

Introduction to Physiology

CASE STUDY 1

Programme: BSc Health and Social Care

Module Code: BMHP5023

Lecturer: Shaila Hussain

Student Name: Ednyra Kaimi Metzger

Student ID Number:2414270

Table of Contents

a) Introduction.....	3
b) Explain how blood sugar levels are maintained.....	3
c) Show how oxygen and glucose are used to produce energy.....	5
D) Briefly examine how recording and tracking blood sugar levels helps individuals.....	7
e) Include evidence-based recommendations.....	8
f) Conclusion.....	9
References.....	10

a) Introduction

Diabetes Mellitus is defined as a chronic health disorder where the body cannot control the level of blood sugar properly (Wahidin *et.al* 2024). The chosen case study 1 highlights that Diabetes Mellitus is because the body is not able to produce adequate insulin or the insulin that is produced is not utilised efficiently. Insulin is a hormone that aids glucose to get into the body cells to be utilised in providing energy. When it is broken, glucose is retained in the blood, and this causes high blood sugar. It can be stated that with time, poorly managed diabetes may result in severe health complications like heart disease, nerve damage, kidney damage, and vision loss.

Several conditions predispose one to diabetes, and these involve risk factors like being overweight or obese, unhealthy eating habits and smoking. Risk can also be caused by genetic predisposition and family history as risk factors. Moreover, old age, hypertension and elevated cholesterol levels are the other factors that lead to the onset of diabetes, especially Type 2 Diabetes (Beulens *et.al* 2022).

b) Explain how blood sugar levels are maintained

Basic structure and healthy functioning of human body depends on understanding of maintaining healthy lifestyle. The process of maintaining the level of blood glucose within the safe range is called Blood Glucose Homeostasis. This is the regulation that is primarily linked to Insulin and glucagon hormones, which are synthesised by the Pancreas. When one eats, the carbohydrates contained in food are absorbed into glucose and are transferred into the blood. Insulin is released by the pancreas when the level of blood sugar increases. Insulin assists in transporting glucose to the body cells, where it is utilised in the production of energy or is stored to be utilised in the liver and muscles (Singh *et.al* 2025). This will decrease the level of sugar in the blood and will not allow it to reach dangerous levels. In cases where the level of sugar in the blood decreases, such as after taking a meal or during physical activities, another hormone known as glucagon is released by the pancreas. The presence of glucagon in the body sends a signal to the liver to feed the blood supply with stored glucose. This equilibrium is lost in individuals with Diabetes Mellitus due to the synthesis of insulin in the body being low or the body being incapable of using the insulin. Due to this, glucose will be left in the blood, and this will reach dangerous levels unless taken care of.

The routine data that is collected in social and healthcare is used by identifying components that results in particular health conditions. An effective level of blood glucose maintenance involves making sure that the body receives an adequate amount of glucose to use as energy, but does not experience excess levels which are too high or too low. To have effective blood glucose level, it is necessary to maintain the level of glucose in the normal range to help the body meet its energy requirements for maintaining at effective level of body's needs. Normal blood sugar levels are usually 4-7 mmol/L before meals and not more than 8.5 mmol/L after meals, but this can vary depending on the condition and medical advice concerning Type 2 Diabetes cases (Knowdiabetes, 2026). Glucose provides the body cells with the major energy and most importantly, the brain, the muscles and other essential organs. When there is a too low drop in sugar content in the blood, a condition referred to as Hypoglycaemia may develop. Conversely, constantly high blood sugar, which is Hyperglycaemia, is said to destroy blood vessels and organs in the long run.

