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What Is Glucose? What Happens to It Normally?

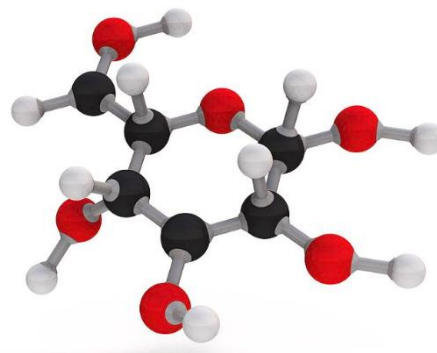
Glucose, a sugar, is a source of energy for the cells that make up muscles and other tissues. It's also the brain's main source of fuel. Glucose comes from two major sources: food and the liver.

When you eat something, it is metabolized and the glucose from that is absorbed into the bloodstream. From there, it enters cells with the help of insulin. The liver stores the extra glucose.

Insulin is a hormone comes from the pancreas, a gland behind and below the stomach.

The pancreas releases insulin into the bloodstream. As the insulin enables glucose to enter the cells, and thus the amount of glucose in the bloodstream goes down. As the blood glucose level drops, so does the release of insulin from the pancreas... until you have your next snack/meal and then the whole process starts again.

If you wait too long to eat and your blood glucose levels start to become too low, the glucose stored in your liver will be released into your blood to help maintain normal blood glucose levels. Got it?



So What Happens in the Body During Diabetes?

Diabetes mellitus refers to a group of diseases that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin that is produced.

When insulin is not able to take glucose from the blood into the cells, the blood glucose levels remain high. This is known as

hyperglycemia.

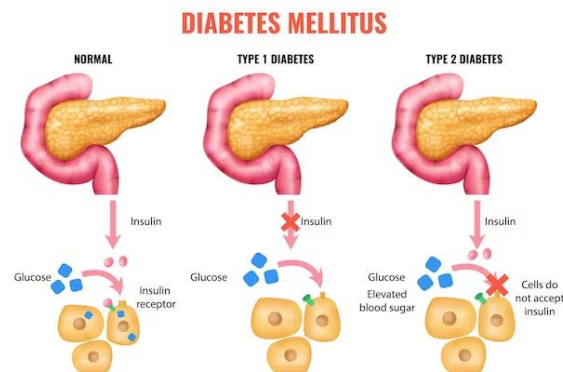
Over time, hyperglycaemia leads to serious damage to many of the body's systems, especially the nerves and blood vessels.



What Are the Types of Diabetes?

Prediabetes is a health condition where blood sugar levels are higher than normal, but not high enough yet to be diagnosed as type 2 diabetes. Prediabetes puts you at increased risk of developing type 2 diabetes, heart disease, and stroke.

- ∂ **Type 1 diabetes** is characterized by autoimmune destruction of the pancreatic beta cells, leading to absolute insulin deficiency. Type 1 diabetes accounts for approximately 5 to 10% of diabetes in adults. Type 1 diabetes can start at any age, but usually starts during childhood or teen years.
- ∂ **Type 2 diabetes**, the most common type (over 90%), can develop at any age, but it is more common in people older than 40. However, type 2 diabetes in children is increasing. Type 2 diabetes is characterized by hyperglycaemia usually due to progressive loss of insulin production as well as resistance to the insulin that is produced, resulting in relative insulin deficiency





- ∂ **MODY (Maturity Onset Diabetes of the Young):** It is a rare form of diabetes that typically runs in families and is caused by specific genetic mutations.
- ∂ **Gestational diabetes** occurs during pregnancy. But it may go away after the baby is born. Women with gestational diabetes are at an increased risk of complications during pregnancy and at delivery. These women, and possibly their children, are also at increased risk of type 2 diabetes in the future.

Did You Know?

- ∂ The number of people with diabetes rose from **108 million in 1980 to 422 million in 2014**. The prevalence has been rising more rapidly in low- and middle-income countries than in high-income countries.
- ∂ Diabetes is a **major cause** of blindness, kidney failure, heart attacks, stroke and lower limb amputation.
- ∂ Between 2000 and 2019, there was a **3% increase** in diabetes mortality rates by age.
- ∂ In 2019, diabetes and kidney disease due to diabetes caused an estimated **2 million deaths**.
- ∂ Diabetes can be treated and its consequences avoided or delayed with a healthy diet, regular physical activity, maintaining a normal body weight, avoiding tobacco, taking medication regularly and regular screening and treatment for complications.

