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1. Introduction

1.1 Define the condition (Diabetes)

Diabetes refers to a cluster of metabolic disorders characterised by chronic hyperglycaemia that leads to damage in various organs such as the kidney, heart, and blood vessels, causing dysfunction (Schleicher *et al.* 2022, p.1). Primarily, diabetes is classified into two types: Type-1 diabetes and Type-2 diabetes, but they function differently by affecting glucose metabolism. Diabetes is a serious concern as when the glucose metabolism process is disrupted, elevated glucose levels in the blood lead to life-threatening complications such as cardiovascular diseases, nerve dysfunction and kidney damage.

1.2 Key risk factors

The development and progression of diabetes are heavily dependent on several modifiable and non-modifiable factors. Poor dietary practices, sedentary lifestyle, obesity, smoking and alcohol abuse result in insulin resistance and poor glucose regulation (Andersson *et al.* 2023, p.4). On the other hand, ageing, family history and genetic factors also increase susceptibility to developing diabetes (NHS UK, 2026). These factors emphasise the importance of healthy lifestyle factors to prevent the progression of the disease by ensuring glycaemic control.

1.3 Purpose of the report

This report is purposeful to improve patients' knowledge regarding diabetes by providing the anatomy and physiology of blood glucose regulation underlying the pathophysiology of the disease. Additionally, this report also highlights the role of evidence-based lifestyle changes and recommends improving blood glucose regulation by preventing hyperglycaemia.

2. Section 1: Anatomy & Physiology

2.1 The process of blood sugar regulation

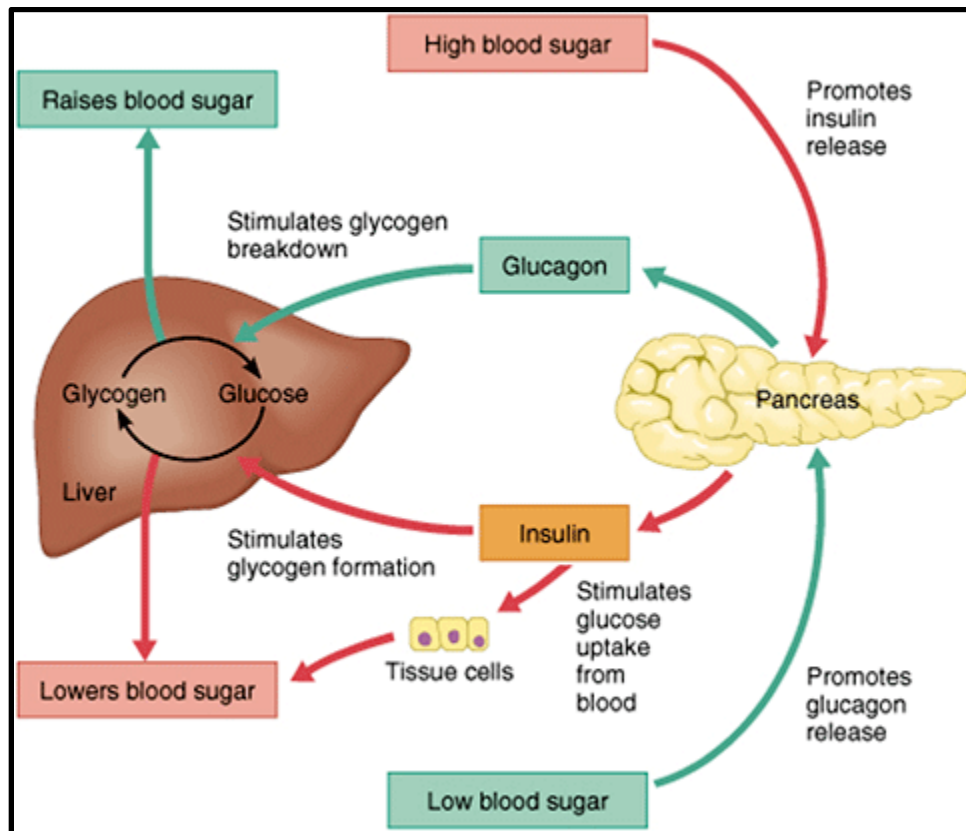


Figure 1: Blood glucose regulation

(Source: Atrainceu, 2026)

Blood glucose regulation in the body is a continuous physiological process that occurs every minute per day (Figure 1). Normal bodily functions require a glucose supply between 60-140mg/dl (Pereira *et al.* 2025, p.6). In general, the pancreas plays a vital role in maintaining glucose homeostasis in the body through the secretion of Insulin from the islets of Langerhans. Deepa Maheshvare *et al.* (2023, p.02) note that glucose-induced insulin secretion is the process that triggers insulin secretion in the blood in response to increased blood glucose levels. After taking a meal, a glucose transporter GLUT-2 (Glucose-Transporter 2) helps in the movement of glucose to the pancreatic β cells. Within these cells, glucose metabolism occurs through glycolysis that converts glucose into smaller molecules and produces Adenosine Tri-Phosphate (ATP). This ATP production amplifies insulin secretion in the blood that contributes to controlling blood glucose levels.

