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1. Introduction

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK, 2023), a National Institutes of Health (NIH) organisation in the United States of America, defines diabetes as a disfunction of the body system that produces energy from sugar. This chronic disease translates into consistent abnormal level of sugar in the blood, causing many negative effects to the organs of the affected people and a loss of energy.

The malfunction is mainly due to the lack of sufficient level of insulin, or the absence of insulin, an hormone produced by the pancreas involved in the process of transformation of glucose (i.e. sugar) into energy. It could also be due to an incorrect use of insulin in the cells during the energy production process (NIDDK, 2023).

The World Health Organisation (2024) indicates that there are three main types of diabetes: diabetes Type 1, diabetes Type 2 and gestational diabetes. Diabetes Type 1 occurs when the pancreas does not make any insulin due to an auto-immune malfunctioning that destroys pancreas cells which produce insulin, while diabetes Type 2 is caused by an insufficient level of insulin, or by a dysfunction of insulin towards the cells. Gestational diabetes on another hand affects pregnant women with high level of sugar but below the diabetes diagnosis conclusion.

Although the National Health Service (NHS, 2025) recognises that Type 1 diabetes cannot be prevented since it is caused by a disfunction of the immune system, NHS (2025) on another hand identifies key risk factors for Type 2 diabetes that can be prevented such as excess body weight, not physically active, smoking habit, or being overstressed.

After a general discussion on relevant organs and particular metabolism involved in the diabetes occurrence, this paper will further focus on analysing Type 2 diabetes particulars and discuss how it can be monitored and explore preventive measures for the disease.

2. Anatomy & Physiology

To analyse diabetes, it is important to understand the metabolic process for energy production, the organs involved and the chemistry process. The main source of energy in the body is glucose also named sugar. Although the human body produces glucose, its main source comes from food. When food that contains carbohydrate (e.g. fruits, dairy products, starchy foods, sugary foods, etc.) enters the body, they are processed in the

stomach to extract glucose and inject it into the bloodstream. As the glucose level in the blood raises, the pancreas starts producing insulin, specifically the beta cells, to process the glucose into the body cells for it to be transformed into energy. Therefore, insulin operates like a key to open the cells for the glucose to enter into them (KOVÁCS, *et al.*, 2024).

However, the liver also has some glucose in store that can be released in the blood, which in turn increases the insulin production for processing glucose into the cells. The correct metabolism is a right balance between the liver, the pancreas and the food ensuring the appropriate level of insulin for the quantity of glucose in the bloodstream; thus, sufficient energy production without any glucose excess in the blood. Therefore, diabetes happens when this is no longer the case (KOVÁCS, *et al.*, 2024).

KOVÁCS, *et al.* (2024) described the journey of glucose to the cells with very complex mechanisms, including the role of sensors on the cells' membranes that detect the presence of glucose in the blood and the messaging process to indicate the need of energy. The final stage of that glucose journey is the transformation of glucose into adenosine triphosphate, commonly known as ATP. ATP plays multiple roles in the body such as transportation and fuel for all the mechanical activities in the body involving muscles, activation of chemical reactions to produce various products such as membranes, hormones and molecules necessary for the good functioning of the body, its growth and repair (NAKRANI, Mihir N., WINELAND, Robert H., et ANJUM, Fatima, 2020).

The specific process of glucose transformation into ATP in the cells starts with an intermediate conversion of glucose into glucose-6-phosphate. Adding phosphate to glucose allows it to enter the cell and requires oxygen for the specific reaction of oxidative phosphorylation. Then instantly start the glycolysis, a step-by-step process that have as result the production of ATP. The ratio of the production process is two ATP molecule out of an initial single molecule of glucose. That is why the process can literally be described as the cellular respiration (NAKRANI, Mihir N., WINELAND, Robert H., et ANJUM, Fatima, 2020).

3. Pathophysiology

The negative impact of diabetes comes from the excess of glucose in the bloodstream and organs affecting the macrovascular and microvascular systems because it damages vessels and the related organs. Without any appropriate response or treatment,

consequences are numerous, such as coronary and arterial disease that may result into heart attacks, kidney malfunctioning, cerebrovascular malfunctioning that may cause stroke, nerves system damaging or weak irrigation of legs that may result into amputation and blindness (WHO, 2024).

WHO (2024) further states that in 2021, caused 1.6 million deaths, Indeed, when not properly handled, diabetes develops into many complications that are fatal for the affected people. In fact, out of the many nontransmissible diseases such as cardiovascular illnesses, cancers, or respiratory diseases) diabetes is the only one which number is still increasing while others are decreasing (WHO, 2024).

In 2021, WHO launched an initiative to mitigate the increase of diabetes globally: the WHO Global Diabetes Compact. The initiative set five targets includes improved diagnosis, reduction of blood pressure, increased access to appropriate treatment. But most importantly, Global Diabetes Compact has set mechanisms to control glycaemia, recognizing the importance of preventive measures (WHO, 2021).

