Nutrition in Health & Disease Course

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Module 7: Prevention of Diabetes Mellitus

Overview

Diabetes results from reduced production of the hormone insulin, resistance of the body tissues, to the effect of insulin, or both.

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood glucose. Hyperglycaemia, also called raised blood glucose or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels.

In 2014, 8.5% of adults aged 18 years and older had diabetes. In 2019, diabetes was the direct cause of 1.5 million deaths and 48% of all deaths due to diabetes occurred before the age of 70 years. Another 460 000 kidney disease deaths were caused by diabetes, and raised blood glucose causes around 20% of cardiovascular deaths (1).

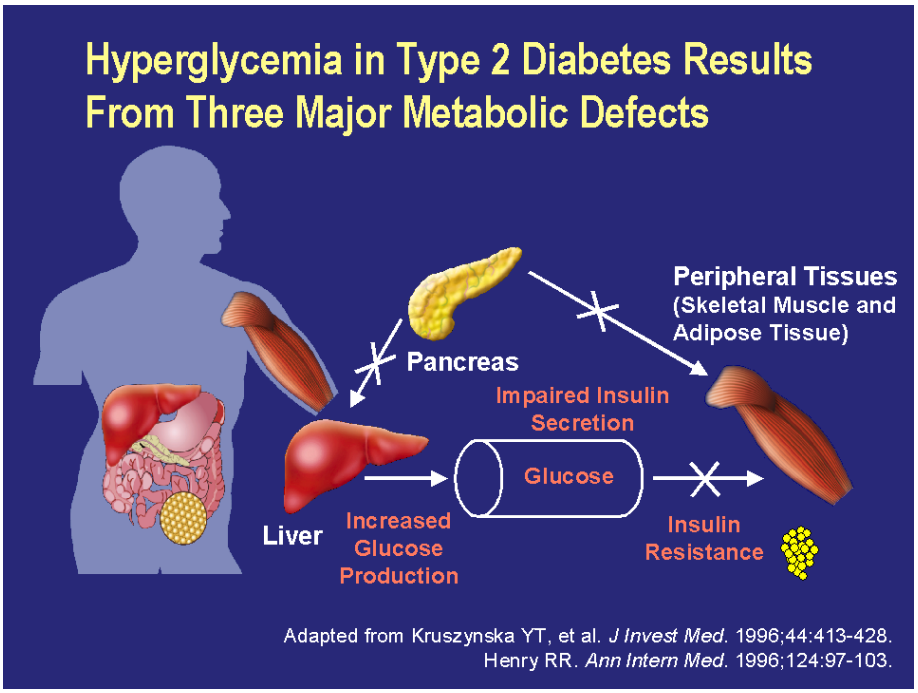
Between 2000 and 2019, there was a 3% increase in age-standardized mortality rates from diabetes. In lower-middle-income countries, the mortality rate due to diabetes increased 13%.

By contrast, the probability of dying from any one of the four main noncommunicable diseases (cardiovascular diseases, cancer, chronic respiratory diseases or diabetes) between the ages of 30 and 70 decreased by 22% globally between 2000 and 2019.

Pathophysiology of DM:

After a meal, our body breaks down carbohydrates in the stomach, releasing glucose into the blood. In the healthy body, the pancreas produces insulin to regulate glucose levels in the blood, which acts to trigger the liver to store glucose as glycogen encourage cells in the rest of the body to take up glucose & prevent cells from releasing protein and fat as energy

In diabetes, the production of insulin or the body's sensitivity to insulin is reduced. This results in too much glucose in the blood.



Some of the excess glucose is filtered out by the kidneys, causing them to excrete more salt and water, leading to passing large amounts of urine. As a result, people with diabetes can experience thirst and dehydration. This can also lead to dehydration of the lens in the eye, causing blurred vision.

Some of the excess glucose can also pass into the urine, giving it a sweet smell. The sugars in urine make it a fertile ground for bacteria to grow, which increases the risk of urinary tract infections (such as thrush).

Because the glucose has not entered cells to be used for energy, people with diabetes can feel very tired. Also, cells are not prevented from releasing proteins and fats, diabetes can also lead to weight loss.

Symptoms

Symptoms of diabetes may occur suddenly. In type 2 diabetes, the symptoms can be mild and may take many years to be noticed.

Symptoms of diabetes include:

- feeling very thirsty
- needing to urinate more often than usual
- blurred vision
- feeling tired
- losing weight unintentionally
- Over time, diabetes can damage blood vessels in the heart, eyes, kidneys and nerves.

People with diabetes have a higher risk of health problems including heart attack, stroke and kidney failure. Diabetes can cause permanent vision loss by damaging blood vessels in the eyes.