Insulin mainly binds with the receptors on adipose tissue, liver cells and muscles, which promotes glucose uptake from the blood into tissues. Absorbed glucose is primarily used in energy production or stored as glycogen to meet further needs. However, abnormalities in insulin secretion disrupt the blood glucose regulation process in cases of lower production of insulin by the beta-cells or insulin resistance (Szablewski, 2024, p.1). Consequently, insulin resistance induces glucose uptake into the tissues by causing excessive glucose accumulation in the blood and disrupts glucose homeostasis. Therefore, a continuous interaction between pancreatic beta-cells, insulin and glucose uptake helps in maintaining blood glucose levels within a safe and effective level.

2.2 Description of cell metabolism

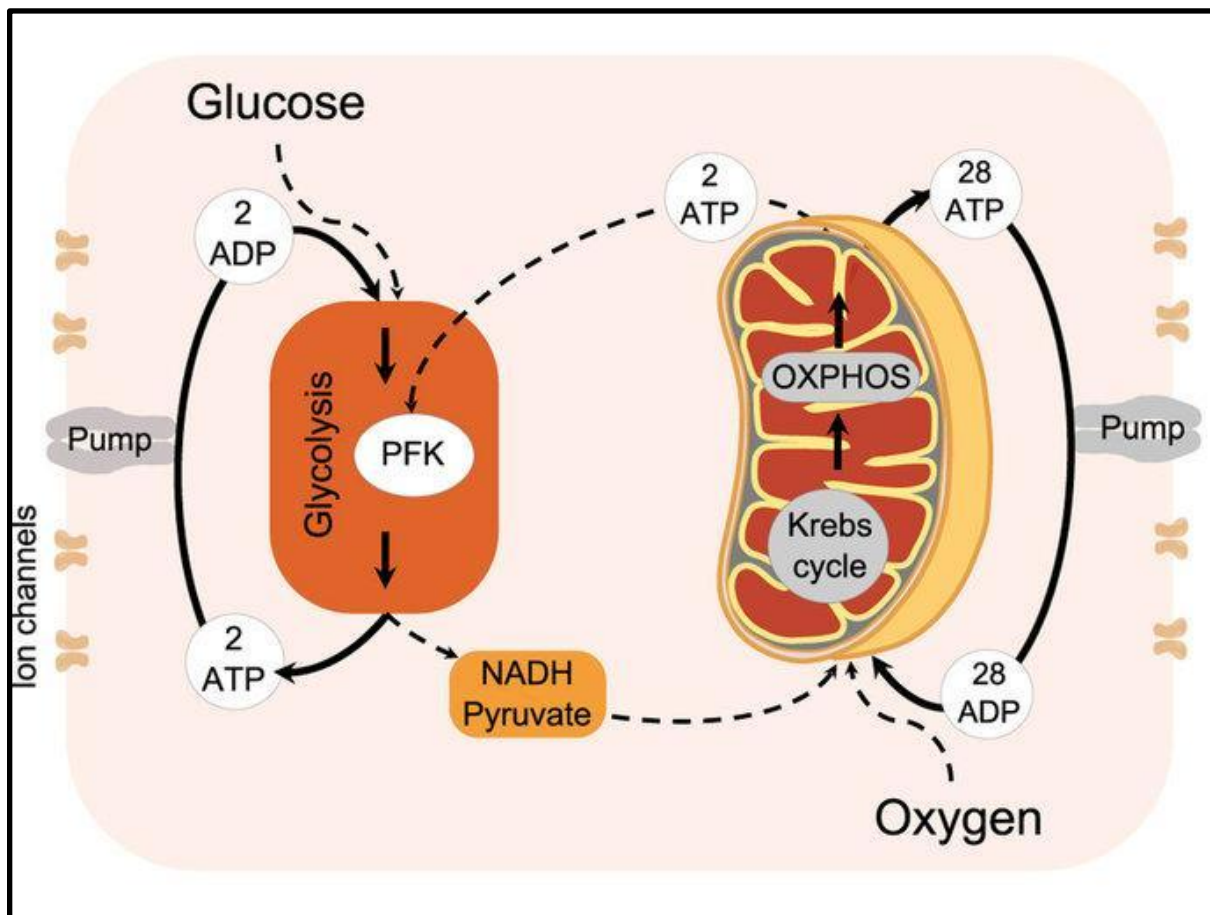


Figure 2: Cell metabolism

(Source: Creative-proteomics, 2026)