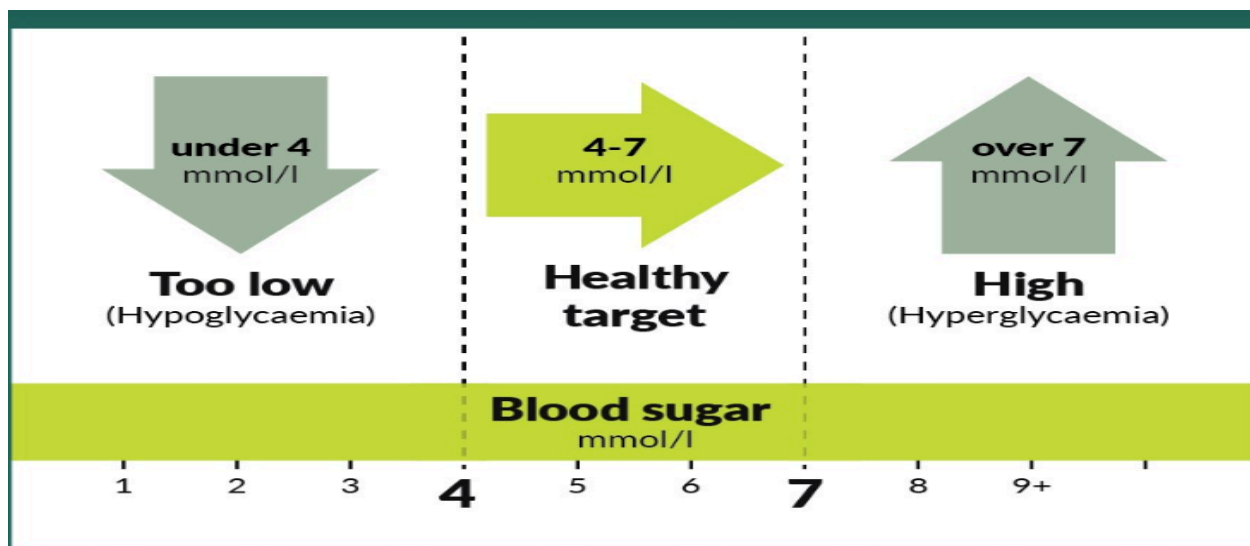


Figure 1: Blood Sugar Target Level

(Source: Knowdiabetes, 2025)

This figure outlines the effective blood sugar level including healthy target and high hyperglycaemia (Knowdiabetes, 2026). In order to maintain the blood sugar levels at effective and safe level, people must have a balance between a variety of factors such as diet, physical activity and drug intake in case of necessity for body's needs. Exercise enhances the metabolism of glucose in the body. In the case of diabetes patients, it is

important to check the level of sugar in the blood and adhere to the treatment plan associated with insulin injection or taking pills (Chen *et.al* 2023). These measures help to maintain stable levels of glucose, and the body carries out its functions correctly, minimising the chances of complications in the long run.

c) Show how oxygen and glucose are used to produce energy

The body requires an unending source of energy to carry out essential processes such as movement, breathing, digestion, and maintenance of body temperature. Cellular Respiration is a process through which energy is generated in cells. Glucose and oxygen are used by cellular respiration to produce energy in the form of adenosine triphosphate, which is used to support numerous biological processes in the body. The carbohydrates in food are acquired as glucose. In the digestion process, carbohydrates are decomposed into glucose and taken into the bloodstream (Xie *et.al* 2022). Breathing is the way through which oxygen gets into the body and is carried by blood to body tissues. Both oxygen and glucose are channelled to the cells, where they are utilised in the production of energy in a variety of chemical reactions through cell metabolism.