Many people with diabetes develop problems with their feet from nerve damage and poor blood flow. This can cause foot ulcers and may lead to amputation.

Type 1 diabetes

Type 1 diabetes (previously known as insulin-dependent, juvenile or childhood-onset) is characterized by deficient insulin production and requires daily administration of insulin. In 2017 there were 9 million people with type 1 diabetes; the majority of them live in high-income countries. Neither its cause nor the means to prevent it are known.

In **type 1 diabetes**, the pancreas is unable to produce insulin. Symptoms usually develop quickly; if untreated, fats and protein build up in cells can cause people to enter a *ketoacidotic coma*, which requires urgent hospital treatment with insulin and fluids. People with severe type 1 diabetes require insulin treatment for survival. Type 1 accounts for around 15% of diabetes in the UK and is most commonly diagnosed in childhood.

Type 2 diabetes

Type 2 diabetes affects how your body uses sugar (glucose) for energy. It stops the body from using insulin properly, which can lead to high levels of blood sugar if not treated.

Over time, type 2 diabetes can cause serious damage to the body, especially nerves and blood vessels.

Type 2 diabetes is often preventable. Factors that contribute to developing type 2 diabetes include being overweight, not getting enough exercise, and genetics.

Early diagnosis is important to prevent the worst effects of type 2 diabetes. The best way to detect diabetes early is to get regular check-ups and blood tests with a healthcare provider.

Symptoms of type 2 diabetes can be mild. They may take several years to be noticed. Symptoms may be similar to those of type 1 diabetes but are often less marked. As a result, the disease may be diagnosed several years after onset, after complications have already arisen.

More than 95% of people with diabetes have type 2 diabetes. Type 2 diabetes was formerly called non-insulin dependent, or adult onset. Until recently, this type of diabetes was seen only in adults but it is now also occurring increasingly frequently in children.

Gestational diabetes

Gestational diabetes is hyperglycaemia with blood glucose values above normal but below those diagnostics of diabetes. Gestational diabetes occurs during pregnancy.

Women with gestational diabetes are at an increased risk of complications during pregnancy and at delivery. These women and possibly their children are also at increased risk of type 2 diabetes in the future.

Gestational diabetes is diagnosed through prenatal screening, rather than through reported symptoms.

Impaired glucose tolerance and impaired fasting glycaemia

Impaired glucose tolerance (IGT) and impaired fasting glycaemia (IFG) are intermediate conditions in the transition between normality and diabetes. People with IGT or IFG are at high risk of progressing to type 2 diabetes, although this is not inevitable.

Risk factors of DM

1. **Type 1 Diabetes**

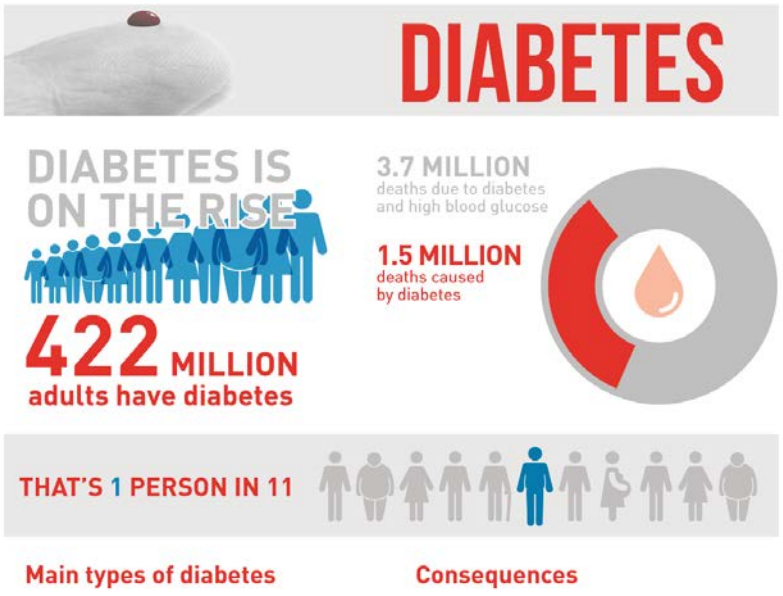
Type 1 diabetes is thought to be caused by an immune reaction (the body attacks itself by mistake). Risk factors for type 1 diabetes are not as clear as for prediabetes and type 2 diabetes. Known risk factors include:

- Family history: Having a parent, brother, or sister with type 1 diabetes.
- Age: You can get type 1 diabetes at any age, but it usually develops in children, teens, or young adults.

