



## Diabetes Mellitus

<sup>1</sup>Mr. Mahesh Daunge, <sup>2</sup>Ms. Deepmala Ghorpade, <sup>3</sup>Dr. Gajanan Sanap

<sup>1,2,3</sup> Department of Pharmacy LBYP College of Pharmacy Pathri, India.

---

### ABSTRACT:

Diabetes mellitus is a chronic disorder of glucose metabolism with serious clinical consequences. The multi-system complications of diabetes include microvascular (retinopathy, nephropathy, neuropathy) and macrovascular (ischaemic heart disease, stroke, peripheral vascular disease) endpoints. The prevalence of diabetes has been rising in the last few decades, fuelled by the global rise in the prevalence of obesity. The premature morbidity, mortality, reduced life expectancy, and financial and other costs to the patient with diabetes, their carers, and the health service, make it an important public health condition. The classification and diagnosis of diabetes are complex and have been the subjects of much consultation, debate, and revision stretching over the past decades. Expert committees from the World Health Organization and American Diabetes Association have formulated, converged, and diverged in their position on the diagnostic criteria for diabetes, based on the measurement of fasting or 2-h post-load glucose, but most recently there has been an ongoing debate on whether glycated hemoglobin (HbA1c) should be used for diagnosing diabetes. The aetiological classification of diabetes has now been widely accepted, with type 1 and type 2 diabetes being the two main types of diabetes, and type 2 diabetes accounting for the majority (>85%) of total diabetes prevalence.

**Key words:** Aetiology; diagnosis; epidemiology; MRCP; prevention; screening; type 1 diabetes; type 2 diabetes

---

### INTRODUCTION:

Diabetes is a lifelong complaint, which is markedly affected by day-to-day variations in diet, exercise, infection, and stress. These factors have to be addressed on a diurnal basis while managing diabetes and the case is the person stylish equipped to deal with the situation. Hence, a thorough knowledge of the complaint and how it alters normal body functions and the mindfulness of its acute and habitual complications is necessary. It enables the diabetic case to take better care of him or herself. Mindfulness of diabetes, its complications, and better health care have proved to ameliorate the long-term outlook of this complaint. The operation of diabetes is privately linked to food thus; knowledge about food and nutrition and the scientific base of biochemistry, physiology, and pathogenesis go a long way towards understanding and dealing with the complaint.<sup>1</sup>Diabetes is a major cause of morbidity And mortality worldwide wide The word diabetes is from the Greek diabainein which means to pass through, about the inordinate urine produced as a symptom of these conditions. The term diabetes, without qualification, generally refers to diabetes mellitus, which roughly translates to inordinate sweet urine( known as" glycosuria.

