



Diabetes Unveiled- Breaking Down Myths and Hidden Mechanisms

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ARTICLE DETAILS

Research Paper

Accepted: 24-05-2025

Published: 10-06-2025

Keywords:

Diabetes Insipidus, Diabetes Mellitus, Anti-diuretic hormone (ADH), Sugar, Glucose, Pancreas, Glucagon, Glycogen, Insulin, Hyperglycemia, Hypoglycemia, autoimmune disorder, HbA1c

ABSTRACT

Diabetes is a complex metabolic disorder that extends beyond the common perception of excess sugar in the blood. This paper explores two major forms of diabetes—Diabetes Insipidus and Diabetes Mellitus—by highlighting their underlying mechanisms, causes, symptoms, and distinctions. Diabetes Insipidus, often unrelated to glucose metabolism, results from the deficiency of a hormone known as ‘antidiuretic hormone’ (ADH) and leads to excessive water loss, whereas Diabetes Mellitus is associated with impaired insulin production or function, affecting glucose regulation. Diabetes Mellitus is further categorized into Type 1 (insulin-dependent), primarily autoimmune in origin, and Type 2 (insulin-resistant), largely driven by lifestyle and environmental factors. The paper also delves into hormonal interactions, diagnostic criteria including HbA1c values, and long-term complications of poorly managed diabetes. Preventive strategies like regular physical activity, dietary control, and routine screening are emphasized. Additionally, common myths and confusions surrounding diabetes are addressed to foster better public understanding. With rising global prevalence, diabetes poses a significant public health challenge. This work underscores the need for comprehensive awareness, early detection, and multifaceted management approaches to mitigate its impact and improve quality of life.

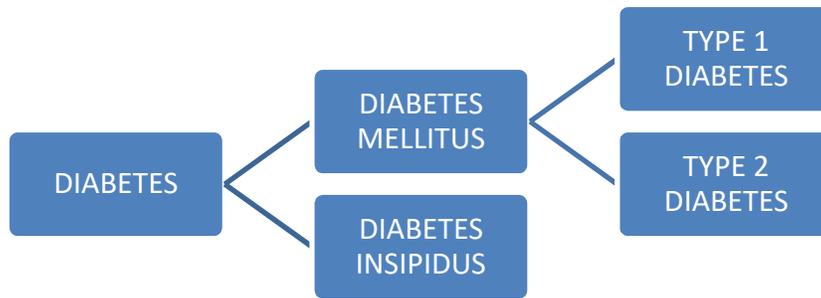


INTRODUCTION

Diabetes, one of the most prevalent chronic conditions worldwide, is often narrowly understood as a disease caused by excessive sugar consumption. However, the term "diabetes" encompasses a broad spectrum of disorders that affect the body's ability to regulate fluids and glucose. At its core, diabetes involves disruptions in the balance and function of vital hormones, such as insulin and antidiuretic hormone (ADH), which play key roles in maintaining homeostasis. Both forms of diabetes: Diabetes Insipidus and Diabetes Mellitus—each have distinct causes, mechanisms, and effects on the body. Diabetes Insipidus, though lesser known, is a condition marked by the deficiency or insensitivity to ADH, resulting in the excessive loss of water through urine. It is unrelated to blood glucose levels and is often caused by neurological damage, genetic mutations, or electrolyte imbalances. Whereas, Diabetes Mellitus, the more common type, arises due to the dysfunction in insulin production or response. It is primarily divided into Type 1, an autoimmune condition, and Type 2, which is linked to lifestyle factors such as poor diet and physical inactivity. This paper aims to dissect the mechanisms, causes, and symptoms of both types of diabetes, clarify widespread misconceptions, and provide a detailed understanding of diagnostic tools and preventive strategies. With rising rates of diabetes worldwide, particularly Type 2, a comprehensive understanding of its nature is essential for early intervention, better management, and improved public health outcomes.

DIABETES

Diabetes is most often perceived as a sugar-related disorder only. This is partly correct, but not the whole *truth*. Diabetes is a much broader condition than most people realize. Diabetes has been classified into more than one category and its subsequent sub-types, based on its regulation and mechanisms, and specifically, **pathophysiology**, the study of disordered physiological functions, often linked with a disease or injury, or simply, *how and why* normal functions of body *go wrong*.



DIABETES INSIPIDUS

Let's begin with the “master gland” located in the **brain**, called the **pituitary gland**, associated with the “master switchboard”, **hypothalamus**. The posterior pituitary, also known as the **neurohypophysis** or *pars nervosa*, releases a peptide (protein-based) hormone called **vasopressin or anti-diuretic hormone (ADH)**, which is synthesised by the hypothalamus and transported via the supra-optic nuclei, to the pituitary. As the name suggests, “vaso” means *vessels* and “pressin” means *pressing/constricting*, highlights its action of constricting blood vessels. In the kidneys, ADH acts on the **nephrons**, which are the functional units of the kidneys, responsible for filtering blood.

