

GHAZANFAR HUSSAIN

STUDENT NUMBER 2513364

MODULE BMHP 5023

LECTURER SAMUEL ASSAN

CASE STUDY REPORT DIABETES TYPE2

INTRODUCTION

Diabetes Mellitus is a chronic metabolic condition characterised by abnormally high levels of glucose in the blood. Glucose is an essential source of energy for the body's cells; however, it needs to be transported from the bloodstream into cells effectively. Insulin, a hormone produced by the beta cells of the pancreas, plays a central role in this process. In type 2 diabetes, the body cells become less responsive to insulin, known as insulin resistance, and the pancreas may eventually be unable to produce sufficient insulin to compensate. Consequently, glucose remains in the bloodstream, resulting in hyperglycaemia. NICE identifies insulin resistance combined with progressive pancreatic dysfunction as important features of type 2 diabetes. (NICE 2026)

Risk factors can be divided into non-modifiable and modifiable factors. Increasing age, family history, and genetic susceptibility cannot be changed, whereas excess weight, physical inactivity, dietary patterns, and prolonged sedentary behaviour can potentially be modified. These factors can interact rather than operating independently, meaning that diabetes risk is influenced by a combination of biological, behavioural, and social circumstances. Maintaining blood glucose within an appropriate range involves a complex homeostatic system. Following food consumption, increasing blood glucose stimulates insulin release, which encourages glucose uptake and storage. When blood glucose decreases, glucagon promotes the release of stored glucose from the liver. In type 2 diabetes, insulin resistance disrupts this regulation, producing persistent hyperglycaemia. NICE recommends that targets are agreed individually and reviewed according to the patient's treatment circumstances and risk of hypoglycaemia. (NICE, 2026) This report will also consider how glucose and oxygen are used to generate cellular energy, how blood glucose can be recorded and monitored, and how evidenced-based lifestyle intervention can support effective management and reduce the risk of diabetes-related complications.

Blood glucose regulation is an important physiological process that ensures cells receive a continuous supply of glucose for energy while preventing blood glucose levels from becoming excessively high or low. The pancreas, particularly the islet of Langerhans, plays a central role in maintaining blood glucose levels through the hormones insulin and glucagon. After a meal, carbohydrates are digested into glucose and absorbed into the bloodstream. As blood glucose levels rise, cells in the pancreas

release insulin acts like a chemical messenger allowing glucose to move from the blood into body cells particularly skeletal muscle and adipose tissue. It also promotes the storage of glucose as glycogen in the liver and muscles. As glucose is taken up and stored blood glucose levels return towards the normal range. When blood glucose falls alpha cells in the pancreas release glucagon, which stimulates the liver to break down glycogen and release glucose into the bloodstream. This negative feedback system helps maintain blood glucose within a safe physiological range. At cellular level glucose is an important substrate for cellular respiration which produces adenosine triphosphate (ATP). ATP is the main energy carrying molecule used by cells to perform functions such as muscle contraction, active transport, growth and repair. Cellular respiration can be divided into glycolysis, the Krebs cycle and oxidative phosphorylation. During glycolysis which occurs in the cytoplasm one glucose molecule is broken down into pyruvate producing a small amount of ATP. When sufficient oxygen is available pyruvate enters the mitochondria and is further processed through the Krebs cycle. Electrons and hydrogen are transferred to the electron transport chain where oxygen acts as the final acceptor. This process known as oxidative phosphorylation produces most of the ATP generated from glucose. Water is then formed as a final product while carbon dioxide is produced during earlier stages. Therefore, glucose provides the chemical energy and oxygen support efficient aerobic respiration within mitochondria. Together they enable cells to produce ATP efficiently. In type 2 diabetes insulin resistance reduces the effectiveness of insulin meaning glucose uptake by cells is impaired and blood glucose can remain elevated. Understanding this relationship between the pancreas, insulin, glucose uptake, oxygen and ATP is important when considering the physiological effects and management of type 2 diabetes.