## ■ Difference of different type of diabetes

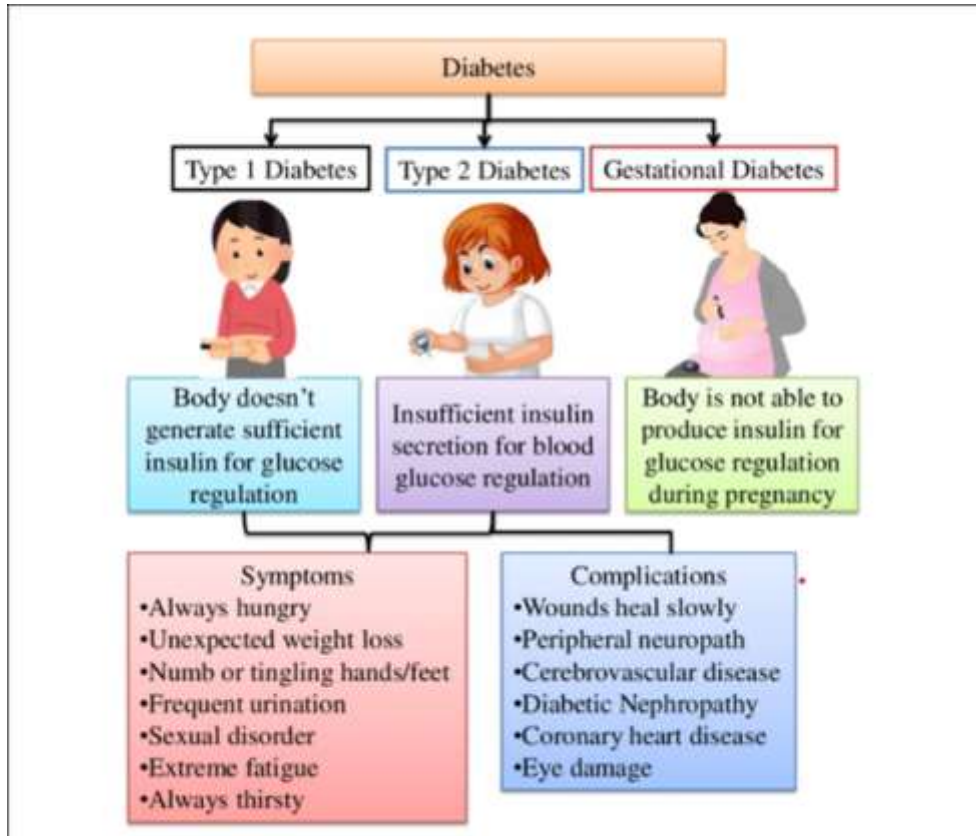


Fig no. 1 show types of diabetes: type1 , type2, type3 and there sign and symptom

### 1. Type 1 Diabetes:

**Cause:** Autoimmune destruction of insulin-producing beta cells in the pancreas.

**Characteristics:** 1. Typically diagnosed in children and young adults.

2. Requires lifelong insulin therapy.

**Symptoms:** Increased thirst, frequent urination, extreme fatigue, weight loss.

### 2. Type 2 Diabetes:

**Cause:** Insulin resistance combined with a decline in insulin production; often linked to obesity and lifestyle factors.

**Characteristics:**

More common in adults but increasingly seen in children.

Can often be managed with lifestyle changes and/or medications, although insulin may be needed later.

**Symptoms:** Similar to Type 1, but may develop gradually and be less noticeable.

### 3. Gestational Diabetes:

**Characteristics:**

Typically occurs in the second or third trimester.

Usually resolves after childbirth but increases the risk of developing Type 2 diabetes later.

**Symptoms:** Often asymptomatic; high blood sugar levels detected through routine screening.

### 4. Other Specific Types

**Monogenic Diabetes:** Caused by genetic mutations (e.g., Maturity-Onset Diabetes of the Young, or MODY).

**Secondary Diabetes:** Results from other medical conditions or medications (e.g., pancreatic disease, certain drugs).<sup>1</sup>

Feature	Type 1 Diabetes	Type 2 Diabetes	Gestational Diabetes
Cause	Autoimmune destruction of beta cells	Insulin resistance and deficiency	Hormonal changes during pregnancy
Onset	Typically childhood or adolescence	Usually in adults, but rising in youth	During pregnancy
Insulin Production	Little to no insulin	Insulin produced, but ineffective	Typically normal post-pregnancy
Management	Requires lifelong insulin therapy	Managed with lifestyle, medications, and possibly insulin	Diet and exercise; may require insulin
Symptoms	Rapid onset of symptoms	Gradual onset of symptoms	Often asymptomatic; discovered during screening
Risk Factors	Family history, genetic predisposition	Obesity, sedentary lifestyle, age ↓	Previous gestational diabetes, obesity

Fig no2. show the difference between the different type of the diabetes

### 3.Causes of Diabetes

Diabetes has so many causes they are, type 1 diabetes is also partly inherited and then triggered by certain infections, with some evidence pointing at the Coxsackie B4 virus. There is a genetic element in individual susceptibility to some of these triggers which has been traced to particular HLA genotypes these are the genetic "self" identifiers relied upon by the immune system. In the case of type 2 diabetes, it is due to a combination of lifestyle .<sup>1</sup> Genetic factors Several Numbers of changes in life and food habit modifications. The other causes include age, obesity, food habit modification, etc.<sup>1</sup> is happening among people in the name of modern trends and fashion.