Risk Factors for Diabetes

∂ **Age** – if you are **over 45**

∂ **Genetic causes**

- Many people with type 2 diabetes have a family member with either type 2 diabetes or other medical problems associated with diabetes, such as high cholesterol and triglyceride levels, high blood pressure, or obesity.
- The lifetime risk of developing type 2 diabetes is 5 to 10 times higher in first-degree relatives (ex: sibling or child) of a person with diabetes compared with a person with no family history of diabetes.

∂ **Lifestyle factors**

- Eating an unhealthy diet
- Having a sedentary lifestyle
- Being overweight

∂ **High blood pressure**

∂ **Having prediabetes or history of diabetes during pregnancy**



Symptoms

In type 1 diabetes, symptoms tend to come on quickly and be more severe.

In type 2 diabetes, the symptoms can be mild and may take many years to be noticed. Symptoms can also depend on how high your blood glucose is.

Many people, especially if they have prediabetes, gestational diabetes or type 2 diabetes, **may not have symptoms**.

Symptoms of diabetes seen in different people are:

- ∂ Feeling thirstier than usual (polydipsia)
- ∂ Urinating often (polyuria)
- ∂ Feeling hungrier than usual (polyphagia)
- ∂ Losing weight without trying
- ∂ Feeling tired and weak
- ∂ Feeling irritable or having other mood changes.
- ∂ Having blurry vision
- ∂ Having slow-healing sores



Complications

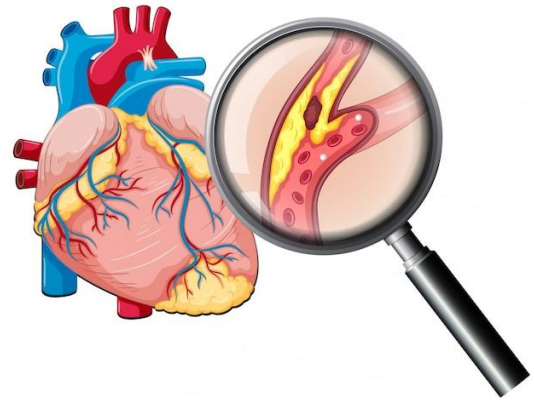
The longer you have diabetes and the less controlled your blood glucose, the higher the risk of complications. Eventually, diabetes complications may be disabling or even life-threatening.

The major complications of diabetes can be divided into those cause my microvascular disease versus those cause by macrovascular disease.

- Macrovascular injury tends to affect the brain, heart, and peripheral blood vessels.
- Microvascular injury usually affects the eyes, kidneys, and peripheral nerves.

∂ **Heart and blood vessel (cardiovascular) disease**

- Diabetes significantly increases the risk of many heart problems. These can include coronary artery disease with chest pain, heart attack, stroke and narrowing of arteries (atherosclerosis).
- If you have diabetes, you're more likely to have heart disease or stroke.



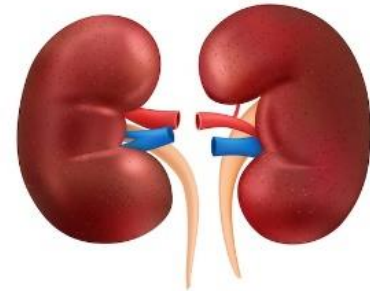


∂ **Nerve damage from diabetes (diabetic neuropathy)**

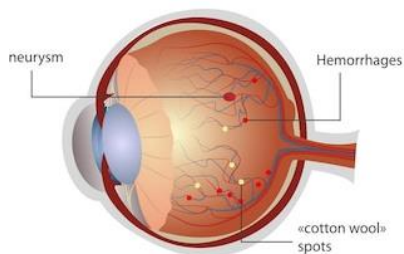
- Too much glucose can injure the walls of the tiny blood vessels (capillaries) that nourish the nerves, especially in the legs.
- This can cause tingling, numbness, burning or pain that usually begins at the tips of the toes or fingers and gradually spreads upward. This leads to nerve damage and poor blood flow and can cause foot ulcers and may even lead to an amputation.
- Damage to the nerves related to digestion can cause problems with nausea, vomiting, diarrhea or constipation.
- For men, it may lead to erectile dysfunction.

∂ **Kidney damage from diabetes (diabetic nephropathy)**

- The kidneys hold millions of tiny blood vessel clusters (glomeruli) that filter waste from the blood. Diabetes can damage this delicate filtering system.