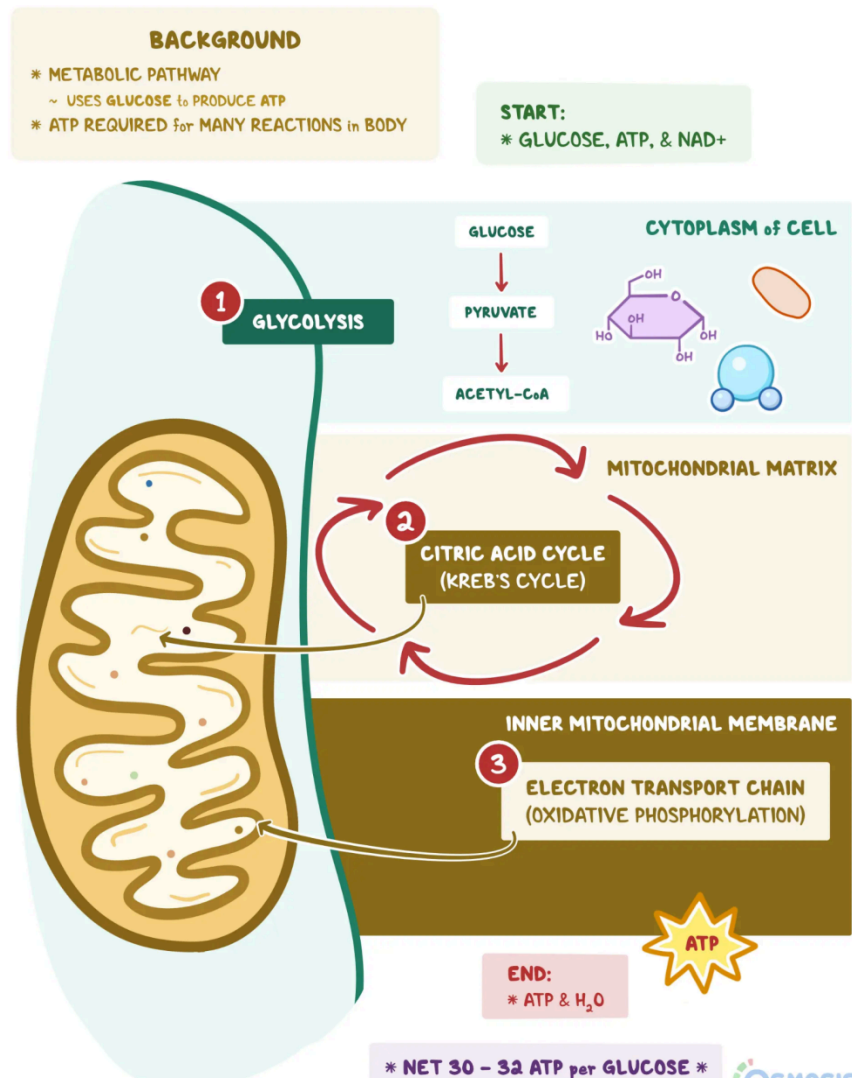


Figure 2: Glucose in Energy Production

(Source: Tarantino, 2025)

The above figure outlines that glycolysis is the initial phase in the process of cellular respiration (Tarantino, 2025). This occurs within the cytoplasm of the cell and degrades glucose to smaller molecules referred to as pyruvate. In this step, a little bit of ATP is generated. Glycolysis does not utilise oxygen, yet it is the preparation of the molecule of glucose for the further steps of energy production through cellular metabolism. The other phases take place within the mitochondrion, which is commonly called the powerhouse of the cell. In this case, the pyruvate undergoes further breakdown via the Krebs Cycle. The result of this cycle is the release of carbon dioxide as a waste product and the production of molecules, which transfer energy to the last stage in respiration.

The last process is referred to as the Electron Transport Chain. In this step, oxygen is very important because it takes the electrons and enables the reactions to proceed effectively (Feng *et.al* 2024). This process produces a great deal of ATP as compared to the previous levels. The other by-product formed by the combination of oxygen and hydrogen ions and electrons is water. Altogether, the simplified chemical reaction of cellular respiration could be represented as: glucose + oxygen = carbon dioxide + water + energy (ATP). This is done to guarantee cells have energy to perform their functions. In case of the lack of glucose or oxygen, the cells are not able to synthesise sufficient ATP, and it may influence the functionality of organs and the overall well-being. To people whose blood sugar is regulated, it is significant that the blood glucose rate must be sustained at normal levels since glucose is one of the major fuels in the body.