Blood glucose regulation is an essential physiological process that provides the body with energy while maintaining glucose within a safe range. Following the consumption of carbohydrates, digestion breaks food down into glucose which is absorbed into the bloodstream. Increased blood glucose levels stimulate the cells of the pancreas to release insulin. Insulin moves glucose from the body stream into body cells where it can be used to produce energy or stored as glycogen. In type 2 diabetes this normal process becomes impaired because body cells develop insulin resistance. This means that cells respond less effectively to insulin, reducing glucose uptake and causing glucose to remain in the bloodstream. Initially the pancreas attempts to compensate by producing additional insulin. However, continued insulin resistance can place increased demand on pancreatic cells and their ability to produce sufficient insulin may decline over time. Consequently, blood glucose levels become persistently elevated, resulting in hyperglycaemia. Persistent hyperglycaemia affects normal cellular and vascular function. Excess glucose promotes oxidative stress, inflammation and the formation of advanced glycation end-products (AGEs). This process can damage blood vessels and tissues over time. Hyperglycaemia can explain several symptoms associated with type

2 diabetes excess glucose increases the amount of glucose filtered by the kidneys causing water to be lost through urine. This can result in frequent urination (polyuria) and increase thirst (polydipsia). reduced glucose uptake by cells can also contribute to tiredness and reduced energy. Persistently elevated glucose can damage small and large blood vessels and nerves increasing the risk of complications including cardiovascular disease chronic kidney disease, and peripheral neuropathy.

Lifestyle factors can significantly influence glucose regulation and progression of type 2 diabetes. A diet containing excessive refined carbohydrates added sugars and energy-dense food may contribute to weight gain and worsen insulin resistance. In contrast a balanced diet containing vegetables whole grains fibre and appropriate portion sizes can support healthier blood glucose levels. Physical activity also play an important role because contracting skeletal muscles can increase glucose uptake and improve insulin sensitivity. Regular physical activity can therefore help the body use glucose more effectively conversely prolonged physical inactivity may contribute to insulin resistance and poorer glucose control. Physical activity improves glucose control because exercising muscles use glucose for energy. Regular activity can therefore increase insulin sensitivity and help maintain a healthy body weight; lack of physical activity may contribute to insulin resistance. Smoking can also negatively affect diabetes management chemicals in Tobacco smoke can increase inflammation and may worsen insulin resistance. Smoking also damages blood vessels adding to the cardiovascular risks already associated with diabetes. Consequently, dietary improvement and smoking cessation are important lifestyle interventions for improving glucose regulations Therefore, stopping smoking maintaining regular physical activity and following a balanced diet are important components of managing type 2 diabetes and reducing the risk of long-term complication.

Monitoring health data is an important part of managing long term condition because it provides measurable information about changes in person health for individuals with diabetes, regularly recording blood glucose levels can help identify patterns of hyperglycaemia and support decisions about diet physical activity and prescribed medication. Consistent monitoring can also help healthcare professional assess whether treatment is effective and reduce the risk of complications associated with prolonged high blood glucose such as cardiovascular disease kidney damage neuropathy. Routine health data are important for monitoring and managing diabetes because they provide regular information about the person condition and response to treatment. Blood glucose monitoring allows individuals and healthcare professionals to identify patterns of high or low glucose levels and assess treatment and lifestyle changes Are effective. For people with type 2 diabetes recording blood glucose levels can support informed decision about diet physical activity and medication. Other routine measurements include blood pressure and body weight, and cholesterol provides a broader assessment of diabetes management and cardiovascular risk.

Haemoglobin is particularly useful because it provides an indication of average blood glucose levels over two or three months. Regular monitoring can identify deteriorating control and allow healthcare professional to review treatment before complication develop. Routine data also supports early identification of diabetes –related complications and monitoring kidney function urine, albumin, eye health and foot health can help detect changes that may otherwise remain unnoticed. Accurate and consistent records enable healthcare professional to compare results overtime evaluate treatment outcome and provide personalised advice. Routine health data supports evidence-based decision-making promotes patients' involvement and contribute to reducing the risk of long-term complication associated with poorly controlled diabetes.

Lifestyle modification is a fundamental component of type 2 diabetes management because changes in diet physical activity and body weight can improve glycaemic control and reduce cardiovascular risk. NICE (2026) recommends that dietary advice should be individualised according to nutritional needs Cultural preferences and willingness to change. A realistic approach is therefore to make gradual changes rather than impose restrictive diets. Adults with type 2 diabetes should be encouraged to consume high fibre, low-glycaemic and carbohydrates including vegetables fruits wholegrain and pulses, while reducing saturated and trans-fat NICE A practical dietary change could involve replacing refined carbohydrates such as white bread and sugary foods with wholegrain alternative and increasing vegetable intake. Higher-fibre food can slow glucose absorption reducing rapid post-meal increases in blood glucose. Reducing excessive energy intake can also support weight loss which may improve insulin sensitivity and emphasises integrating dietary changes with weight management and increased physical activity rather than treating nutrition as an isolated intervention.