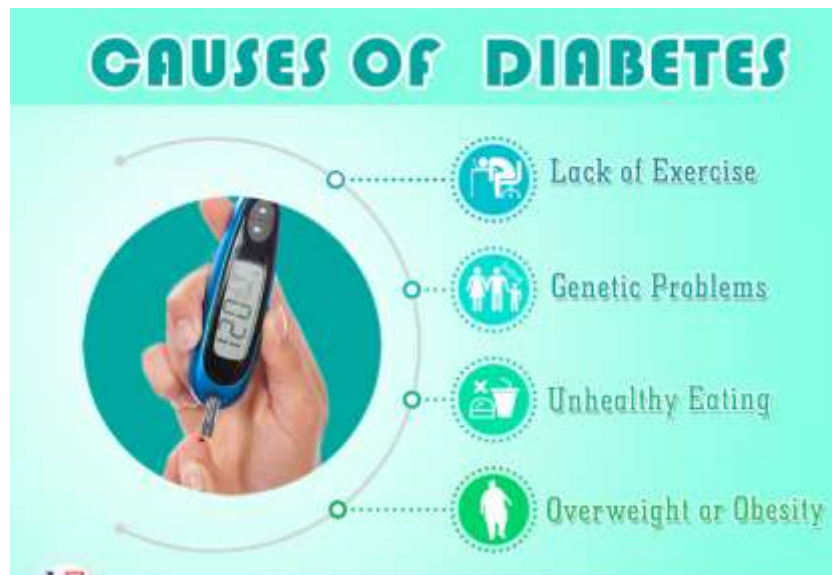


Fig no. 3 show causes of diabetes

The BMI cut point for Indians for any cardio-metabolic risk factors is 23 kg/min for both sexes, whereas that of waist circumference (WC) is. 87cm for men and 82cm for wome<sup>01</sup>. in the case of abdominal adiposity, there is also a probable indication that there is preferential abdominal adiposity in Indians irrespective of the degree of general adiposity Nowadays, the working patterns of people are also changed, the work patterns from labor to sedentary, the increase in computerization and mechanization, and improved transport are just a few of the changes that have had an .<sup>1</sup>impact on human metabolism in recent days the increased rate of childhood obesity in between the 1960s and 2000s is believed to have led to the increase in type 2 diabetes in children and adolescents.<sup>2</sup> Monogenic forms, e.g., MODY, constitute 1–5 % of all cases The other major causes of diabetes are represented in the following<sup>3</sup>. Fig no shows different disease condition that causes diabetes.

