

Diabetes and its Types - A Review

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ABSTRACT

Diabetes is increasing worldwide due to various factors. Type 1 diabetes is a chronic condition where the immune system attacks insulin producing cell in the pancreas. Type 2 diabetes is a chronic condition where the body becomes resistant to insulin or doesn't produce enough leading to high blood sugar levels. Aim for this review to describe the Type1 and Type 2 diabetics and their symptoms, causes, prevention and treatment.

Keywords - Diabetes, Type 1 and Type 2, Insulin.

1. INTRODUCTION

The rising number of people with diabetes mellitus is being driven by factors such as population growth, ageing, urbanization, sedentary lifestyles, and the growing prevalence of obesity. Globally Diabetics was estimated in 2000 Approximately 2.8% and envisage around 4.4% in next 30 years The global number of people living with diabetes mellitus is expected to increase from 171 million in 2000 to 366 million by 2030[1]. Cataracts continue to be the primary cause of blindness worldwide, impacting around 18 million individuals [2]. In people with diabetes, cataracts develop at a younger age and are 2 to 5 times more common, making the resulting vision impairment a major concern for the workforce.

Diabetes is a disease it is caused due to excessive amount of blood sugar. Our body needs energy and glucose is main source of glucose to build the muscles and tissue of the body. Typically, an unhealthy lifestyle and insufficient physical activity are the primary contributors to type 2 diabetes. Diabetes occurs when there is an excess of sugar in the bloodstream. In some cases, the pancreas fails to convert food into insulin, causing sugar to remain unprocessed, which leads to diabetes. Diabetes can affect various organs, including the kidneys, eyes, nervous system, and blood vessels. There are 2 main types of diabetes. The first type is juvenile diabetes,[3] which primarily affects children and damages the cells in the pancreas responsible for producing insulin. The second type is type 2 diabetes,[4] which typically develops after the age of 40 due to insufficient physical activity and poor lifestyle choices. Diabetes is a chronic condition that cannot be cured but can be managed through medication, consistent exercise, and a balanced diet. Type 2 diabetes is also referred to as insulin-independent diabetes because patients do not require insulin injections at regular intervals. In contrast, type 1 diabetes is known as insulin-dependent diabetes, as individuals with this type must receive insulin injections at regular intervals.

2. TYPE 1 and TYPE 2

TYPE 1: Type 1 diabetes mellitus (T1DM) is a long-term autoimmune disorder characterized by elevated blood sugar levels (hyperglycemia), which result from a lack of insulin due to the destruction of pancreatic islet β -cells.[5] T1DM is one of the most prevalent endocrine and metabolic conditions in children. In the majority of cases (70–90%), the destruction of β -cells is caused by an autoimmune response, accompanied by the development of T1DM-related auto antibodies; this form is known as

autoimmune T1DM (or type 1a diabetes mellitus).[6] In a smaller group of individuals, no immune response or auto antibodies are present, and the cause of cell destruction remains unknown (idiopathic T1DM or type 1b diabetes mellitus) which has a strong genetic link. Unless stated otherwise, the term T1DM generally refers to autoimmune T1DM in this context.

TYPE 2: Type 2 diabetes is a condition that arises from issues in how the body manages and uses sugar, also known as glucose, as energy. [6]This chronic condition leads to excessive sugar levels in the bloodstream. Over time, high blood sugar can cause complications in the circulatory, nervous, and immune systems.

In type 2 diabetes, there are mainly two issues. The pancreas doesn't produce enough insulin, a hormone responsible for moving sugar into the cells. Additionally, the cells do not respond effectively to insulin, resulting in less sugar being absorbed.

Type 2 diabetes was previously referred to as adult-onset diabetes, but both type 1 and type 2 can develop in both children and adults. [7]Type 2 is more common in older adults, but the rising rates of childhood obesity have led to an increase in type 2 diabetes among younger individuals.