Figure 2 indicates the cell metabolism process that converts glucose and oxygen into energy in the form of ATP. After glucose penetration into the cells with insulin, it couples with oxygen in the blood. Once in mitochondria, the glucose takes part in cellular respiration, where its metabolism

occurs to release the stored energy (Casanova *et al.* 2023, p.03). This process further produces ATP and NADH, as a primary source of energy which contributes to muscle contraction, protein synthesis and nerve functions. On the other side, during the process of cellular respiration, the by-products such as CO₂ and water are formed and excreted through the lungs and kidneys. In the Krebs cycle, pyruvate is completely broken down and produces CO₂ and increases the production of NADH with a small amount of ATP (Arneth, 2023, p.183). Hence, a simple equation concerning cellular respiration is presented as –

Oxygen + Glucose → ATP (Energy) + Water + Carbon Dioxide

Thus, glucose metabolism or insulin regulation is key in diabetes. Insulin cannot work optimally without glucose being able to get into the cells. This results in a rise in blood glucose and a decrease in the amount of energy available to the cells. This disruption causes disruption of normal physiological function and is a part of the symptoms of diabetes, such as fatigue and a decrease in physical function. The importance of the physiological mechanisms underlines the need to maintain good blood glucose control. Cellular energy production is maintained, and the risk for long-term complications from Type 2 diabetes is minimised with good management.

3. Section 2: Pathophysiology & Impact

3.1 Effects of blood sugar regulation failure

Blood sugar regulation primarily fails when insulin secretion is impaired, insulin resistance or an increase in endogenous glucose production that abnormally elevates glucose concentration in the blood. Among the healthy individuals, insulin helps glucose to move from the bloodstream into the cells to stimulate ATP production through the process of cellular respiration. However, in the case of type-1 diabetes, lower production of insulin due to autoimmune dysfunctions of beta-cells of the pancreas (Eizirik *et al.* 2023, p.426). While in type-2 diabetes, insulin production continues, but cells become resistant to the action that leads to disruption of glucose penetration into the cells, thus the consequences of hyperglycaemia.

On the other hand, a continuous condition of high blood glucose level causes polydipsia (extreme thirst), while it also spills into the urine, which causes glycosuria. The long-term absence of insulin forces the body to assume starvation, which leads to the breakdown of stored fats that release free fatty acids, which the liver converts into ketone (Panov *et al.* 2024, p.19). This process ultimately leads to diabetic ketoacidosis due to excessive accumulation of acidic ketones. Chronic hyperglycaemia affects blood vessels and damages nerve functions, which increases life-threatening complications, including heart disease, kidney malfunctioning and nerve damage.

Thus, blood glucose regulation failure affects the quality of life of the patients by increasing the risk of morbidity.

3.2 Lifestyle factors affect glucose control

Lifestyle factors such as diet, exercise and smoking have a broader influence on blood glucose levels, particularly among patients with diabetes. Diet plays a pivotal role as carbohydrates are directly responsible for elevating blood glucose levels in the blood. For example, foods containing simple carbohydrates such as refined sugar, candy, and honey are readily responsible for increasing blood glucose concentration. In contrast, A study of Campaniello *et al.* (2022, p.4) highlights that a diet with low 5-10% carbohydrates increase fat metabolism while reducing glucose levels in the blood. Thus, portion control and maintenance of meal timing greatly improve blood glucose level control.

Physical activity also plays a key role in strengthening glucose regulation in the blood by enhancing insulin sensitivity, which leads to a rapid cell response to glucose uptake from the blood (Cockcroft and Andrews, 2024, p.384). Exercise stimulates muscle cells to utilise glucose to provide an energy supply continuously while lowering glucose concentration in the blood. In contrast, smoking impairs blood glucose level control by preventing insulin from binding with cellular receptors, which causes insulin resistance (Sakr *et al.* 2023, p.1). Tobacco smoke contains chemicals that cause inflammation and oxidative stress, both of which result in insulin resistance (Sakr *et al.* 2023, p.2). Therefore, the presence of nicotine in the bloodstream leads to alterations in biochemical processes in the cells, thereby affecting glucose control in the blood.

