A-chain and B-chain.

4. Packaging into Vesicles:

- Folded proinsulin is packaged into secretory vesicles for further processing.



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