There is no cure for type 2 diabetes, but it can be managed through weight loss, a healthy diet, and regular exercise. If lifestyle changes alone aren't sufficient to control blood sugar, medication or insulin therapy may be needed.

3. SYMPTOMS

The symptoms of type 2 diabetes tend to develop gradually. In fact, it's possible to have type 2 diabetes for years without realizing it [8]. When symptoms do appear, they may include:

- Increase thirst frequent urination.
- Increased hunger
- Unintended weight loss.
- Fatigue.
- Blurred vision.
- Slow healing sores.
- Frequent infection.
- Numbness or tingling in the hand or feet.
- Areas of darkened skin, usually in the armpits and neck.

4. CAUSES

Type 2 diabetes primarily results from two issues -

- Cells in the muscles, fat, and liver become resistant to insulin, causing the cells to absorb insufficient sugar.
- The pancreas fails to produce enough insulin to maintain healthy blood sugar levels.

The exact cause of this is not fully understood,[9] though being overweight and inactive are significant contributing factors. Insulin is a hormone produced by the pancreas, a gland located behind and below the stomach. It regulates the body's use of sugar in the following ways:

- When sugar enters the bloodstream, it prompts the pancreas to release insulin.

- Insulin then travels through the bloodstream, allowing sugar to enter the cells.
- As sugar levels in the blood decrease,
- The pancreas reduces the release of insulin in response to the lower blood sugar

5. THE ROLE OF GLUCOSE:

Glucose, a form of sugar, serves as a primary energy source for cells in muscles and other tissues the process of utilizing and regulating glucose involves the following steps:

- Glucose originates from two main sources: food and the liver.
- It is absorbed into the bloodstream and enters cells with the assistance of insulin.
- The liver stores and produces glucose.
- When glucose levels drop, the liver breaks down stored glycogen into glucose to maintain a healthy blood glucose level [10].

In type 2 diabetes, this process is impaired. Rather than entering the cells, sugar accumulates in the bloodstream[11]. As blood sugar levels increase, the pancreas secretes more insulin. Over time, the insulin-producing cells in the pancreas become damaged and are unable to produce enough insulin to fulfill the body's requirements.

6. RISK FACTOR:

Several factors can increase the likelihood of developing type 2 diabetes, including [13][14].

- **Genetic Predisposition:** Family history of diabetes increase susceptibility due to inherited genetic variants affecting insulin production and function.
- **Obesity and Adiposity:** Increased body mass index (BMI) and central adiposity contribute to insulin resistance through inflammatory cytokines and free fatty acid accumulation.
- **Sedentary Lifestyle:** Physical inactivity reduces glucose uptake by skeletal muscles, impairing sensitivity and promoting hyperglycemia.
- **Age:** Risk increase after 45 years.
- **Ethnicity:** Higher risk in African American, Hispanic and Pacific Islander population.
- **Unhealthy Diet :** High in processed carbs, sugar and unhealthy fats.
- **High blood pressure:** Hypertension (>140/190mmHg).

7. COMPLICATION

Type 2 diabetes impacts several key organs, such as the heart, blood vessels, nerves, eyes, and kidneys [15]. Moreover, risk factors that heighten the likelihood of developing diabetes also increase the risk of other severe conditions. Proper diabetes management and blood sugar control can reduce the chances of these complications and additional health issues[15].

Hypertension, defined as a history of hypertension treatment through diet, exercise, or medication, or previous records of elevated blood pressure (>160 mm Hg systolic or 90 mm Hg diastolic) on multiple occasions, along with high pressure at the time of examination. Atherosclerotic heart disease was defined by any abnormal electrocardiogram, significant coronary angiography findings, prior coronary artery bypass surgery or angioplasty, or a history of typical angina [16]. Cerebrovascular disease was indicated by signs of uneven carotid pulses or bruits, abnormal neurological findings on memory, speech, motor, or sensory exams, or a history of transient ischemic attacks or completed stroke. [17]. Peripheral vascular disease was identified if asymmetric or weakened dorsal is pads or posterior tibial pulses were present or if there was a history of claudication. Gastroparesis was indicated by frequent complaints of early fullness

and nausea. Additionally, the prevalence doubles for patients aged 45 to 64, and it affects one in every older adult over 65 years. Currently, only half of those affected are aware they have diabetes mellitus.