DIABETIC RETINOPATHY



∂ Eye damage from diabetes (diabetic retinopathy)

- Diabetes can damage the blood vessels of the eye. This could lead to blindness.

∂ Skin and mouth conditions

- Diabetes may leave you more prone to skin problems, including bacterial and fungal infections.

∂ Foot damage

- Nerve damage in the feet or poor blood flow to the feet increases the risk of many foot complications, including amputation of the limb.

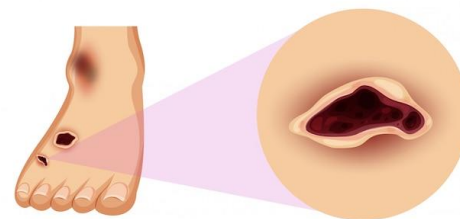
∂ Hearing impairment

- Hearing problems are more common in people with diabetes.

∂ Alzheimer's disease

- Type 2 diabetes may increase the risk of dementia, such as Alzheimer's disease.

diabetic foot



∂ **Depression related to diabetes**

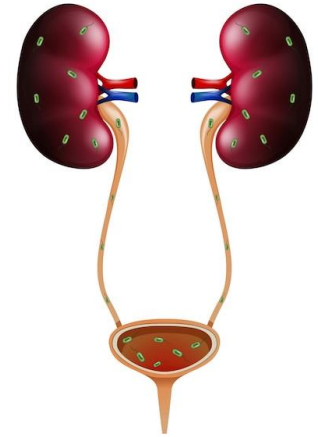
- Depression symptoms are common in people with type 1 and type 2 diabetes.

∂ **Urinary Infections**

- Diabetes can also lead to urinary tract infections due to high glucose levels in the urine.

∂ **Diabetic ketoacidosis ('DKA')**

- A dangerous condition that occurs when fats are burned to make energy. Ketones rise in the blood, making the level of acid in the blood too high.



Who Should Get Tested for Diabetes?

It is recommended that the following people be screened for diabetes:

- ∂ Anyone with a **body mass index higher than 23**, regardless of age, who has additional risk factors. These factors include:
 - High blood pressure
 - Non-typical cholesterol levels
 - An inactive lifestyle
 - A history of polycystic ovary syndrome or heart disease
 - Having a close relative with diabetes
- ∂ Anyone **older than age 35** is advised to get an initial blood glucose screening. If the results are normal, they should be screened every three years after that.
- ∂ Women who have had **gestational diabetes** are advised to be screened for diabetes **every three years**.
- ∂ Anyone who has been diagnosed with **prediabetes** is advised to be tested every year.
- ∂ Anyone who has **HIV** is advised to be tested.



Evaluating for Diabetes

∂ Clinical presentation

- **Type 2 diabetes**

The majority of patients with type 2 diabetes are asymptomatic, and hyperglycemia is noted on routine laboratory evaluation.

- **Type 1 diabetes**

Diabetic ketoacidosis, may be the initial presentation in approximately 25% of adults with newly diagnosed type 1 diabetes. Symptoms may include nausea, vomiting, abdominal pain, laboured breathing, exhaustion.



∂ Comprehensive history

Patients with newly diagnosed diabetes require:

- A history and physical examination to assess the characteristics of onset of diabetes
- Nutrition and weight history
- Assessment of physical activity

- Cardiovascular risk factors
- History of diabetes-related complications
- Diabetic ketoacidosis (DKA) frequency (typically type 1 diabetes)
- Family history
- Current management
- More diabetes-specific microvascular complications are related to duration and degree of hyperglycemia. Such complications may be present in newly diagnosed patients with type 2 diabetes owing largely to delays in diagnosis.

∂ Biochemical testing

- Fasting and 2 hrs post food sugar
- HBA1C (if not measured in last 3 months)
- If not measured in the past one year, measure:
 - Fasting lipid profile
 - Liver function tests
 - Urine for microalbumin
 - Serum creatinine (with estimated glomerular filtration rate [eGFR])



What Are the Criteria to Diagnose Diabetes?