D) Briefly examine how recording and tracking blood sugar levels helps individuals

Monitoring and maintaining the level of blood sugar in the body is also a major aspect of managing the disease safely and effectively for individuals diagnosed with Type 2 Diabetes. Self-monitoring blood glucose enables individuals and medical workers to have valuable information on how the body reacts to food, physical exercise, medication and daily routine life (Martí-Mateos *et.al* 2023). The information assists in making treatment choices and enhancing effective long-term management of the condition. Among the primary advantages of monitoring the level of blood sugar in the body, one can speak about the ability to determine the patterns and tendencies in a person over time. It is possible to measure the levels before meals, after meals and before bedtime and determine how certain foods or activities affect the blood glucose levels. This will enable them to make positive corrections to their dieting, exercise or drug regimen. As a case in point, once it has been underestimated that blood sugar levels always increase after specific meals, the eating habits may be changed to decrease the amount of carbohydrates or learn to eat the right amount.

The effective way of recording and tracking blood sugar levels includes frequent check-ups to identify dangerous changes in the level of sugar in the blood as it helps individuals that have type 2 diabetes to manage their condition by addressing lifestyle factors like smoking, exercise and diet (Chang *et.al* 2025). Hyperglycaemia (high blood

sugar) is a potential health condition when the body fails to utilise insulin well, and there is no proper balance of medication and diet. Uncontrolled high blood sugar over time can cause severe complications of the heart, kidneys, eyes and nerves. Conversely, low blood sugar or Hypoglycaemia can be caused by drug use, delayed meals/ exercises or high physical exertion. When blood glucose levels are recorded, it makes people acknowledge these variances promptly and take the right measures to rectify them.

The other significant advantage is that the ability to monitor outcomes will enable the health practitioners to determine the effectiveness of treatment strategies. Nurses and doctors can access the information about the blood glucose levels of patients when they come to their appointment with a record and decide whether medication, insulin therapy or changes in their lifestyle are required (Tuobeniyere *et.al* 2023). The method enhances interaction between patients and health care providers and enables individualised management of diabetes. Also, maintaining a record of blood sugar levels will make a person more interested in self-care. It brings to light the importance of lifestyle choices to the health of the population and encourages patients to adhere to prescribed care plans more regularly.

e) Include evidence-based recommendations

- The lifestyle change could be a major factor that helps people with Type 2 Diabetes condition. The individuals are recommended to begin with, dietary habits could be improved to ensure that people can control their blood glucose. The patients should be advised to adhere to a well-balanced diet, which consists of whole grains, vegetables, fruits, lean proteins and healthy fats. There is some evidence that changing everyday habits by organisations like the World Health Organisation and National Institute for Health and Care Excellence indicates that patients could be better able to manage their blood sugar levels and avoid complications. Limiting consumption of high-sugar foods, processed carbohydrates, and saturated fats might help avoid the development of sudden elevations of blood sugar (Downes and Tryon, 2023). Moreover, eating fibre-rich food could decelerate the glucose absorption rate in the body and maintain a more stable level of sugar in the blood.

- Regular exercise could also help in the management of diabetes as a recommendation for improving type 2 diabetes conditions. Individual should exercise as it could make the body more sensitive to insulin and may enable the muscles to utilise glucose as an energy source. It is not surprising that the health guidelines usually suggest an average of 150 minutes of moderate physical activity that could include walking, cycling or swimming every week. Regular exercise could thus aid in the reduction of blood glucose, enhance the strength of the cardiovascular system and overall wellness (Camafort *et.al* 2023). Weight management could also be used to benefit diabetic patients. Obesity is directly associated with insulin resistance. Even losing a few pounds could help the body to better regulate the glucose level and make diabetes less difficult to treat (DiMatteo *et.al* 2025). Eating healthy and exercising could therefore affect the long-term health outcomes positively.
- The other significant lifestyle recommendation is the cessation of smoking. Smoking could expose a person to the risk of heart diseases and other Diabetes Mellitus complications. Cessation of smoking could allow patients to enhance the flow of blood and minimise the chances of other health issues.

f) Conclusion

Conclusively, patients with Diabetes Mellitus need to be aware of the causes and management of the disease. This report has indicated the significance of knowing what diabetes are, the risk factors, and how the body controls the level of blood glucose. Frequent examination of the sugar level of the blood will enable individuals to recognise the trends and bring the situation under control, especially in the case of Type 2 Diabetes. In addition, healthier lifestyle habits, including better eating habits, physical activity, and smoking, are welcome because they help maintain better blood glucose levels and minimise the likelihood of chronic complications.