8. PREVENTION

Adopting a healthy lifestyle can help prevent Type 2 diabetes. If you've been diagnosed with prediabetes, making lifestyle adjustments may slow down or even halt the progression to diabetes[18][19].

A healthy lifestyle involves:

- **Consuming nutritious foods:** Opt for foods that are lower in fat and calories but higher in fiber. Focus on including fruits, vegetables, and whole grains in your diet.
- **Staying active:** Aim for at least 150 minutes per week of moderate to intense aerobic activity, such as brisk walking, cycling, running, or swimming.
- **Shedding excess weight:** If you're overweight, losing even a small amount of weight and maintaining it can help delay the shift from prediabetes to Type 2 diabetes. For those with prediabetes, losing 7% to 10% of body weight can significantly reduce the risk of developing diabetes.
- **Avoiding prolonged periods of inactivity:** Remaining sedentary for extended periods can increase the likelihood of developing Type 2 diabetes. Make an effort to stand or move around every 30 minutes for at least a few minutes.

For individuals with prediabetes, a medication like metformin (Fortamet, Glumetza, and others) may be prescribed to lower the risk of progressing to Type 2 diabetes.[21] It is typically recommended for older adults who are obese and struggle to manage blood sugar levels through lifestyle changes alone.

9. TREATMENT

There are various classes of medications commonly prescribed to manage blood sugar levels in individuals with diabetes.[20] Most of these medications are either taken orally or administered through injections. In patients with Type 1 diabetes (T1D), insulin is necessary because the body no longer produces it[22]. In contrast, the management of Type 2 diabetes (T2D) is more flexible, as lifestyle modifications can significantly influence blood sugar control. However, if lifestyle changes alone are insufficient, additional medications may be prescribed to help regulate blood glucose levels. Unlike individuals with Type 1 diabetes, those with Type 2 diabetes can still produce insulin, so they typically start with oral medications before needing insulin for better diabetes management.

10. APPLICATION

There are various types of applications designed to assist diabetic patients in effectively managing their condition [23].

1. **Blood sugar tracking:** These apps enable users to monitor their blood glucose levels and identify trends.
 - **mySugr** – Records blood sugar readings, food consumption, and insulin doses with an easy-to-use interface.
 - **Glucose Buddy** – Tracks glucose levels, medication, meals, and physical activity.

- **Diabetes** – Provides comprehensive analytics, carbohydrate counting, and syncs with glucometers.
- 2. **Insulin management:**
 - **RapidCalc** – Aids in determining bolus insulin doses.
 - **Hedia Diabetes Assistant** – Offers insulin dosage suggestions based on meal intake.

11. DISCUSSION

Diabetic patients from through severe complications, for example, Enterococcus, klebsiella, and E.coli, have UTI infections. The current investigation did not reveal a speed up bacteriuria event in diabetics therefore this grew to be truly full size. At this time there is no significant link between bacteriuria and type of treatment used to treat diabetes Traditional Indian medicinal plant such as *Momordica charantia* (Bitter gourd) and *Beta vulgaris* (Beetroot) possess bioactive phytochemicals with antimicrobial and anti-inflammatory properties that may help UTI.

12. CONCLUSION

The prevalence of diabetes mellitus is rising rapidly. Individuals with diabetes have not always experienced the same positive outcomes following cataract surgery as those without diabetes. However, recent advancements in surgical and pharmacological treatments may enable safer and more efficient procedures for diabetic patients. It is important to give particular attention to both systemic and eye-related conditions.