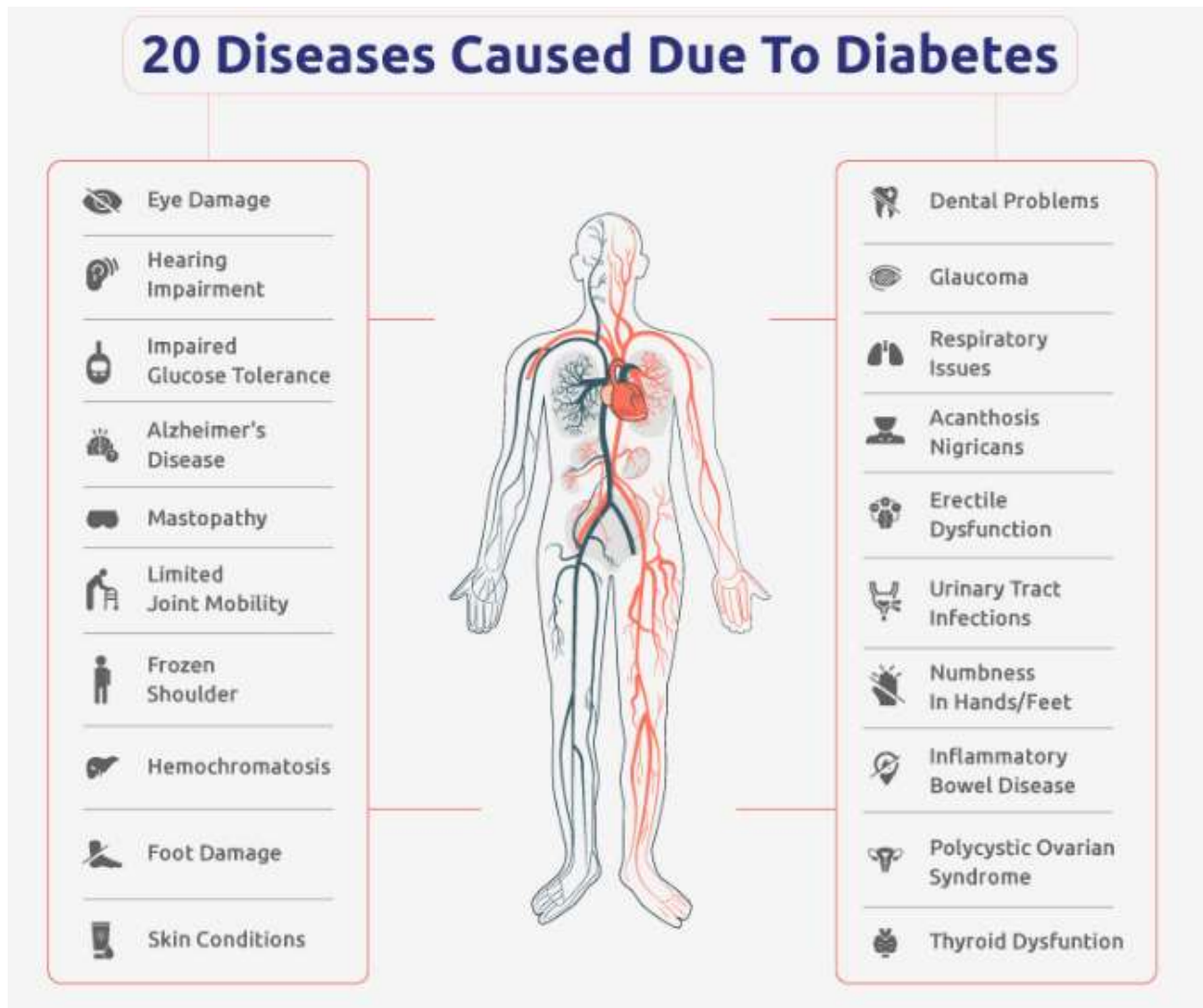


Fig no.5 show the different disease condition that causes the diabetes

#### 4.Signs and Symptoms

The classical symptoms of diabetes are polyuria( frequent urination), polydipsia( increased thirst), and polyphagia( increased hunger)<sup>1</sup>. In type 1 diabetes people generally may also present with diabetic ketoacidosis, a state of metabolic dysregulation characterized by the smell of acetone; a rapid-fire, deep breathing known as Kussmaul breathing, nausea, puking, and abdominal pain; and altered countries of knowledge<sup>4</sup>. A rarer but inversely severe possibility is a hyperosmolar nonketotic state, which is more common in type 2 diabetes and is substantially the result of dehumidification. Frequently, the case has been drinking extreme quantities of sugar-containing Some skin rashes can occur in diabetes which is inclusively known as diabetic dermadromes.<sup>5</sup>



Fig no. 5 show the sign and symptom of diabetes

## 5. Complications:

Type 2 diabetes affects numerous major organs, including the heart, blood vessels, jitters, eyes and feathers. Also, factors that increase the threat of diabetes are threat factors for other serious conditions. Managing diabetes and controlling blood sugar can lower the threat for these complications and other medical conditions.<sup>2</sup>

**Heart and blood vessel complaint.** Diabetes is associated with an increased threat of heart complaint, stroke, high blood pressure and narrowing of blood vessels, a condition called atherosclerosis<sup>6</sup>.

**whim-whams damage in branches.** This condition is called neuropathy. High blood sugar over time can damage or destroy jitters. That may affect in chinking, impassiveness, burning, pain or begins at the tips of the toes or fritters and gradationally spreads overhead.<sup>7</sup>

**Other whim-whams damage.** Damage to jitters of the heart can contribute to irregular heart measures. whim-whams damage in the digestive system can beget problems with nausea, puking, diarrhea or constipation. whim-whams damage also may beget erectile dysfunction.<sup>8</sup>

**order complaint.** Diabetes may lead to habitual order complaint or end-stage order complaint that can not be reversed. That may bear dialysis or a order transplant.<sup>9</sup>

**Slow mending.** Left undressed, cuts and pocks can come serious infections, which may heal inadequately. Severe damage might bear toe, bottom or leg amputation<sup>10</sup>.