However, diabetes Type 2 can be prevented, and even reversed, with change in lifestyle best practices. HORTON (2009) analysed the impact of lifestyle habits. He described the two aspects of lifestyle changes from responsible diet by reducing excessive consumption of food, increasing spending of energy by exercising. The two approaches applied in tandem reduce the pressure on the metabolic process of glucose transformation into energy; thus, the need for excessive production of insulin. The first approach addresses the risk factors aspects by mitigating modifiable risk factors.

XU, Yu, *et al.* (2024) more empirically identified key risk factors into three categories: (i) the non-modifiable risk factors such as sex, origin, or genetics; (ii) the modifiable risk factors such as sleeping quality, overweight, or lifestyle; (iii) environmental risk factors such as air pollution. In that approach, the conclusion is that change in lifestyle is the major contributor to the increase of diabetes in China population, with the increased urban population, sedentary lifestyle, diet too rich in carbohydrate and fat, and drinking and smoking habits. As an example, smoking only independently increases the risk of developing diabetes by 45% (XU, Yu, *et al.*, 2024).

4. Monitoring & Data Use

The United States Centers for Disease Control and Prevention (CDC, 2024) explains the importance of tracking blood sugar level as the way to know what causes high or low sugar levels fluctuations in the day, depending on what food are consumed or what activities activate the changes. This allows for preventing the occurrence of the peaks by adopting the appropriate measures and informs the proper treatment to be administered by the therapists.

With a frequent use of a blood sugar meter, as advised by the doctor, a person affected will be able to track the data, since some glucometers can even save the data. Based on the results, the doctor will be able to interpret and recommend the best practices. CDC (2024) advises, although varying depending on age, weight, etc., to consider a range between 80 and 130 mg/dL before food and below 180 mg/dL two hours after the start of a meal. The objective is to mitigate the occurrence of hypoglycemia and hyperglycemia.

Some regular best practices include having meals at regular frequency, limit alcohol or being reasonably active to mitigate the risk of hypoglycaemia. While avoiding stress, reducing food quantity and very rich ones, being physically active would reduce the level of sugar in the blood. In some extreme cases, the high sugar level above 240 mg/dL may necessitate an emergency call since this may result into more serious medical condition.

Futhermore, WEINSTOCK, Ruth S., *et al.* (2020) discussed the importance for Blood Glucose Monitoring for diabetes patients and concluded that tracking blood level before and after meals, before and after exercise and at bedtime and fasting, and using a combination of actions around adapting the diet, adjusting the physical exercise and taking appropriate medication would significantly maintain the blood into a reasonable range over time.

5. Evidence-Based Lifestyle Recommendations

As indicated above, lifestyle is a key driver not only for causing diabetes Type 2 disease, but also for preventing it, and even in some cases reversing it (HORTON, 2009). When conducting a systematic review of various trials on the matter, HORTON (2009) noticed that good physical activity reduces the risk of developing diabetes. Surprisingly, appropriate diet only or physical exercise only would have almost equivalent positive impact than a combination of both approaches. In the same study, another positive action demonstrating the positive effect of lifestyle on preventing diabetes is weight loss. In addition, the same impact was proven to be effective in clinical environment although challenging.

Most practically, the National Institute for Health and Care Excellence (NICE, 2026), published detailed guidelines to encourage lifestyle practices that improves diabetes Type 2 management. For example, on the diet, the guidelines recommend eating food rich in high-fibre, low level of glucose, such as fruits and vegetables, oily fish, and low-fat milk products. On physical activity, Diabetes UK (2024) advises to start small and increase at one's specific pace. The objective is to move more and adopt habits that break the cycle of sedentary lifestyle. Walking is the most advised activity for beginners for avoiding injuries and unnecessary pain.

6. Conclusion

In conclusion, although diabetes Type 1 is almost unavoidable, studies have shown that diabetes Type 2 can be prevented and even controlled to avoid its negative impact. Indeed, before envisaging medicines, especially external insulin intake, change of lifestyle, appropriate diet, physical activities and loss of weight would help managing the disease.

However, it is important to start with understanding the roots causes of diabetes, the risk factors, the physiological patterns and metabolism that lead to diabetes Type 2 in order to prevent it or manage it. Once this is achieved, a proper monitoring of data of sugar levels under the supervision of healthcare professionals for proper assessment of results would allow to adopt the most appropriate practices.

All the main health organisations have understood the risk associated with this still growing disease and the importance of education and awareness to fight it effectively. Once again, the positive message being that diabetes Type 2 is preventable, controllable and at some extend, reversible if well managed. Another positive news is the availability of treatment for patient affected with blood test devices and insulin becoming more affordable.

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