ADH causes **reabsorption of water and electrolytes** (ions and minerals), mainly from the distal parts of the nephron like, **DCT (distal convoluted tubule)** and **collecting duct**, back into the bloodstream. This prevents **excessive loss of water** by urination, and therefore produce a more concentrated urine. Its purpose is to maintain proper water and electrolyte balance in the body.

In case of **hyposecretion** (deficiency) of ADH, the amount of water excreted out by the urine becomes more than the amount of water being consumed by the body. This condition is known as **Diabetes Insipidus**. As a result, the person may experience symptoms such as:

- Dehydration (excessive loss of water)
- Pale coloured urine
- Polydipsia (extremely thirsty)
- Polyurea (excessive urination)
- Fatigue (due to electrolyte imbalance)
- Bed wetting (in infants)

Now, since we are aware of the fact that its the brain that causes a large impact on the mechanism of this condition, ADH deficiency can be caused by factors such as,



- brain injury (especially in the pituitary and hypothalamus)
- neurosurgery
- genetic mutation affecting ADH receptors
- intake of strong **diuretics** (substances that **suppress** ADH levels).
- Hypercalcemia (high calcium levels that damage the kidneys)
- Hypokalemia (deficiency of potassium)

Though there is no *specific* medical prevention for this condition yet, some basic steps in order to keep ADH levels maintained are-

- Avoid excessive consumption of diuretics, such as, coffee, tea and alcohol
- Manage chronic electrolyte imbalances (hypercalcemia and hypokalemia)
- Genetic counselling
- Avoid unnecessary neurological interventions

Although, a *typical cure* for diabetes insipidus *does not exist* yet, still it can be effectively managed through a treatment such as-

- Desmopressin (DDAVP)- a **synthetic** form of ADH can be administered orally, intranasally, or by injections.

DIABETES MELLITES

Here, we will discuss about the **pancreas**, and its role on diabetes. Pancreas is a mixed gland located behind the stomach. It produces two key hormones: **glucagon** produced by the *α -cells (alpha-cells)*, and **insulin** produced by the *β -cells (beta-cells)*. Both the hormones act **antagonistically** to each other, that is, have **opposite** effects on blood glucose levels.

Before explaining mechanisms causing high (**hyperglycemia**) and low (**hypoglycemia**) blood glucose, here are some important terms:

Glycogen	A polymer of glucose (made by many units of glucose molecules combined together)
Glycogenolysis (lysis=breakdown)	Conversion of glycogen into glucose .



Glycogenesis (genesis=formation)	Conversion of glucose back to glycogen .
Gluconeogenesis (neo=new); (genesis=formation)	Formation of new glucose from non-carbohydrate sources (eg. Proteins, fats)

The **Glucagon** (from α -cells) **increases** the glucose or sugar levels in blood, by inhibiting the cellular uptake of glucose by the cells, therefore termed as a **diabetogenic** or **hyperglycemic** hormone. It acts on the **hepatocytes** (liver cells), where it triggers the glycogen (polymer of glucose), which gets converted into glucose by the process of “glycogenolysis”. The word ‘lysis’ means *breakdown*, therefore meaning breakdown of glycogen, stored in the liver, into glucose. Finally, the glucose gets released in the blood through blood vessels and reaches our body parts.

On the other hand, **Insulin** (from β -cells) **decreases** the glucose levels in blood, by boosting the permeability and consumption of glucose by the cells, therefore termed as an **anti-diabetogenic** or **hypoglycemic** hormone. The liver also has insulin binding receptors. Insulin binds to GLUT-4 (protein channels on the liver) allowing glucose from the blood to enter into the liver and be converted back to glycogen. This process is known as “glycogenesis”, ‘genesis’ meaning *formation or synthesis*. In this way, blood glucose levels are decreased. However, the liver too has a specific storage capacity. In this case, insulin will form the GLUT-4 channels in the fat cells (adipocytes) and the extra glucose will be stored in the form of fat, which can potentially lead to obesity.

Some other factors causing **hyperglycemia** are:-

- **Growth hormone (GH)**- promotes glycogenolysis and gluconeogenesis, Gluconeogenesis is the formation of glucose in liver by the breakdown of **non-carbohydrate** substrates (eg. Proteins, fats).
- **Thyroid stimulating hormone (TSH)**- promotes glycogenolysis in order to maintain **BMR** (basal metabolic rate).
- **Adrenal gland**- produces “life-saving hormone” known as **Cortisol**, which promotes glycogenolysis and gluconeogenesis + **Catecholamines**- produce FFF (fear, flight, fight) hormone which promotes glycogenolysis.