Plasma glucose test	Normal	Prediabetes	Diabetes
Fasting	Below 100 mg/dl	100 – 125 mg/dl	126 mg/dl or more
2 hrs post lunch or dinner	Below 140 mg/dl	140 - 199 mg/dl	200 mg/dl or more
Hba1c	< 5.7	5.7 to 6.49 mg/dl	6.5 or above

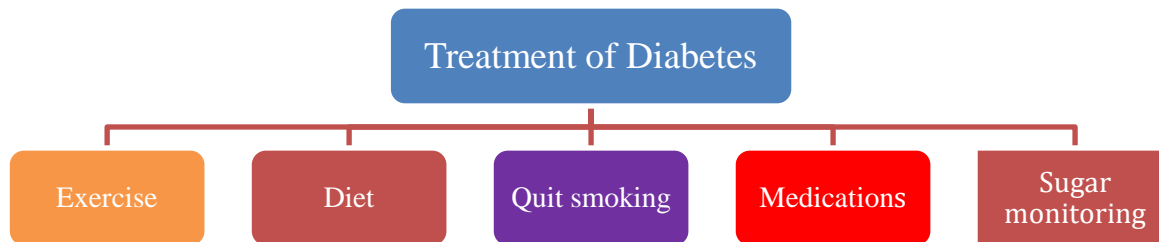
If the diagnostic test is consistent with prediabetes, it should be repeated annually.

Treatment of Diabetes



Being diagnosed with type 2 diabetes can be overwhelming and you will likely have questions about why it developed, what it means for your long-term health, and how it will affect your everyday life. Your doctor can help answer your questions and talk to you about what to expect. They can guide you to supportive services such as diabetes lectures, an appointment with a dietician or consultation with a diabetologists.

Treatment of diabetes includes holistic approach with steps to be taken as below:



Lifestyle Modifications – Take Charge

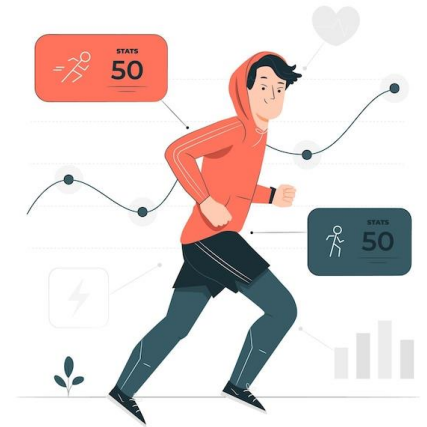
∂ Exercise

Getting regular physical activity is very important for good health. Exercise makes the body more sensitive to insulin which helps lower blood glucose levels.

- **Types of exercise** — Exercise could mean going to the gym and running on a treadmill, but you can also do brisk walking, doing housework, dancing, swimming, bicycling, or hiking. Even gentle forms of exercise are good for your health.
- **Wear well-fitting, protective footwear.** Check your feet for sores and blisters after you complete your exercise.
- **Drink plenty of water** before, during, and after exercise. This helps to prevent dehydration, which can upset blood glucose levels.
- Keep rapidly absorbed **carbohydrates on hand** (glucose tablets, hard candies, or juice). If your blood glucose level becomes low during exercise and you develop symptoms of sweating and shaking, eat the carbohydrate.



- If you take oral diabetes medications, you probably will not need to adjust the dose of these medications for exercise.
- If you have diabetes and use insulin, you should also do the following:
 - Measure your blood glucose before, during, and after exercise to determine your body's typical response to exercise.
 - If your pre-exercise blood glucose reading is 270 mg/dl or higher, avoid vigorous exercise until your blood glucose level is lower. If your pre-exercise blood glucose is below 100 mg/dl, you may need to eat a small snack containing carbohydrates so your blood glucose does not fall too low during exercise.
 - Choose an insulin injection site away from exercising muscles. For example, if you go for a run, avoid using your legs as an injection site.
- **Duration and frequency** - a goal of **150 minutes** of moderate-intensity or **75 minutes** of vigorous-intensity physical activity per week. Increase the intensity, frequency, and duration of exercise gradually.





- **Precautions With Exercise**

- People with diabetes-related eye complications (severe retinopathy) may be advised to avoid vigorous or high-impact activities and strenuous weightlifting, which can increase blood pressure and cause bleeding in the eye.
- People with neurologic complications (peripheral neuropathy) are usually advised to avoid traumatic weight bearing exercises such as running, which can lead to foot ulcers and stress fractures.

० **Quit Smoking**

Over **25%** of people newly diagnosed with diabetes actively smoke.

People with diabetes who smoke have an increased risk of the following:

- Death, especially from heart attacks and strokes
- High low-density lipoprotein (LDL or 'bad') cholesterol levels
- Worsened blood glucose control compared with non-smokers
- Nerve damage from diabetes
- Kidney disease leading to dialysis
- Foot ulcer and amputation of toes, feet, or legs, caused by peripheral vascular disease



Quitting smoking is one of the most important things people can do to improve their health.