**Hearing impairment.** Hearing problems are more common in people with diabetes.<sup>7</sup>

**Sleep apnea.** Obstructive sleep apnea is common in people living with type 2 diabetes. rotundity may be the main contributing factor to both conditions.

**Madness:** Type 2 diabetes seems to increase the threat of Alzheimer's complaint and other diseases that beget madness. Poor control of blood sugar is linked to a more rapid-fire decline in memory and other thinking chops.<sup>11</sup>

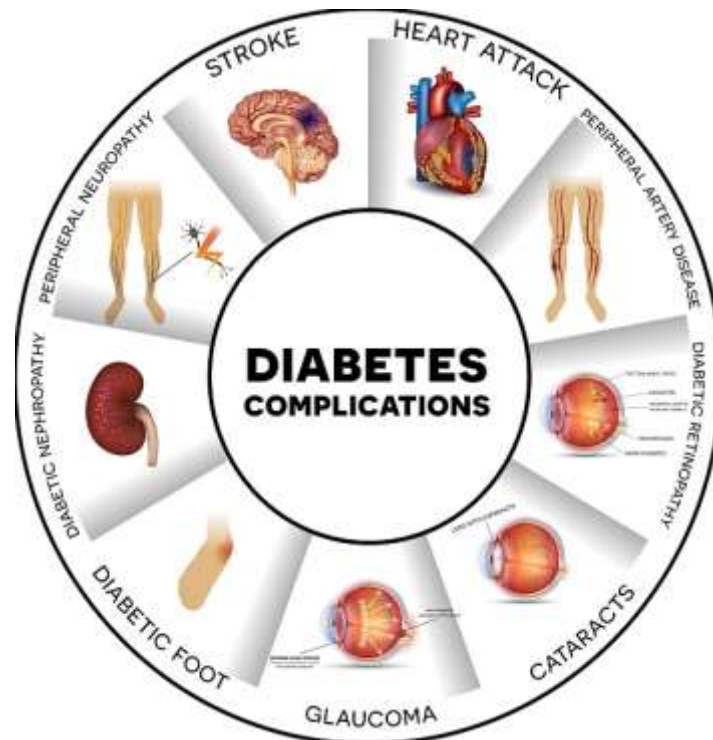


Fig no6. showing complication of diabetes

## 6. Prevention:

Healthy Life choices can help help type 2 diabetes. However, life changes may decelerate or stop the progression to diabetes, If you've entered a opinion of prediabetes. Choose foods lower in fat and calories and advanced in fiber. Focus on fruits, vegetables and whole grains<sup>1</sup>.

Getting active. Aim for 150 or further twinkles a week of moderate to vigorous aerobic exertion, similar as a brisk walk, bicycling, running or swimming<sup>12</sup>.

Losing weight. However, losing a modest quantum of weight and keeping it off may delay the progression from prediabetes to class 2 diabetes, If you're overweight. However, losing 7 to 10 of your body weight may reduce the threat of diabetes, If you have prediabetes<sup>2</sup>.

Avoiding long stretches of inactivity. Sitting still for long ages of time can increase the threat of type 2 diabetes. Try to get up every 30 twinkles and move around for at least a many twinkles.

For people with prediabetes, metformin( Fortamet, Glumetza, others), a diabetes drug, may be specified to reduce the threat of type 2 diabetes. This is generally specified for aged grown-ups who are fat and unfit to lower blood sugar situations with life changes<sup>13</sup>.

## 7. Tests for diabetes

Diabetes can be diagnosed using a range of tests listed and discussed below. They are:

- **1 Hemoglobin A1C:** The HbA1C test is a diagnostic <sup>1</sup> test used to check a patient's [glycaemic](#) leve (Table6). The value shown is a two to three months average of a patient's glycaemic level. It is useful and effective in evaluating patients with diabetes or at risk of [diabetes complications](#) .<sup>1</sup>

Table 6. showing [Haemoglobin A1c](#)

