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CASE STUDY REPORT

Type 2 Diabetes: Blood Glucose Control and Healthy Living

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1. Introduction

Diabetes is a chronic (long-term) disorder in which the blood glucose (sugar) level is too high. The glucose is an essential energy source, and insulin is a hormone that facilitates the uptake of glucose from the blood into body cells. Beta cells of the pancreas produce insulin. In type 2 diabetes, insulin doesn't work as effectively as it should in the body cells. This is known as insulin resistance. Initially, the pancreas produces more insulin, but eventually pancreas production of insulin is inadequate to regulate blood glucose levels (NIDDK, 2023).

Factors that increase the risk are age, family history and diabetes in a previous pregnancy. Low activity, excess weight, smoking and a diet with high energy and refined carbohydrates are other factors. There is also a correlation between smoking and type 2 diabetes (Akter et al., 2017). Individuals from a South Asian background may be at risk of developing type 2 diabetes at a younger age and/or a lower body weight than others (NHS, 2024a). These risks should be used to inform supportive care, not to condemn.

Some people do not experience any symptoms initially. Some may experience more thirst or fatigue, increased urination, vision problems or slow healing of wounds. High blood sugar can injure blood vessels and nerves and lead to heart disease, stroke, kidney disease, eye problems and foot ulcers (WHO, 2024). This report describes how the body regulates glucose, how the cells obtain energy from glucose and oxygen, the possible benefits of glucose monitoring and how lifestyle modifications can aid in safe management.

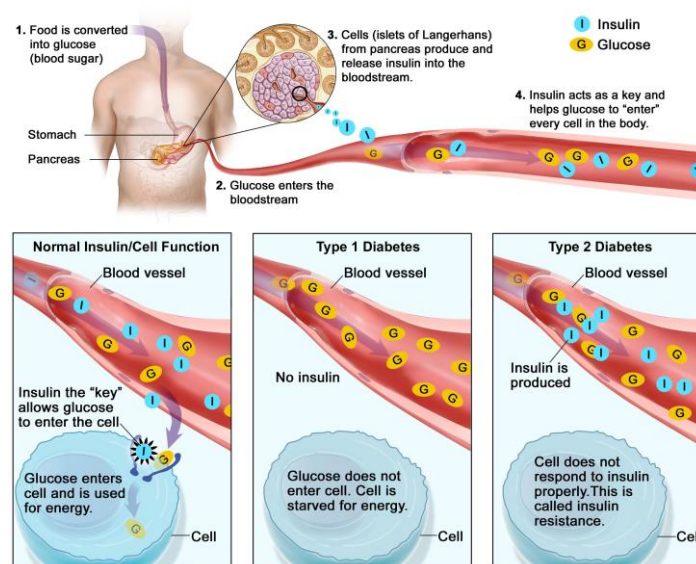


Figure 1. Difference between normal blood glucose and high blood glucose (NIDDK, 2023).

2. How blood glucose is kept within a safe range

Carbohydrates are converted into simple sugars, such as glucose, following a meal. The blood glucose concentration increases because glucose is absorbed from the small intestine into the blood. The pancreas is able to sense this change and secrete insulin from its beta cells. Insulin facilitates the uptake of glucose in muscle and fat. It also stimulates the liver to store glucose as glycogen and minimizes the release of glucose. The effect is then to restore blood glucose to its normal level (NIDDK, 2023).

During the intervals between meals, blood sugar may drop. Glucagon is secreted from the alpha cells of the pancreas. Glucagon stimulates the liver to convert stored glycogen to glucose as needed. The liver then sends out glucose into the blood to help provide organs like the brain. Insulin and glucagon act together: insulin decreases blood glucose after eating, glucagon prevents a drop in blood glucose between meals. This is negative feedback—the body reacts to a change and attempts to bring it back to normal.

Insulin resistance occurs in type 2 diabetes when the cells in the muscles, fat and liver fail to use insulin properly. The pancreas might initially produce more insulin, but may not be enough. The liver may still produce excess glucose and the muscle cells absorb less glucose. This results in high blood glucose or hyperglycaemia (NIDDK, 2023; DeFronzo, 2009). Readings can be affected by food, activity, illness, stress, and sleep and medicines can therefore also affect readings, and this is only one reading.