2. **Type 2 Diabetes:**
    - Have prediabetes.
    - Are overweight.
    - Are 45 years or older.
    - Have a parent, brother, or sister with type 2 diabetes.
    - Are physically active less than 3 times a week.
    - Women have ever had gestational diabetes (diabetes during pregnancy) or given birth to a baby who weighed over 4 kilograms.

3. **Prediabetes**
    - Are overweight.
    - Are 45 years or older.
    - Have a parent, brother, or sister with type 2 diabetes.
    - Are physically active less than 3 times a week.
    - Women have ever had gestational diabetes (diabetes during pregnancy) or given birth to a baby who weighed over 4 kilograms.
4. **Gestational Diabetes**
    - Had gestational diabetes during a previous pregnancy.
    - Have given birth to a baby who weighed over 9 pounds.
    - Are overweight.
    - Are more than 25 years old.
    - Have a family history of type 2 diabetes.
    - Have a hormone disorder called polycystic ovary syndrome (PCOS).

Epidemiology of DM



Diabetes is a chronic, metabolic disease characterized by elevated levels of blood glucose (or blood sugar), which leads over time to serious damage to the heart, blood vessels, eyes, kidneys and nerves. The most common is type 2 diabetes, usually in adults, which occurs when the body becomes resistant to insulin or doesn't make enough insulin. In the past 3 decades the prevalence of type 2 diabetes has risen dramatically in countries of all income levels. Type 1 diabetes, once known as juvenile diabetes or insulin-dependent diabetes, is a chronic condition in which the pancreas produces little or no insulin by itself. For people living with diabetes, access to affordable treatment, including insulin, is critical to their survival. There is a globally agreed target to halt the rise in diabetes and obesity by 2025.

About 422 million people worldwide have diabetes, the majority living in low-and middle-income countries, and 1.5 million deaths are directly attributed to diabetes each year. Both the number of cases and the prevalence of diabetes have been steadily increasing over the past few decades.

Prevention of DM

Lifestyle changes are the best way to prevent or delay the onset of type 2 diabetes.

To help prevent type 2 diabetes and its complications, people should:

- reach and keep a health body weight
- stay physically active with at least 30 minutes of moderate exercise each day
- eat a healthy diet and avoid sugar and saturated fat
- not smoke tobacco.

Diagnosis and treatment

Early diagnosis can be accomplished through relatively inexpensive testing of blood glucose. People with type 1 diabetes need insulin injections for survival.

The WHO recommendations for the diagnostic criteria for diabetes is shown in the following Figure:

Diabetes	
Fasting plasma glucose	≥7.0mmol/l (126mg/dl), or
2–h plasma glucose *	≥11.1mmol/l (200mg/dl)
Impaired Glucose Tolerance (IGT)	
Fasting plasma glucose	<7.0mmol/l (126mg/dl)
2–h plasma glucose*	≥7.8 and <11.1mmol/l (140mg/dl and 00mg/dl)
Impaired Fasting Glucose (IFG)	
Fasting plasma glucose	6.1 to 6.9 mmol/L (110mg/dl to 125 mg/dl)
2-h Plasma glucose*	< 7.8 mmol/dl (140mg/dl)

* Venous plasma 2-h after ingestion of 75gm oral glucose load (OGTT)

One of the most important ways to treat diabetes is to keep a healthy lifestyle.

Some people with type 2 diabetes will need to take medicines to help manage their blood sugar levels. These can include insulin injections or other medicines. Some examples include:

- metformin
- sulfonylureas

- sodium-glucose co-transporters type 2 (SGLT-2) inhibitors.

Along with medicines to lower blood sugar, people with diabetes often need medications to lower their blood pressure and statins to reduce the risk of complications.

Additional medical care may be needed to treat the effects of diabetes:

- foot care to treat ulcers
- screening and treatment for kidney disease
- eye exams to screen for retinopathy (which causes blindness).

Screening for DM

Screening refers to the use of simple tests across an apparently healthy population in order to identify individuals who have risk factors or early stages of disease, but do not yet have symptoms (WHO). According to the American Diabetes Association, all patients should be screened for diabetes at three-year intervals beginning at age 45, especially people who are overweight or obese. If multiple risk factors are present, screening should be done at an earlier age and more frequently.

- Urine examination (Glycosurea)
- Blood sugar testing (standard oral glucose test)

Criteria of Screening for DM

1. All persons >45 years; repeat every 3 years
2. High risk persons: screen at younger age and more frequently
    - Overweight (BMI >25)
    - First-degree relative with diabetes
    - High-risk ethnic population
    - Delivered baby >9 lb or diagnosed GDM
    - Hypertensive
    - HDL <35 mg/dl or TG >200
    - Prediabetes
    - Polycystic ovary syndrome

End of Module 5.