	HbA1c Test Score	Mean Blood Glucose (mg/dL)	Glucose (mmol/L)
Excellent	4.0	50	2.6
	5.0	80	4.7
	6.0	115	6.3
Good	7.0	150	8.2
	8.0	180	10.0
Poor	9.0	215	11.9
	10.0	250	13.7
	11.0	280	15.6
	12.0	315	17.4
	13.0	350	19.3
	14.0	380	21.1

**2. Fasting Tube Glucose** The fasting tube glucose (FPG) test calculates blood glucose situations contemporaneously. For delicacy, the test is administered in the morning after a fasting period of about 8 h. A value larger than 126 mg/ dL infers diabetes.<sup>14</sup>

**3. Random Tube Glucose** the blood sample is taken and analysed after food has been ingested. Diabetes is suspected when the value is lesser than 200 mg/ dL<sup>15</sup>.

**4. Oral Glucose Forbearance Test** it's a medical test conducted when glucose is administered, and the blood sample is analysed to measure how fast glucose has been cleared out. It's used to screen for type 2 diabetes mellitus<sup>16</sup>.

**5.C- Peptide** the beta cell function of the pancreas is measured. The dimension and analysis of urine and serum samples are carried out and the value helps diagnose and treat diabetes.<sup>17</sup>

**6. Autoantibody** the presence of autoantibodies, similar as insulin autoantibody and island autoantibody anti-glutamic acid decarboxylase (GAD) autoantibodies suggests bus-vulnerable response also noticed in type 1 diabetes. The presence of autoantibodies for diabetes in the blood confirms type 1 diabetes.<sup>1</sup>

The following table helps you understand what your test numbers mean.

Diagnosis	A1C (percent)	Fasting plasma glucose (FPG) <sup>a</sup>	Oral glucose tolerance test (OGTT) <sup>ab</sup>	Random plasma glucose test (RPG) <sup>a</sup>
Normal	below 5.7	99 or below	139 or below	
Prediabetes	5.7 to 6.4	100 to 125	140 to 199	
Diabetes	6.5 or above	126 or above	200 or above	200 or above

## 8. Therapy for treatment of diabetes

### 1. Insulin therapy:

The two major insulins are a rapid-acting insulin and an insulin which is more slowly absorbed by adding protamine or high concentrations of zinc ions. These insulin preparations contain insulin as hexamers in which the solubilisation and dissociation of the hexamers determine the absorption of the insulin from the site of injection. The quality of diabetes control is to a degree dependent on these characteristics. Ideally the more slowly absorbed insulin should provide a background, 'square-wave', long-duration insulin level, while the more rapidly acting insulin should be rapidly absorbed and rapidly inactivated, i.e. have a rapid on-off action. In order to design these fast-acting and long-acting variants of insulin a detailed knowledge of the association behaviour and the stability of the hexamer was required.<sup>1</sup>

## 2. Glucose measurement therapy:

Glucose is estimated by (a) estimating blood or capillary blood glucose or (b) estimating levels of glycated proteins. The introduction of glycated haemoglobin (HbA1c) as an index of blood glucose control enabled studies of the relationship between HbA1c and microvascular disease from diagnosis<sup>18</sup>. These studies, including the DCCT in type 1 diabetic patients, encouraged clinicians, probably correctly as it happens, to believe that optimal blood glucose control was desirable in patients with type 2 diabetes. The UKPDS was a 20-year study whose aim was to determine the impact of intensive blood glucose on 21 predetermined clinical endpoints using, in the case of blood glucose control, sulphonylureas or insulin therapy or, in overweight patients, treatment with metformin. In addition, the study investigated the impact of intensive blood pressure control on macro- and microvascular complications of diabetes and compared captopril treatment with atenolol.<sup>19</sup>

## Development of diabetes

In the upper part of the diagram, a beta cell receives a primary insult. It is not known whether this insult is identical in type 1 diabetes and type 2 diabetes but leads to different responses because of variations in genetic susceptibility<sup>20</sup>. The currently accepted view is that an immune-mediated insult leads to the primary beta-cell dysfunction in type 1 diabetes, whereas a different, unknown insult causes type 2 diabetes<sup>18</sup>. Once injured, beta cells have a similar fate in the two types of diabetes. Glucotoxicity, oxidative stress, and cytotoxic cytokines lead to further damage, which eventually results in beta-cell death if the process is not countered by effective self-repair and therapeutic interventions. also be attributable to mildly improved insulin sensitivity resulting from reduced systemic inflammation<sup>15</sup> Such a conclusion is consistent with the demonstration that certain cytokines impair insulin signaling and supports the concept that treating the underlying inflammation improves diabetes control, which is probably an aspect of the beneficial effects of statins and glitazones<sup>18</sup>.

