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Introduction:

Diabetes is a global health issue. It occurs due to the prolonged blood glucose levels due by the inabilities of the body to produce an adequate amount of insulin, utilize it properly, or both. Insulin refers to a hormone secreted by the cells in the pancreas and which assists cells in absorbing glucose in the blood. The majority of the cases (more than 90) of diabetes are type 2. Type 2 is gradual, with the pancreas losing the capacity to produce sufficient insulin, and the body cells (particularly liver, muscle, and fat) being less receptive to the insulin. This is referred to as insulin resistance.

Type 2 diabetes has numerous etiological factors that include a combination of genetics and lifestyle. The fixed risks include old age (after 45 years), the presence of a close family member with diabetes, and ethnicity. South Asian, African-Caribbean, Black African, and Middle Eastern populations are more susceptible to the onset and incidence of diabetes in the West.

Human beings can modify their risk through modification of their habits. Excessive weight and belly fat make one insulin-resistant and inflamed. Additional fat releases fatty acids, which block the insulin signals. Failure to move sufficiently renders the muscle cells less competent to utilize glucose. A high intake of processed food and sweets, smoking, hypertension, and poor cholesterol also contribute to the risk. Another red flag to watch is prediabetes, where the blood glucose level is elevated but not sufficient to confirm that it is diabetes. Prediabetes can prevent or delay type 2 diabetes.

Blood Sugar Levels Regulation:

Hormones secreted by the pancreas maintain the body in a small range of blood glucose (approximately 4.0 to 7.0 millimoles per liter) through the action of insulin and glucagon. This system provides the brain and other organs with stable glucose, as well as regulating energy storage and release of food.

Consumption of carbs increases blood sugar levels. This is detected by the pancreas, and insulin is released into the blood. Insulin commands the liver, muscle, and fat cells to open doors (GLUT4) to allow glucose to get in. In the liver, insulin prevents the production of new glucose and stores the surplus glucose as glycogen. Insulin

stimulates protein synthesis and prevents fat breakdown in muscle and fat. This soon restores glucose to normal levels.

Blood glucose decreases when you have not eaten in a long time. Glucose is elevated by the pancreas through the release of glucagon. Glucagon informs the liver to decompose the stored glycogen and produce additional glucose through the other foods, such as amino acids and glycerol. Other hormones like cortisol, growth hormone, and adrenaline also help in maintaining blood sugar, not reaching too low levels, especially during stress or during prolonged fasting.

Balance is lost in type 2 diabetes. Cells do not respond to insulin, and consequently, normal or even elevated insulin is not effective in reducing glucose. The pancreas first empties more insulin in an attempt to counter this (hyperinsulinism). The insulin-producing cells become fatigued as time progresses and die, thus the insulin decreases. Meanwhile, the liver continues producing excessive glucose in the process of fasting. This mixture maintains the level of blood glucose.

Cellular Metabolism: This is how Glucose and Oxygen are changed into energy

Glucose is the primary source of ATP, the molecule that drives almost all the cell work, at the cellular level. In a full breakdown of glucose in the presence of oxygen, approximately 30-32 ATP molecules are produced. Such an effective process is termed aerobic respiration and takes place in stages within the various sections of the cell.

The initial process of glycolysis occurs in the fluid of the cell (cytosol) and does not require oxygen. The ten enzyme steps break down one six-carbon glucose molecule to two molecules of three-carbon pyruvate. This produces two ATP molecules and two NAD^+ + molecules into NADH, an electron carrier. The process of glycolysis is a common one that is utilized by almost all living things. It rapidly produces ATP, but it is not quite efficient (Sapra and Bhandari, 2025).

The pyruvate produced during glycolysis is transported to the powerhouse of the cell, known as the mitochondria, when oxygen is present. At that point, an enzyme complex converts the pyruvate to acetyl-CoA, producing carbon dioxide and losing one carbon

atom. Acetyl-CoA is then subjected to a series of reactions referred to as the citric acid cycle or the Krebs cycle. The entire process deprotonates the acetyl group, releasing three molecules of NADH and one of FADH₂ and one GTP, which can be broken down to ATP. The carbon atoms are emitted as carbon dioxide, which we ultimately exhale (Berg et al., 2022).