Diabetes mellitus is therefore dependent on the **glucose metabolism** of body. Diabetes mellitus occurs in case of deficiency of insulin or when the insulin becomes non-responsive or ineffective. Thus, it is further divided into two types, **Type 1 diabetes** and **Type 2 diabetes**.



TYPE 1-INSULIN DEPENDENT DIABETES MELLITES (IDDM)

Type 1 is an **autoimmune disorder** which causes hyposecretion (deficiency) of insulin hormone, due to **genetic factors**. Autoimmune disorders refer to those disorders in which, the body automatically starts making **anti-bodies** against its own tissues/cells. In this case, the immune system starts making antibodies against the insulin releasing **β -cells**, due to which, the pancreas is not able to synthesise insulin hormone. Type 1 is **insulin dependent** due to the fact that the required amount of insulin is not being produced, in order to lower the levels of sugar in blood. Since Type 1 has nothing to do with sugar intake, even a perfectly healthy individual could also be diagnosed with Type 1 diabetes. Consequently, glucose levels rise up very quickly and can even reach up to 500-600mg/dL (milligrams per 100 ml of blood).

Some common symptoms likely to be experienced are:-

- Weight loss
- Polyuria (excessive urination)
- Polydipsia (extremely thirsty)
- Polyphagia (extreme hunger)

If undiagnosed, can lead to severe life-threatening conditions characterized by

- Nausea
- Vomiting
- Unconsciousness

Although all age groups can have Type 1, but mostly it is diagnosed in children. Since it is genetically caused, a child can have Type 1 diabetes since birth. Complete prevention of Type 1 diabetes is impossible, but early diagnosis and careful managements can prevent complications. Medications play no role in cure. The patient is treated with

- Lifelong insulin shots (injections)
- Frequent blood glucose monitoring

TYPE 2- INSULIN INDEPENDENT DIABETES MELLITES (IIDM)

Type 2 is primarily caused by **lifestyle habits** and **dietary issues**. In the early stages, despite the amount of insulin, the cells (eg. Muscles, liver, fat cells etc.) are supposed to consume glucose, but they fail to



respond to insulin, and inhibit the cellular uptake of glucose which can lead to high levels of glucose (sugar) in blood. Thus, we can say, Type 2 is **insulin resistant**. Initially the pancreas try to keep up with the adequate levels of insulin for a fixed period of time, known as the ‘compensatory phase’. But as the time passes, and the final stages are nearer, this compensatory phase ends, and the pancreas, especially the β -cells get exhausted and become inefficient, and insulin deficiency starts taking place. Now, the condition of the patient gets worse with a combination of both, insulin resistant, as well as insulin dependent conditions.

As mentioned earlier, Type 2 is mainly due to how our lifestyle impacts our health as well as the food we eat, which may contain high amount of sugar or have a high carbohydrate content, because eventually, it’s the carbohydrates that breakdown to produce glucose in the body and not *only* the typical sugar that we know! Also, it mostly affects people above 40 years of age. However, some unpopular additional factors that can also cause Type 2 diabetes are

- Obesity (can be both, a cause, and a result)
- High cholesterol
- Smoking
- A little bit of genetics involved
- Poor sleep and chronic (prolonged) stress
- Physical inactivity (reduces glucose uptake by muscles)

Some significant observable symptoms include:-

- Pigmentation behind neck
- Body ache
- Obesity (as mentioned earlier, can be a result too)
- Blurry vision
- Slow healing of wounds
- Post-meal fatigue

In case of no early diagnosis, it can lead to deterioration in the later stages in,

- Kidneys
- Liver
- Eyes



- Nerves
- Blood vessels

For the prevention part, we should focus on following activities like-

- Fixing lifestyle habits
- Exercising regularly or even brisk walking (min. 30 mins) daily
- Avoiding sugary food items (a balanced diet is a must, but one should include foods with **low glycemic index** (having low sugar content)
- Weight loss management
- Routine screening/ blood testing
- Avoiding alcohol and smoking
- May even refer a dietician

The positive part in its cure is that, it is possible to treat Type 1 diabetes with both, medications as well as insulin therapy (shots), and additionally by following the above steps. However, as the person gets older, his/her immunity starts degenerating and the medicines do not work much efficiently. In that case, the patient is conventionally given the lifelong insulin injections, and regular or periodic monitoring takes place.