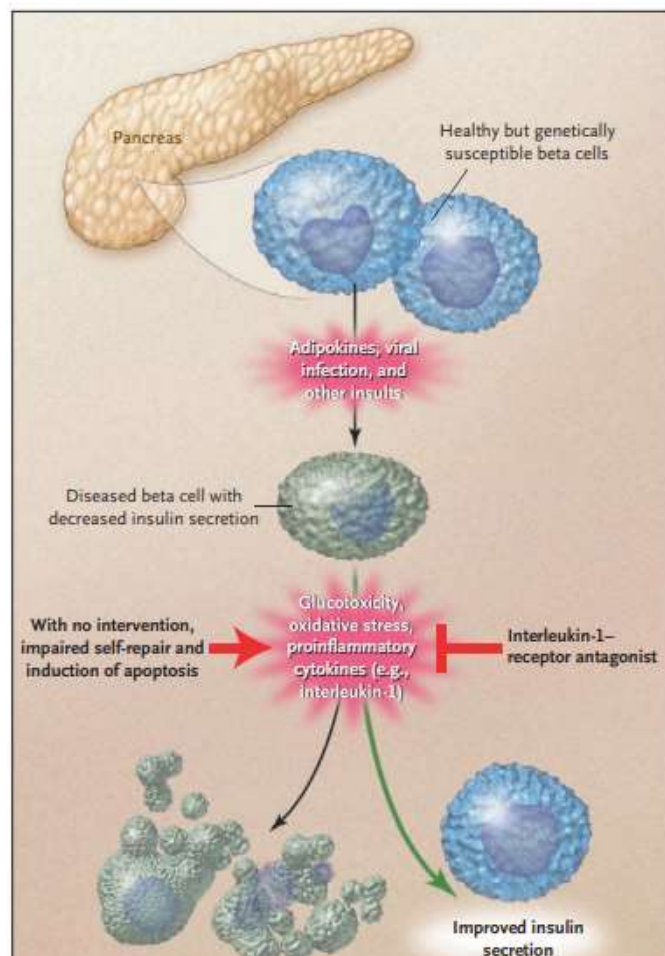


Fig. 7 diagram show the development of the diabetes due to destruction of b call of pancreases



---

## Conclusions:

The expectations for a long and healthy lifespan for the individual who develops diabetes have never been higher. From a societal perspective, the ongoing epidemic threatens to swamp these individual improvements. The major challenges from the individual and societal perspective are to make primary prevention and secondary intervention as effective, widely available, and affordable as possible. It is estimated that the onset of diabetes occurs an average of about 4e7 years before clinical diagnosis based on symptoms, and that one-third to one-half of individuals with type 2 diabetes are undiagnosed at any given time. The proportion undiagnosed varies with age, ethnicity, gender and other factors. Given that a high proportion of individuals exhibit evidence of end-organ damage at the time of clinical diagnosis, and that undiagnosed diabetes is common, screening has been proposed in the hope that early detection and early treatment would reduce the long-term burden to individuals and the health services. However, there is no definitive evidence that screening results in net benefit, and most authorities have proposed further research and limited screening, targeting high-risk subgroups.