The last and most effective step is the oxidative phosphorylation, which occurs in the inner membrane of the mitochondrion. The NADH and FADH₂ high-energy electrons are transduced by a series of protein complexes known as the electron transport chain. When the electrons move, these complexes expel protons located on the inside of the mitochondrion into the space that is located outside the inner membrane, which results in the establishment of a strong electric and chemical gradient. This proton-motive force drives an enzyme known as ATP synthase, which is a miniature turbine. The protons are pumped back via the ATP synthase, and the energy produced transforms ADP into ATP. Oxygen is the last electron acceptor; it is the one that combines with the electrons and the protons to produce harmless water (H₂O) (Wikipedia contributors, 2025). The combination of these steps generates the majority of ATP from glucose.

In diabetes, insulin resistance prevents glucose from entering muscle and fat cells. This restrains the amount of fuel accessible to the energy-generating pathways. This makes the cellular experience a sense of low energy when glucose is abundant in the blood, leading to cellular starvation in the face of overall abundance.

The Importance of Recording and Tracking Blood Sugar Levels

The importance of blood sugar recording and tracking is among the key factors for people with Type 2 diabetes. This daily practice is known as self-monitoring of blood glucose (SMBG), which transforms subjective emotions into factual information. It provides both the patient and the doctor with a long-term view of the behavior of the metabolism of a particular person.

Patients can transform generic information into personalized information by maintaining a comprehensive record of their glucose levels that correlates their levels with foods,

food quantity, time, physical activities, drug intake, stress, and sleep. An example is that they may discover that a particular breakfast cereal raises their blood sugar to a level that is dangerous, or that an evening stroll after dinner makes their levels stay within a normal range. The realization of these patterns provides patients with control and allows them to change their behavior on the spot (Polonsky and Hessler, 2023).

SMBG is also essential in safety, particularly for insulin or sulfonylurea-dependent patients who can develop low blood sugar. The frequent tests enable fast identification of lows (typically less than 4.0 mmol/L) to enable patients to treat them with rapid-acting carbohydrates before the condition deteriorates. This avoids severe complications like confusion, fainting, or seizures. The data also assist in fine-tuning the doses of medications to make them optimal for each individual, benefit them, and lessen the risk of low blood sugar levels (Inzucchi et al., 2024).

The glucose logbook or digital report provides the doctor with a more detailed picture of the control in a patient compared to an individual HbA1c or random clinic value during a clinical visit. HbA1c demonstrates control averageness in 8-12 weeks, but not the highs and lows. The review of patient-collected data will allow clinicians to identify troubling trends, such as frequent high fasting glucose or post-lunch increases, and change the treatment. This process of evidence-based modification of medication, diet, or activity is more effective in comparison with a change that is not based on such data (ElSayed et al., 2025). The practice demonstrates that the effective, proactive care and enhancement of health outcomes are the leading factors that depend on routine, structured data collection about patients (Khoong et al., 2024).

Evidence-Based Lifestyle Recommendations for Management

The initial form of treatment for Type 2 diabetes is lifestyle changes, which also prevent the disease among individuals with prediabetes. There is good clinical evidence that both extensive lifestyle interventions enhance blood-sugar management, reduce cardiovascular risk, and may also remit the illness. These programs are focused on behavior, diet, and exercise (Davies et al., 2022).

Nutritional therapy is an individualized process that has several established principles. The participants are primarily aimed at slimming down to a small 5 to 10 percent of their original body weight. This extent of weight reduction has been proven to significantly reduce insulin resistance. Reduce the amount of glucose that the liver produces and usually reduce the use of drugs that reduce the level of sugar in the blood (Lean et al., 2023). Dietary habits such as the Mediterranean diet come in handy. This diet consists of abundant amounts of vegetable food, fruits, whole grains, beans, nuts, and olive oil, moderate amounts of fish and poultry. It is a good one to keep blood sugar and heart in check. One of the most convenient methods of eating is the plate method: half of your plate should be non-starchy vegetables, a quarter of your plate lean protein, and a quarter of your plate high-fiber carbs. Choose carbs with a low glycemic index to ensure that the blood sugar increases gradually. It is highly essential to reduce the consumption of sugary beverages and highly processed foods (Evert et al., 2023).