4. Section 3: Monitoring & Data Use

4.1 Importance of tracking health data (blood sugar)

Nurses have the responsibility to track health data based on blood sugar levels, particularly for patients with type 2 diabetes. Regular monitoring helps to measure the blood glucose concentration in subcutaneous tissue, which allows to detect changes compared to the post-exercise phase (Helleputte *et al.* 2023, p.1187). Tracking health data related to blood sugar levels allows for the identification of triggers such as foods, stress, or medications. However, lack of information or overlapping records sometimes leads to misinterpretation of disease conditions that may affect treatment procedures (Helleputte *et al.* 2023, p.1188). Recording blood sugar levels over time helps in recognising the pattern of consistent elevation after meals or decrease

after exercise. This episodic action helps in preventing the risk of hyperglycaemia and contributes to the quality of life.

As explained by Chang *et al.* (2022, p. 1), self-monitoring of blood glucose levels makes it easier to improve glycaemic control while reducing the risk of long-term complications. However, a lack of monitoring can also lead to complications of hyperglycaemia and hypoglycaemia (Mathew and Zubair, M., 2026, p.2). Being aware of any abnormal readings early in the process enables prompt action, which will minimise the risk of a serious medical emergency and long-term tissue damage. Therefore, a personalised approach in treatment by enabling to track blood glucose levels promotes patient improvement rapidly.

4.2 The extent through which routine data helps in managing the condition

Routine data collection for blood glucose level monitoring is the cornerstone of diabetes management. Specifically, routine data helps by guiding for pinpoint changes in post-meals spikes that guide adjustments with treatment or medication, diet or activities. As studied by Reddy and Oliver (2024, p.47), a real-time glucose monitoring system utilises the enzyme glucose oxidase to transform glucose into hydrogen peroxide, which measures the changes in glucose levels every 1-5 minutes. The changes in records help to provide alerts regarding hypo or hyperglycaemic conditions, thereby reducing the risk of severity. Lenters-Westra *et al.* (2025, p.1) highlight that a consistent review of glucose levels ensures better HbA1c outcomes to stabilise blood glucose levels. Therefore, tracking or monitoring health records related to blood glucose allows GPs to make informed decisions and provide advice for maintaining control levels over time.

5. Section 4: Evidence-Based Lifestyle Recommendations

5.1 Balanced diet and weight management

A healthy, balanced diet should be advised to patients with diabetes and attending GP surgery diabetes clinics. Improving daily diet with proper menu planning and meal timing would be advantageous for controlling blood glucose levels with respect to self-management. The guidance from NICE that eliminates refined sugars, processed meals and foods having high-glycaemic index while increasing fibre-rich foods to control sugar levels (NICE UK, 2026). It is evidenced that low-carb diets (<130 g) are safe for controlling type-2 diabetes and weight management of patients (NICE UK, 2026). This information would be valuable for the patients who have limited knowledge regarding food choices. Following a healthy diet plan including fibre-

rich foods would be effective in reducing glucose absorption and reducing the risk of post-meal sugar level elevation.

5.2 Regular physical activity

Patients should be aware of regular exercise to reduce the risk of diabetes by controlling blood glucose levels. The WHO (2026) standardises that at least 150 minutes of moderate-intensity aerobic exercise is necessary for patients with diabetes. In line with this, NICE also recommended muscle-strengthening exercise for 2 days a week to maintain blood glucose levels (NICE UK, 2025). Through this advice from nurses, patients can support the reduction of blood glucose levels between the intervals of clinical visits instead of relying solely on medical supervision. Supporting this, Lucia *et al.* (2025, p.2228) stated that regular exercise greatly contributes to reducing HbA1c levels by around 0.5-1% that indicates the use of glucose for energy supply to the body. Therefore, alteration in lifestyle factors with physical activities would improve glucose uptake and induce insulin resistance to support normal blood glucose regulation, to improve quality of life.

5.3 Smoking abstinence and complications control

For patients with diabetes, smoking abstinence would be the necessary attempt to make significant lifestyle changes to reduce complications. Nursing professionals should guide routine cessation support by identifying the triggers and suggesting substitution habits for the practical implications of smoking abstinence. NHS supported this approach by providing guides for Nicotine Replacement Therapy (NRT) for about 12 weeks as per the requirements (NHS UK, 2026). Thus, NRT over a period of time would improve blood circulation by maintaining the flow of oxygen supply into the tissues to support glucose metabolism.

6. Conclusion

Diabetes is a chronic metabolic disorder that arises due to abnormal glucose regulation in the blood that results in long-term health complications. Due to this, patients must have a clear understanding of the disease progression and control mechanisms through regular monitoring of blood glucose levels. Maintenance of a healthy diet plan with regular physical exercise can allow patients to improve their use of glucose breakdown for increasing energy supply, thereby contributing to reducing blood glucose levels. Furthermore, smoking cessation assistance following the guidelines of WHO and NICE can allow patients to achieve behavioural control to avoid smoking. Therefore, nursing professionals' support is necessary for patients with diabetes in terms of guiding them toward lifestyle changes to lead quality of life.

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