Diagnostic Tests and Glucose Values for diagnosis of diabetes-

Diagnostic Test	Over 3 months	Fasting Plasma Glucose (FPG)	(RPG)-Random Plasma Glucose	(OGTT)-Oral Glucose Tolerance Test
Unit(s)	<i>HbA1c</i>	<i>mg/dL</i>	<i>mg/dL</i>	<i>mg/dL</i>
Normal	<5.7	<100	<130	<140
Elevated	5.7-6.4%	100-125	130-199	140-199
High	≥6.5%	≥126	≥200	≥200

NOTE- **HbA1c** shows the **average blood glucose levels** over the past **two to three months** (8-12 weeks). This means that if a person with diabetes has only recently started managing their blood sugar well, their HbA1c may still appear high. On the other hand, someone who previously had good control but is now poorly managing their diabetes may still show a low HbA1c — for a short while.



For individuals who are younger, have had diabetes for a shorter duration, and do not have heart-related conditions, aiming for an HbA1c level of less than 7% is usually beneficial. However, in people who have **serious complications** from diabetes, other major health problems, or a **shorter life expectancy**, targeting an HbA1c **below 7%** may not be suitable or safe.

SOME COMMON MYTHS AND CONFUSIONS

- *Myth-* Person can be diabetic only if he/she consumes excess of sugary foods.
Reality- Sugar can be a cause, but not a *sole* cause, because even an imbalance in water and electrolytes, due to the ADH deficiency, as well as genetic and autoimmune disorders can lead to **Diabetes Insipidus**, and **Type 1 diabetes** respectively. In fact, Diabetes Insipidus has **nothing** to do with **glucose levels**, since the problem arises due to dysfunction of **kidneys**.
- *Myth-* Only taking medicines **without** the implementation of exercise and physical activity is *enough* for a complete or permanent cure of diabetes.
Reality- While medicines may be one kind of a treatment, medicines *alone* are *not enough* to cure diabetes completely or permanently. Medicines will only be effective if exercise and physical activities are equally taken into account, along with the preventive measures listed before.
- *Confusion-* Why is it **not** beneficial to maintain a **less than 7% HbA1c** for people having serious complications in diabetes, other major health problems, or shorter life expectancy (due to old age)?
Answer- The person's body is already under stress, and their health is **fragile**. To maintain less than 7% HbA1c (which is what "*tight control*" means), they might need to take strong medications or insulin, and be very strict about when and what they eat, which could cause sudden **hypoglycemia** (low blood sugar level), which further causes confusion, hallucinations, fainting, instability, weakness, rapid unhealthy weight loss or even falling down, leading to injuries. Therefore, doctors focus on their **immediate safety and quality of life**, as the **risks** of aiming for very low blood sugar **outweigh** the benefits.
- *Myth-* A **family history** linked with diabetes is a definite guarantee that one will develop diabetes.
Reality- A family history of diabetes raises your likelihood of developing the condition but **does not guarantee** it. Genetics play a role, yet environmental and lifestyle factors such as diet,



physical activity, and weight management are equally important. Many people with diabetic relatives never develop diabetes themselves, especially if they maintain healthy habits.

- *Confusion-* Contrasting feature between Type-1 diabetes and Type-2 diabetes.

Answer- To put it in simple words, Type-1 diabetes is **insulin dependent** (depends on insulin amounts), while Type-2 is **insulin resistant** (cells resist responding to insulin).

- *Myth-* In type 1 diabetes, the anti-bodies are formed against the insulin receptors, insulin hormone, and the cells producing it.

Reality- While it holds true for the cells that produce insulin, known as the β -cells in the pancreas, it **does not** target or form anti-bodies against insulin receptors, or the insulin hormone itself.

- *Myth-* Only Type 2 diabetes require exercise and proper nutrition.

Reality- Both, **Type-1** and **Type-2** diabetes demand exercise and good nutrition, and the person may even refer to a dietician if required.

CONCLUSION

Diabetes, whether insipidus or mellitus, is a multifaceted condition that affects millions globally. While Diabetes Insipidus arises from hormonal imbalances affecting water retention, Diabetes Mellitus stems from defects in insulin production or function, disrupting glucose regulation. Both forms present serious health risks if left unmanaged, including dehydration, organ damage, and long-term complications. Despite their distinct mechanisms, both require early diagnosis, continuous monitoring, and appropriate intervention. A major challenge in managing diabetes is the lack of awareness and the persistence of myths surrounding its causes and treatment. Hence, public education, lifestyle modifications, and routine screenings are essential for both prevention and control. Even non-diabetic individuals should try to maintain a balanced diet, engage in regular physical activity, and avoid excessive intake of substances that can affect hormone levels. Finally, healthcare systems must focus on accessibility to diagnostics, insulin therapy, and genetic counselling to decrease the worldwide burden of diabetes effectively.

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