It is important to control your blood sugar in the long term because high glucose can damage blood vessels. Individual targets should be established taking into account treatment, low glucose risk and overall health (NICE, 2026). The HbA1c, which is used to estimate average glucose over the past 2-3 months, is used in conjunction with daily readings.

3. How oxygen and glucose release energy in cells

Cells require energy for transport, development and repair, and for other reactions. A lot of this energy is converted to a usable form, adenosine triphosphate (ATP). Glucose is used as a primary source of energy to produce ATP, and oxygen enhances the most efficient way of doing it: aerobic cellular respiration (Rigoulet et al., 2020).

In the cytoplasm, the glucose is degraded via glycolysis. This generates a little ATP and generates pyruvate. In the presence of oxygen, pyruvate is transported into the mitochondria, and then turned into a compound that enters the citric acid cycle (also known as the Krebs cycle). This cycle releases CO₂ and provides energy to carrier molecules. They transport electrons to the electron transport

chain in the inner mitochondrial membrane. At the end of this chain, oxygen picks up electrons and reacts with hydrogen to make water. Most ATP produced during aerobic respiration is synthesized as a result of the release of energy.

The overall process can be summarised as: glucose + oxygen → carbon dioxide + water + energy (ATP and heat). This is a simplified summary as there are a number of linked reactions in cellular respiration. When oxygen is absent, cells can produce small amounts of ATP by glycolysis, but the energy production is not as efficient.

Diabetes is a disorder that is associated with blood glucose and cell energy. With type 2 diabetes, the cells can still require fuel, but the glucose is not able to be used effectively. Does not imply that all cells cannot utilise glucose; effects vary from tissue to tissue and from person to person. High glucose can harm blood vessels and damage the delivery of oxygen and nutrients to tissues, over time. A healthy diet and proper treatment can help keep blood sugar maintained, and exercise can help muscles get glucose from the bloodstream and increase insulin sensitivity (NIDDK, 2023).

4. Why recording and tracking blood glucose can help

Glucose readings can assist a person and their health care providers in understanding patterns, and determine if a care plan is effective. If self-monitoring has been advised, the time, reading, meals, activity, symptoms and medicines can be recorded. This may indicate if there is an increase in blood glucose following some foods, a decrease in blood glucose during activity or a change in the blood glucose level when sick. It can also assist with detecting low glucose for those taking insulin or medication that can lead to low blood sugar.

Monitoring is only beneficial if individuals are aware of the outcome and what steps to take. The care team should help the person to know when to test, and how to use the meter, their target range, and when to ask for advice. Sometimes, it's more helpful to have a pattern than a single result. HbA1c is used to assess glucose control in a longer time frame, and is typically ordered on a 3-6 monthly basis until glucose control is stable, and then on a 6 monthly basis (NICE, 2026).

The routine use of finger-prick testing is not required for all adults with type 2 diabetes. NICE (2026) recommends that no routine self monitoring be offered, unless there is a clinical indication for this, for example people who take insulin, people who think they are likely to have low blood glucose, certain medicines which can lower blood glucose, and pregnant women. In certain, for example, some illnesses or treatments, short-term monitoring may also prove helpful. For some who are taking insulin, continuous glucose monitoring (CGM) can be helpful, and involves wearing a sensor that tracks levels of glucose over time. The decision should be based on the clinical need, preference, ease of use of the device and access to support.

A good record will be easy to keep up. People can record the time of a reading before or after eating and record any unusual activity, illness or symptoms. These notes can be helpful on a day to day basis for the person and the nurse to see the pattern rather than getting riled up by each high or low result. The nurse can help to clarify which readings require action and when and where to get help. There should be no blame attached to the results, the aim is to facilitate safe choice making and make the care plan more liveable.



Figure 3. Self-monitoring of blood glucose using a glucose meter.

There are limitations to monitoring: There may be discomfort of being tested, financial cost, or anxiety about the test; poor techniques can impact results. NICE suggests self monitoring be reviewed at least once a year, covering technique, frequency, understanding, quality of life and helping/useful for the individual (NICE, 2026). Tracking should supplement, not supplant, professional review, HbA1c testing or treatment.