References

- Beulens, J.W., Pinho, M.G., Abreu, T.C., den Braver, N.R., Lam, T.M., Huss, A., Vlaanderen, J., Sonnenschein, T., Siddiqui, N.Z., Yuan, Z. and Kerckhoffs, J., (2022). Environmental risk factors of type 2 diabetes—an exposome approach. *Diabetologia*, 65(2), pp.263-274.
- Camafort, M., Park, S.M. and Kang, S.M., (2023). Lifestyle modification in heart failure management: are we using evidence-based recommendations in real world practice?. *International journal of heart failure*, 5(1), p.21.
- Chang, H.Y., Yeh, K.C., Huang, Y.Y. and Li, J.H., (2025). The impact of self-regulation education combined with Continuous Glucose Monitoring (CGM) on diabetes outcomes: a randomized controlled study. *Nursing Reports*, 15(3), p.94.
- Chen, J., Yin, D. and Dou, K., (2023). Intensified glycemic control by HbA1c for patients with coronary heart disease and Type 2 diabetes: a review of findings and conclusions. *Cardiovascular Diabetology*, 22(1), p.146.
- DiMatteo, M.R., Martin, L.R. and Haskard-Zolnierrek, K.B., (2025). *Health behavior change and treatment adherence: Evidence-based guidelines for improving healthcare*. Oxford University Press.
- Downes, L. and Tryon, L., (2023). *Health Promotion and Disease Prevention for Advanced Practice: Integrating Evidence-Based Lifestyle Concepts*. Jones & Bartlett Learning.
- Feng, Y., Chen, Y., Wu, X., Chen, J., Zhou, Q., Liu, B., Zhang, L. and Yi, C., (2024). Interplay of energy metabolism and autophagy. *Autophagy*, 20(1), pp.4-14.
- Knowdiabetes, (2025). *Blood Glucose Monitoring*. [Online]. Available Through :<<https://www.knowdiabetes.org.uk/resources/internal/blood-glucose-monitoring/>>.
- [Accessed on: 7th March 2026].
- Martí-Mateos, Y., Safari, Z., Bevers, S., Midha, A.D., Flanigan, W.R., Joshi, T., Huynh, H., Desousa, B.R., Sinha, A.P., Singhal, M., Joshi, A., Kumar, B. and Sethiya, N.K., (2023). Usercentered ‘Swayam Diabetes’ m-Health application for self-care management of Type 2 diabetes in urban home settings, the usability and utility testing of mobile application and perspectives. *International Journal of Chemical and Biochemical Sciences*, 24, pp.141-146.

Singh, A.P., Saxena, R. and Saxena, S., (2025). Understanding Post-Dialysis Hypoglycaemia: Causes, Symptoms and Solutions. *Greenfort International Journal of Applied Medical Science*, 3(2), pp.43-52.

Tarantino C, (2025). *Cellular Respiration*. [Online]. Available Through :<<https://www.osmosis.org/answers/cellular-respiration>.. [Accessed on: 6th March 2026].

Tuobenjiere, J., Mensah, G.P. and Korsah, K.A., (2023). Patient perspective on barriers in type 2 diabetes self-management: A qualitative study. *Nursing open*, 10(10), pp.7003-7013.

Wahidin, M., Achadi, A., Besral, B., Kosen, S., Nadjib, M., Nurwahyuni, A., Ronoatmodjo, S., Rahajeng, E., Pane, M. and Kusuma, D., (2024). Projection of diabetes morbidity and mortality till 2045 in Indonesia based on risk factors and NCD prevention and control programs. *Scientific reports*, 14(1), p.5424.

Xie, Y., Zhao, H., Zhao, M., Huang, H., Liu, C., Huang, F. and Wu, J., (2022). Effects of resistance exercise on blood glucose level and pregnancy outcome in patients with gestational diabetes mellitus: a randomized controlled trial. *BMJ open diabetes research & care*, 10(2).