



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Name: Yan Kurylyshyn

Student ID: 2418839

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Lecturer: Dr Soban Sadiq

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Diabetes mellitus is a chronic metabolic disorder characterised by elevated blood glucose levels (hyperglycaemia) resulting from defects in insulin production, insulin action, or both. The two main types are Type 1 diabetes, an autoimmune condition leading to insulin deficiency, and Type 2 diabetes, which is far more common and associated with insulin resistance and relative insulin deficiency.

Type 2 diabetes is a significant and growing public health concern in the United Kingdom and globally. It is strongly associated with lifestyle and environmental factors, although genetic predisposition also plays a role.

Several modifiable and non-modifiable risk factors contribute to the development of Type 2 diabetes:

Non-modifiable factors:

- Age (risk increases over 40 years)
- Family history of diabetes
- Ethnicity (higher prevalence in South Asian, African-Caribbean populations)
- Genetic predisposition

Modifiable factors:

- * Obesity, particularly central (abdominal) obesity
- * Physical inactivity
- * Poor diet (high in refined sugars, saturated fats)
- * Smoking
- * Excessive alcohol consumption

The increasing prevalence seen in GP surgeries reflects broader societal trends, including sedentary lifestyles and rising obesity rates. Without effective management, diabetes can lead to serious complications such as cardiovascular disease, neuropathy, nephropathy, and retinopathy.

Maintaining blood glucose within a narrow physiological range (approximately 4–7 mmol/L fasting) is essential for normal body function. This balance is achieved through hormonal regulation, primarily involving insulin and glucagon, produced by the pancreas.

Role of Insulin:

Insulin is released by beta cells in the pancreas in response to elevated blood glucose levels (e.g., after eating). Its functions include:

- * Facilitating glucose uptake into muscle and fat cells
- * Promoting glycogen storage in the liver
- * Inhibiting glucose production (gluconeogenesis)

Role of Glucagon

Glucagon is secreted by alpha cells when blood glucose levels fall. It acts to:

- * Stimulate glycogen breakdown (glycogenolysis)
- * Promote glucose release from the liver

Homeostasis Mechanism

This system operates through negative feedback:

- * High blood glucose → insulin released → glucose lowered
- * Low blood glucose → glucagon released → glucose increased

In Type 2 diabetes, insulin resistance means that body cells do not respond effectively to insulin, resulting in persistently elevated blood glucose levels. Over time, pancreatic function may also decline, worsening the condition.

c) Cellular Metabolism: Use of Oxygen and Glucose for Energy

Cells require energy to function, which is produced through cellular respiration—a biochemical process that converts glucose into energy in the form of adenosine triphosphate (ATP).

Stages of Cellular Respiration

1. Glycolysis (in cytoplasm):

- Glucose is broken down into pyruvate
- Produces a small amount of ATP

2. Krebs Cycle (in mitochondria):

- Pyruvate is further broken down
- Produces electron carriers (NADH, FADH₂)

3. Electron Transport Chain:

- Oxygen is required
- Generates the majority of ATP

Role of Oxygen and Glucose

Glucose is the primary fuel source

Oxygen is essential for efficient ATP production (aerobic respiration)

Without sufficient insulin, glucose cannot effectively enter cells. As a result:

- Cells are deprived of energy
- Blood glucose levels rise
- The body may break down fat and protein as alternative energy sources

This inefficiency contributes to symptoms such as fatigue and weight loss in poorly controlled diabetes.

Recording and tracking blood glucose levels is essential for people with type 2 diabetes, allowing them to safely and effectively manage their condition. This is typically done using:

- Blood glucose measurements with a finger prick (glucometer)
- Continuous glucose monitoring (CGM) devices

Regular monitoring allows people to:

- Identify patterns in blood glucose levels
- Understand how diet, physical activity, and medications affect glucose levels
- Detect hyperglycemia (high blood sugar) and hypoglycemia (low blood sugar)
- Adjust lifestyle and treatment accordingly

For example, if blood glucose levels rise significantly after certain meals, dietary adjustments can be made. Similarly, monitoring helps healthcare providers tailor treatment plans, reducing the risk of long-term complications such as cardiovascular disease and nerve damage. Overall, continuous tracking promotes better glycemic control and allows people to take an active role in managing their condition.

Evidence-Based Lifestyle Recommendations

Lifestyle modifications are a key component in managing Type 2 diabetes and are strongly supported by organisations such as the NHS and Diabetes UK.

1) Healthy diet

Where the food is balanced(Whole grain, fruits, vegetables, lean protein) Also reduces sugar and saturated fat.

2) Regular Physical Activity

At least 150 minutes of moderate exercise per week (e.g., brisk walking, cycling)and include strength training exercises

3) Control weight

Controlling weight helps to improve blood glucose control

4) No smoking

Stopping smoking reduces the risk of cardiovascular complications

5) No alcohol

Helps prevent blood sugar fluctuations and reduces additional health risks.

6) Regular Medical Check-ups

Routine monitoring of:

- HbA1c levels
- Blood pressure
- Cholesterol

Which helps ensure early detection of complications and effective management.

In conclusion, diabetes mellitus is a complicated long-term illness marked by high blood sugar levels brought on by compromised insulin activity. Environmental and lifestyle factors have a significant impact on type 2 diabetes in particular. While cellular respiration depends on glucose and oxygen to generate energy, the body uses insulin and glucagon to maintain blood glucose homeostasis. Insulin resistance interferes with these functions in people with Type 2 diabetes, resulting in increased blood glucose and decreased cellular energy availability.

Regular blood glucose monitoring and the implementation of evidence-based lifestyle modifications, such as a nutritious diet, more exercise, and weight control, are essential for effective treatment. People can greatly lower their risk of problems and enhance their general quality of life with the right intervention and self-management.

Reference:

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