Regular physical activity is another important evidence-based intervention and realistic initial target could be a 20–30-minute brisk walk on most days gradually progressing towards at least 150 minutes of moderate intensity activity each week. Diabetes guidelines support regular physical activity as part of diabetes management. Evidence from a 2024 systematic review and analysis involving 126 studies and 6,718 participants found that physical activity produced clinically meaningful reductions with the magnitude of improvement influenced by baseline glycaemic control.

Physiologically exercise increases glucose uptake by skeletal muscle and improves insulin sensitivity allowing glucose to move from the bloodstream into muscle cells more effectively. Resistance exercise can additionally increase muscle mass providing greater capacity for glucose utilisation. Weight management is particularly important for people with overweight or obesity and a realistic goal may be gradual and sustained weight reduction through portion control, Healthier food choices and increased activity. The diabetes prevention program demonstrated the effectiveness of intensive lifestyle modification targets at least 7% weight loss and 150 minutes of physical activity weekly

diabetes incidence was 58% lower than place over an average 2.8-year following up in high-risk adults. New England journal of medicine overall realistic lifestyle changes can improve physiological outcome by reducing insulin resistance lowering blood glucose and supporting healthier body weight and improving cardiovascular risk factors. Therefore, personalised and sustainable behavioural changes supported by healthcare professional should form an important part of holistic type 2 diabetes management.

Conclusion

Understanding type 2 diabetes requires an understanding of the relationship between glucose insulin, the pancreas cellular and metabolism and energy production. In normal physiology, pancreatic cells released insulin when blood glucose increases allow glucose to enter cells and be stored or metabolised. Glucose can undergo aerobic respiration using oxygen to generate ATP which provides energy for cellular activities. In type 2 diabetes insulin resistance and progressive cells dysfunction disrupt this homeostatic process resulting in persistent hyperglycaemia and increased risk of vascular and metabolic complication. Lifestyle management is an important component of diabetes care. A balanced high fibre diet appropriate portion control regular physical activity and smoking cessation can support glucose regulation and reduce cardiovascular risk. Clinical evidence demonstrate that structured lifestyle intervention can substantially reduce diabetes risk, while contemporary evidence demonstrate that different forms of exercise can improve glycated haemoglobin however recommendation must be realistic and individualised rather than based on a one size fits all approach. Monitoring health data also supports effective management. Glycated haemoglobin provides information about longer term glycaemic control while blood glucose monitoring can be useful for selected individuals. Importantly data should be interpreted by the patients and healthcare professional together so that appropriate action can be taken. Health professionals have a significant role in assessment education, monitoring, medication reviews. Lifestyle supports prevention of complication and shared decision-making. Person-centred communication can help individual develop achievable goals and maintain self-management. Overall understanding the physiological mechanisms and consequences of type 2 diabetes reinforce the importance of early intervention ongoing monitoring and sustainable lifestyle management. Effective professional support can help individual maintain better glucose control reduce complication and improve long term health and quality of life.

Reference

American diabetes Association (2026a) 5 Facilitating positive health behaviour and wellbeing to improve health outcome. Standards of care in diabetes 2026 diabetes care ,49(suppl,1pps89-S

American diabetes Association (2026b) 7 diabetes technology standards of care in diabetes 2026 diabetes care 49(suppl.1 pps150-S

American diabetes Association (2026c) 6 Glycaemic goals hypoglycaemia and hyperglycaemic crises standard of care in diabetes 2026 diabetes care 49 (suppl 1) ppS132-S

Diabetes prevention program research group (2022) Reduction in the incidence of type 2 diabetes with lifestyle intervention of metformin New England journal of medicine 346(6) pp 393-403

NHS (2025) What is type 2 diabetes London NHS

NICE (2026a) Type 2 diabetes in adults management (NG28 London National institute for Health and care Excellence

NICE (2026b) Type 2 diabetes in adults management blood glucose London national institute for health and care Excellence

NICE (2026c) type 2 Diabetes in adults management person-centred medicine London national institute for health and care Excellence

UK Prospective Diabetes study (UKPDS) Group (1998a) intensive blood glucose control with sulphonyl Reas or insulin compared with conventional treatment and risk of complication in patients with type 2 diabetes, The lancet 352(9131) pp 837-853

UK Prospective Diabetes study (UKPDS) Group (1998b) Effect of intensive blood – glucose control with metformin on complications in overweight patients with type 2 Diabetes the lancet 352(9131) pp854-865