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REFERENCES

1. Wild S, Roglic G, Green A, Sicree R, King H, for the year 2000 and projection for 2030 Global prevalence of diabetes estimates. *Diabetes Care* 2004;(27):1047–1053 doi:10.2337/diacare.27.5.1047.
2. World Health Organization, [Accessed 7 September 2006.]
3. Y. L. Sun and D. L, Zhang, Machine Learning Techniques for Screening and Diagnosis of Diabetes. A Survey. *Technical Gazette* 2011; vol(26): pp 872–880.
4. S. Malik, S. Harous, and H. El-Sayed, Comparative analysis of machine learning algorithms for early prediction of diabetes mellitus in women. *Modelling and Implementation of Complex Systems*, Springer, in Proceedings of the International Symposium on Modelling and Implementation of Complex Systems 2020; pp. 95–106.
5. Eisenbarth, G. S, Type I diabetes mellitus. A chronic autoimmune disease. *N. Engl. J. Med* 1986; 314: 1360–1368 .
6. Atkinson, M. A, Eisenbarth, G. S. & Michels, A. W, Type 1 diabetes. *Lancet* 2014;383, 69–82.
7. Ahmed AM, History of diabetes mellitus .*Saudi Med J* 2002;Apr23(4):373-378.
8. <https://www.mayoclinic.org/diseases-condition/type-2-diabetes/symptoms-causes/syc-20351193>.

9. American Diabetes Association, Standards of medical care in diabetes. *Diabetes care* 2006 ; 29 (Supple 1): S4- S42.
10. <http://www.mayoclinic.org/disease-condition/type-2-diabetes/symptoms-cause/syc-20351193>.
11. Reiber GE, The epidemiology of diabetic foot problem. *Diabet Med* .1996; 13 (Suppl 1): S6
12. . United Kingdom Prospective Diabetes Study Group, Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *Lancet* 1998;352:837–853.
13. Aiello L, Cahill M, Wong J, Systemic considerations in the management of diabetic retinopathy. *Am J Ophthalmol* 2001;132:760–776. doi: 10.1016/s0002-9394(01)01124-2.
14. Nathan DM, Long-term complications of diabetes mellitus. *N Engl J Med* 1993; 328:1676-1685.
15. International Diabetes Federation. *IDF Diabetes Atlas*. 7th. Brussels, Belgium 2015; International Diabetes Federation.
16. Arnold SV, Khunti K, Tang F, et al Impact of micro- and macrovascular complications of type 2 diabetes on quality of life: insights from the DISCOVER prospective cohort study. *Endocrinol Diabetes Metab* 2004 ;5(2):e00321. doi: 10.1002/edm2.321.
17. Afaya RA, Bam V, Azongo TB, Afaya A, Knowledge of chronic complications of diabetes among persons living with type 2 diabetes mellitus in northern Ghana. *PLoS One* 2020;15:e241424. doi: 10.1371/journal.pone.0241424.
18. Grock S., Ku J.H., Kim J., Moin T, A Review of Technology-Assisted Interventions for Diabetes Prevention. *Curr Diab Rep* 2017 ;17(11):107. PMID: 28942537.
19. Diabetes Prevention Program Research Group, Reduction in the incidence of type 2 diabetes with life style intervention or metformin . *N Engl J Med* 2001 ; (344):1343-1350.
20. Chan M, Reducing cost related medication non adherence in patients with diabetes .*Drug Benefit Trends* 2010;(22):67-71.
21. Saxena S, Mitchell P, Rochtchina E, Five-year incidence of cataract in older persons with diabetes and pre-diabetes. *Ophthalm Epidemiol* 2004; (11):271–277. Doi: 10.1080/09286580490510733.
22. Gordon M.O, Beiser J., Brandt J.D, Heuer D.K, Higginbotham E.J, Johnson C.A, et al, The Ocular Hypertension Treatment Study: baseline factors that predict the onset of primary open-angle glaucoma. *Arch Ophthalmol* 2007; 120:714–720. Doi: 10.1001/archophth.120.6.714.
23. Nuffield Council on Bioethics, *Medical profiling and online medicine the ethics of personalized healthcare in a consumer age* . London : Nuffield Council on Bioethics.