## References:

---

1. Shivashankar M, Mani D. Gambaran Singkat Diabetes. 2021;3.
2. Guariguata L, Whiting D, Weil C, Unwin N. The International Diabetes Federation diabetes atlas methodology for estimating global and national prevalence of diabetes in adults. *Diabetes Res Clin Pract.* 2011;94(3):322-332. doi:10.1016/j.diabres.2011.10.040
3. Neumann A, Lindholm L, Norberg M, Schoffer O, Klug SJ, Norström F. The cost-effectiveness of interventions targeting lifestyle change for the prevention of diabetes in a Swedish primary care and community based prevention program. *Eur J Heal Econ.* 2017;18(7):905-919. doi:10.1007/s10198-016-0851-9
4. Gupta V, Khadgawat R, Saraswathy KN, Sachdeva MP, Kalla AK. Emergence of TCF7L2 as a most promising gene in predisposition of diabetes type II. *Int J Hum Genet.* 2008;8(1-2):199-215. doi:10.1080/09723757.2008.11886031
5. Permutt MA, Wasson J, Cox N. Genetic epidemiology of diabetes. *J Clin Invest.* 2005;115(6):1431-1439. doi:10.1172/JCI24758
6. Goel R, Bhardwaj S, Bana S. Pharmaceutical excipients. Dos Forms, Formul Dev Regul Recent Futur Trends Pharm Vol 1. 2023;1:311-348. doi:10.1016/B978-0-323-91817-6.00003-6
7. Manikpuriya S, Gandakhe I, Shinde N, Pawar S, Sanap G, Yashwantrao B. Formulation and Evaluation of Transdermal Patch Containing Withania Coagulans. *Asian J Pharm Res Dev.* 2024;12(3):66-74. doi:10.22270/ajprd.v12i3.1396
8. Hall D. Promoting the health of children. *Practitioner.* 2001;245(1624):614-618. doi:10.1016/0378-3782(82)90014-7
9. Rodgers G. Renaissance Hotel SESSION 1 : FRAMING WOMEN ' S UROLOGIC RESEARCH Bladder Health — Entrée to LUTS Prevention. Published online 2015.
10. Won JC, Lee JH, Kim JH, et al. Diabetes fact sheet in Korea, 2016: An appraisal of current status. *Diabetes Metab J.* 2018;42(5):415-424. doi:10.4093/dmj.2018.0017
11. Lenhard MJ, Maser RE, Patten BC, DeCherney GS. The new diagnosis and classification of diabetes mellitus. *Del Med J.* 1998;70(8):355-359.
12. Sanskruti Pawar, Shubhangi Manikpuriya, Gajanan Sanap. The Phytochemical and Pharmacological Screening of Withania Coagulans. *World J Biol Pharm Heal Sci.* 2023;16(3):109-117. doi:10.30574/wjbphs.2023.16.3.0501
13. Sanap GS, Mohanta GP. Design and evaluation of miconazole nitrate loaded nanostructured lipid carriers (NLC) for improving the antifungal therapy. *J Appl Pharm Sci.* 2013;3(1):46-54. doi:10.7324/JAPS.2013.30109
14. Panichayupakaranant P, Tewtrakul S. Plumbagin production by root cultures of *Plumbago rosea*. *Electron J Biotechnol.* 2002;5(3):35-39. doi:10.2225/vol5-issue3-fulltext-4
15. Katon WJ. The Comorbidity of Diabetes Mellitus and Depression. *Am J Med.* 2008;121(11 SUPPL. 2):8-15. doi:10.1016/j.amjmed.2008.09.008
16. Naar-King S, Idalski A, Ellis D, et al. Gender differences in adherence and metabolic control in urban youth with poorly controlled type 1 diabetes: The mediating role of mental health symptoms. *J Pediatr Psychol.* 2006;31(8):793-802. doi:10.1093/jpepsy/jsj090
17. Preparations A, The FOR, Of M, Ras THE. *Indian J ournal of M edical R esearch and P harmaceutical S ciences Indian J ournal of M edical R esearch and P harmaceutical S ciences.* 2020;7(September):1-8.
18. Ramachandran A, Snehalatha C, Vijay V, Wareham NJ, Colagiuri S. Derivation and validation of diabetes risk score for urban Asian Indians. *Diabetes Res Clin Pract.* 2005;70(1):63-70. doi:10.1016/j.diabres.2005.02.016
19. Holman RR, Paul SK, Bethel MA, Matthews DR, Neil HAW. 10-Year Follow-up of Intensive Glucose Control in Type 2 Diabetes. *N Engl J Med.* 2008;359(15):1577-1589. doi:10.1056/nejmoa0806470

- 
20. Alberti KGMM, Zimmet P, Shaw J. International Diabetes Federation: A consensus on Type 2 diabetes prevention. *Diabet Med.* 2007;24(5):451-463. doi:10.1111/j.1464-5491.2007.02157.x