Tikrit University

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Bio Chemistry

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Diabetes mellitus

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Diabetes mellitus

Diabetes mellitus (DM), commonly known as diabetes, is a group of metabolic disorders characterized by high blood sugar levels over a prolonged period

Normal Insulin Metabolism

Insulin

- Produced by the β cells in the islets of Langherans of the pancreas –
- Facilitates normal glucose range of 3.9 – 6.7 mmol/L –
- Promotes glucose transport from the bloodstream across the cell membrane to the cytoplasm of the cell
- Analogous to a that unlocks the cell door to allow glucose in •
- Insulin after a meal:
- Stimulates storage of glucose as glycogen
- Inhibits gluconeogenesis
- Enhances fat deposition in adipose tissue
- Increases protein synthesis

Fasting state

Counter-regulatory hormones (especially glucagon) stimulate glycogen → – glucose When glucose unavailable during fasting state • Lipolysis (fat breakdown) – Proteolysis (amino acid breakdown) –

What are the types of diabetes?

There are several types of diabetes. The most common forms include:

Type 2 diabetes: With this type, your body doesn't make enough insulin and/or your body's cells don't respond normally to the insulin (insulin resistance). This is the most common type of diabetes. It mainly affects adults, but children can have it as well.

Prediabetes: This type is the stage before Type 2 diabetes. Your blood glucose levels are higher than normal but not high enough to be officially diagnosed with Type 2 diabetes.

Type 1 diabetes: This type is an autoimmune disease in which your immune system attacks and destroys insulin-producing cells in your pancreas for unknown reasons. Up to 10% of people who have diabetes have Type 1. It's

usually diagnosed in children and young adults, but it can develop at any age.
Gestational diabetes: This type develops in some people during pregnancy. Gestational diabetes usually goes away after pregnancy. However, if you have gestational diabetes, you're at a higher risk of developing Type 2 diabetes later in life.
Other types of diabetes include:
Type 3c diabetes: This form of diabetes happens when your pancreas experiences damage (other than autoimmune damage), which affects its ability to produce insulin. Pancreatitis, pancreatic cancer, cystic fibrosis and hemochromatosis can all lead to pancreas damage that causes diabetes. Having your pancreas removed (pancreatectomy) also results in Type 3c.
Latent autoimmune diabetes in adults (LADA): Like Type 1 diabetes, LADA also results from an autoimmune reaction, but it develops much more slowly than Type 1. People diagnosed with LADA are usually over the age of 30.
Maturity-onset diabetes of the young (MODY): MODY, also called monogenic diabetes, happens due to an inherited genetic mutation that affects how your body makes and uses insulin. There are currently over 10 different types of MODY. It affects up to 5% of people with diabetes and commonly runs in families.
Neonatal diabetes: This is a rare form of diabetes that occurs within the first six months of life. It's also a form of monogenic diabetes. About 50% of babies with neonatal diabetes have the lifelong form called permanent neonatal diabetes mellitus. For the other half, the condition disappears within a few months from onset, but it can come back later in life. This is called transient neonatal diabetes mellitus.
Brittle diabetes: Brittle diabetes is a form of Type 1 diabetes that's marked by frequent and severe episodes of high and low blood sugar levels. This instability often leads to hospitalization. In rare cases, a pancreas transplant may be necessary to permanently treat brittle diabetes.

Symptoms of high blood sugar include

Frequent urination, increased thirst, and increased hunger. If left untreated, diabetes can cause many complications. Acute complications can include diabetic ketoacidosis, hyperosmolar hyperglycemic state, or death, Serious long- term complications include cardiovascular disease, stroke, chronic kidney disease, foot ulcers, and damage to the eyes Diabetes is due to either the pancreas not producing enough insulin, or the cells of the body not responding properly to the insulin produced.

There are three main types of diabetes mellitus: • Type 1 diabetes results from the pancreas's failure to produce enough insulin due to loss of beta cells. This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes". The loss of beta cells is caused by an autoimmune response. • Most often occurs in people under 30 years of age • Peak onset between ages 11 and 13 • Progressive destruction of pancreatic β cells 4 • Autoantibodies cause a reduction of 80% to 90% of normal β cell function before manifestations occur •
Causes: •
Genetic predisposition •
Exposure to a virus

Onset of Disease •
Weight loss •
Polydipsia (excessive thirst) •
Polyuria (frequent urination) •

Polyphagia (excessive hunger) •

Weakness and fatigue • Ketoacidosis •

Diabetic ketoacidosis (DKA) o Life-threatening complication of Type 1 DM o Occurs in the absence of insulin o Results in metabolic acidosis •

Type 2 diabetes begins with insulin resistance, a condition in which cells fail to respond to insulin properly.

As the disease progresses, a lack of insulin may also develop. This form was previously referred to as "non insulin-dependent diabetes mellitus" (NIDDM) or "adult-onset diabetes".

The most common cause is a combination of excessive body weight and insufficient exercise. •

Accounts for 90% of patients with diabetes •

Usually occurs in people over 40 years old • 80-90% of patients are overweight •

Insulin resistance o Body tissues do not respond to insulin o Results in hyperglycemia

• Decreased (but not absent) production of insulin •

Gradual onset •

Person may go many years with undetected hyperglycemia •

Marked hyperglycemia (27.6 – 55.1 mmol/L) •

Non-specific symptoms •

Fatigue •

Recurrent infections •

Prolonged wound healing •

Visual changes •

Gestational diabetes is the third main form, and occurs when pregnant women without a previous history of diabetes develop high blood sugar levels.

Develops during pregnancy Detected at 24 to 28 weeks of gestation

Associated with↑ risk for cesarean delivery, perinatal death, and neonatal complications

Signs and symptoms

The classic symptoms of untreated diabetes are 'weight loss, polyuria (increased urination), polydipsia (increased thirst), and polyphagia (increased hunger). Symptoms may develop rapidly (weeks or months) in type 1 diabetes, while they usually develop much more slowly and may be subtle or absent in type 2 diabetes.

Complications

Diabetic nephropathy

Diabetic retinopathy

Diabetic neuropathy

Secondary Diabetes

Results from another medical condition or due to the treatment of a medical • condition that causes abnormal blood glucose levels

Cushing syndrome (e.g. steroid administration) –

Hyperthyroidism –

Parenteral nutrition

Diagnostic

- Studies Fasting plasma glucose level >7 mmol/L

- Random plasma glucose level > 11.1 mmol/L plus symptoms
- Impaired Glucose Tolerance Test – patient is “challenged” with glucose load.
- Patient should be able to maintain normal BG. Diabetes if BG > 11.1 mmol/L 2 hr post challenge Hemoglobin A1C test (glycosylated Hgb)
- Reflects amount of glucose attached to Hgb over life of RBC – Indicates overall glucose control over previous 90 – 120 days