5. Evidence-based lifestyle recommendations

Going to the doctor, quitting smoking, eating a healthy diet, exercising and maintaining normal weight can help control glucose and prevent heart and blood vessel disease. They should be realistic, considering the person and culture, the budget, the work, other health needs and mobility. Lifestyle support is in addition to prescription medications; patients should not stop or change prescription medications unless advised to do so by their health care professional.

5.1 Healthy eating

Following a balanced dietary pattern can promote blood glucose, weight, blood pressure and cholesterol control. Vegetables, whole fruit, beans and lentils, wholegrain foods, nuts in appropriate amounts and lean protein are all choices. Consume fewer foods and beverages with added sugar and heavily processed snack foods. Reduce foods and drinks rich in added sugar and highly processed snack foods and large amounts of refined carbohydrates. Sweets drinks are typically not

a good everyday option. No specific 'diabetes diet' exists – a plan that can be adhered to is helpful rather than a strict diet that is difficult to follow (NICE, 2026).

Carbohydrate foods have an impact on Glucose, and type and size count. Local meals – not asking people to cut out familiar foods! For instance, patients can talk about the amount of rice to eat, increase the amount of vegetables and lentils, limit the intake of sugary beverages, and decrease the amount of foods that are deep fried. Advice can be tweaked by a dietitian or diabetes nurse. Very low-calorie diets should only be used under professional supervision, particularly in combination with medicines that lower the level of glucose in the blood (NHS, 2024b).

5.2 Physical activity

Exercise causes muscles to consume glucose and can enhance the body's response to insulin. For most adults, the World Health Organization (WHO, 2024) suggests that 150 minutes of moderate activity is at least the recommended amount each week. You can count brisk walking, cycling, dancing, swimming or any other home exercises that are suitable. Those who are inactive should begin with smaller amounts, for example, walking for 10 minutes after eating, and work their way up slowly. Muscle maintenance: 2+ days of strength activities can also be beneficial.

All activities should be safe and practical. Clinicians should have a discussion with people with foot problems, heart symptoms or mobility limitations about suitable options. Persons taking insulin or hypoglycemic medications should be advised on monitoring, carrying extra sugar if taking insulin or adjusting food or medication around activity. A sustained plan is more likely to be followed if it comes in small regular changes rather than a big bang.

5.3 Stop smoking

People who smoke are at greater risk of developing type 2 diabetes and its complications. Nicotine may increase blood glucose and chemicals in tobacco smoke may damage blood vessels and cause inflammation. Smoking increases the risk of heart disease, stroke, kidney disease and poor circulation, which are other health risks for people with diabetes (CDC, 2024b). Quitting is therefore crucial in managing diabetes. A stop-smoking service can help the person to begin his/her quit date and refer the person to a practice nurse. Support is key without blame as quitting can be challenging due to nicotine dependence.

5.4 Weight, sleep, stress and medicines

Slow weight reduction can help people who are overweight or obese to become more insulin sensitive and to control their glucose levels. Goals should be determined on a per-person basis, and must not be embarrassing or shameful. Other treatments will be needed, but healthy sleep habits

and stress management can help. Glucose can increase with illness and stress, so patients should be aware of how to reach their health care team if they are ill.

6. Conclusion

Type 2 diabetes occurs when the body's insulin does not work properly and the pancreas is not able to generate enough insulin to maintain blood glucose at a normal level. Insulin and glucagon are normally present in the body to regulate glucose levels between meals and after eating. In aerobic respiration cells use glucose and oxygen to generate ATP molecules which are used to fuel the body's activities. With long-term exposure, high blood glucose can cause damage to blood vessels and nerves, therefore blood glucose management is the key to safety and stability.

Some people may find that their blood sugar readings help them identify patterns and make connections between what they eat or drink, what their bodies do, illness and treatment, and what the effects are on their blood sugar. Finger-prick testing is not required for all patients, however, and should only be used in a definite and agreed care plan. Routine health checks and HbA1C continue to be important. Better outcomes can be supported through healthy eating, regular activity, quitting smoking, slow weight gain or loss and medication adherence. The practice nurse should communicate these connections in an accessible way, assist the patient to make goals and track progress non-judgementally. The most effective plan is individual, realistic, safe and evidence based.

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