Exercising increases insulin sensitivity and aids in the short and long term. The American Diabetes Association recommends that adults with type 2 diabetes engage in moderate to vigorous aerobic exercise at least 150 minutes per week, but not more than two days per week, and should not exceed more than 3 days without breaks. Physical activity, such as walking, cycling, or swimming, can help circulate GLUT4 protein to muscle cells without the need for insulin and allow muscle cells to absorb glucose during and after the exercise (Colberg et al., 2022). Strength training is strongly recommended and should be performed at least three times a week, and can be done by the use of weights, resistance bands, or body weight. Muscle construction provides a large reservoir in which glucose can be stored in the body to maintain blood sugar levels. Even such minor interventions as getting on your feet or going out on a small walk every half hour can make your body better at processing post-meal sugar levels (Dempsey et al., 2024).

To manage diabetes, it is necessary to quit smoking. Smoking makes insulin resistance worse and accelerates issues with the small and large blood vessels, such as trouble with the eyes, kidneys, and blood flow, and increases the risks of heart attacks and strokes. Diabetic patients who smoke ought to receive effective counseling and

assistance with such medications as nicotine replacement drugs or varenicline (U.S. Preventive Services Task Force, 2024). A structured, evidence-based diabetes-prevention program is the most appropriate choice for people with prediabetes. They are programs that originate with massive clinical trials of intervention, such as the Diabetes Prevention Program (DPP), where people receive education, peer support, and behavior coaching to help them lose weight by means of diet and exercise and reduce the likelihood of developing type 2 diabetes by 50 percent (Knowler et al., 2024).

Conclusion:

Diabetes type 2 is a chronic illness that affects the energy processing by the body. To treat it effectively, one needs to know how insulin functions, how beta cells malfunction, and how cells utilize energy, as well as how one can apply that information in a personalized and data-driven manner. These concepts are linked to actual daily behaviors by regularly measuring and monitoring blood sugar. Individuals become active and informed contributors in their care when they apply their own data, as well as the tested lifestyle interventions, nutritional, physical, and cessation of smoking. Collaboration with the team of health professionals is the most promising opportunity to maintain the level of blood sugar safe, reduce the chance of severe health issues, and enhance long-term health and well-being.

References

- Berg et al. (2022). *Biochemistry (9th ed.)*. W.H. Freeman.
- Colberg et al. (2022). *Physical Activity/Exercise and Diabetes: A Position Statement of the American Diabetes Association*. Diabetes Care.
- Davies et al. (2022). *Management of Hyperglycaemia in Type 2 Diabetes, 2022*. A Consensus Report by the American Diabetes Association (ADA) and the European Association.
- Dempsey et al. (2024). *Benefits for Type 2 Diabetes of Interrupting Prolonged Sitting With Brief Bouts of Light Walking or Simple Resistance Activities*. Diabetes Care.
- ElSayed et al. (2025). *Glycemic Targets: Standards of Care in Diabetes—2025*. Diabetes Care.
- Evert et al. (2023). *Nutrition Therapy for Adults With Diabetes or Prediabetes: A Consensus Report*. Diabetes Care.
- Inzucchi et al. (2024). *Management of Hyperglycaemia in Type 2 Diabetes: A Patient-Centred Approach*. Diabetologia.
- Khoong et al. (2024). *The role of routine and structured social needs data collection in hospitals*. Journal of the American Medical Informatics Association.
- Knowler et al. (2024). *Long-term Effects of Lifestyle Intervention or Metformin on Diabetes Development and Microvascular Complications: The Diabetes Prevention Program Outcomes Study*. The Lancet Diabetes & Endocrinology.
- Lean et al. (2023). *Primary care-led weight management for remission of type 2 diabetes (DiRECT): an open-label, cluster-randomised trial*. The Lancet.
- Polonsky and Hessler. (2023). *What are the qualities of effective diabetes self-management education and support?* Diabetes Spectrum.
- Sapra and Bhandari. (2025). *Physiology, Glucose Metabolism*. In StatPearls [Internet]. StatPearls Publishing.
- U.S. Preventive Services Task Force. (2024). *Interventions for Tobacco Smoking Cessation in Adults, Including Pregnant Persons*. JAMA.
- Wikipedia contributors. (2025). *Cellular respiration*. In Wikipedia, The Free Encyclopedia.