० Diet

Changing the type and amount of food eaten can help people with diabetes to lose weight, improve blood glucose levels, and lower blood cholesterol levels and blood pressure.

There are a lot of dietary options available that can be followed in diabetes. You can choose from the option suitable to you. Consult a dietician to guide you through the best possible option for you.

Few of the dietary recommendations for diabetics are:

- Minimize sugar and refined flours.
- Avoid high sugar beverages such as juices, soda and alcohol.
- Try millets instead of wheat or white flour.
- Consider adopting a 2-meal intermittent fasting regime after discussing with your doctor.
- Incorporate salads and lentils into your routine meal plan.
- Maintain adequate hydration with plain water.
- Eat adequate amounts of fibre.
- Take vitamin D supplements as prescribed by your doctor.
- Opt for the low-fat version when you can.



Medications and Blood Glucose Documenting

- ∂ If your blood glucose levels are not controlled by lifestyle modifications alone, your doctor will start you on oral medications.
- ∂ The daily regimen may include oral medications and/or insulin, blood glucose monitoring, carefully planned meals and snacks, and exercise.
- ∂ There are several different classes of diabetes medications that work in different ways to help manage blood sugar levels.

Diabetes medicines available nowadays have **minimal side effects** and are very effective in controlling sugar. Choice of medicines depends on multiple factors like age, comorbidities, sugar levels, social background of the patient and social support available. Consult your doctor to discuss the plan of medications that can be best suitable for you.

- ∂ Since medication regimens may be difficult to manage, it is best to make a list of all of your medications, including dose and frequency. Along with this, make a blood glucose chart that you bring to the doctor each time you come for your follow up appointment.





Below is an example of the chart:

My blood sugar levels					
My target sugar levels					
Fasting			2 hrs post lunch		
110 - 150			160 - 190		
My Monthly Sugar log chart					Month - September
Date and Time		Fasting	Time	PPBS	Remarks
1/09/23	8 am	115	3 pm	225	Ate Sweet – Jalebi in lunch

You can also maintain a record of your sugar values by using mobile apps like Diabetes Diary or Blood Pressure & Sugar Tracker etc.

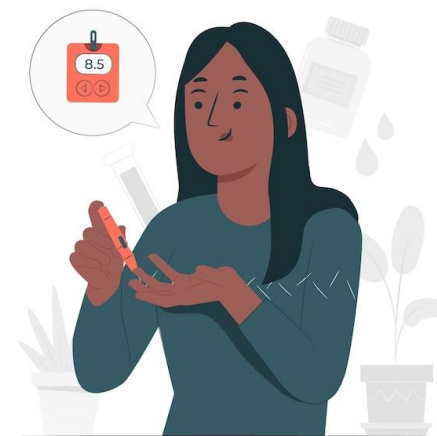
Self Blood Glucose Monitoring

It is very important for you to have a blood glucometer at home and when you're travelling. It allows you to check your blood glucose level and regular times which can then be documented and shared with your doctor.

Not only will this help your doctor manage your treatment better, but it will also help you understand which dietary choices are benefiting you most and will help you make better decisions for your health.

Here are the steps to checking your blood glucose at home:

- ∂ Gather your supplies. Get your lancing device ready.
- ∂ After washing your hands, insert a test strip into your meter.
- ∂ Use your lancing device on the side of your fingertip (usually your middle or ring finger) by your fingernail to avoid having sore spots on the frequently used part of your finger.
- ∂ Get a small drop of blood. Touch and hold the edge of the test strip to the drop of blood and wait for the result.
- ∂ Your blood glucose level will appear on the meter's display.
- ∂ Document your glucose level in your diabetes chart.



You can watch the video on how to measure blood sugar on – <https://www.youtube.com/@AHCH>

Continuous Glucose Monitoring devices

These automatically estimate your blood glucose level throughout the day and night. You can see what your blood glucose level is at any time. You can also review how your blood glucose level changes over a few hours or days and spot trends. **These are particularly helpful for people with type I diabetes and fluctuating type II diabetes.** You can discuss about these devices with your doctor.



o What happens if my blood glucose level becomes too low?

Sometimes blood glucose levels drop below where they should be, which is called **hypoglycemia**. For most people with diabetes, the blood glucose level is too low when it is below **70 mg/dL**.

Symptoms of hypoglycaemia include

- o Fast heartbeat
- o Sweating
- o Irritability or confusion
- o Hunger



- o Tremors
- o Nervousness or anxiety
- o Dizziness
- o Unconsciousness

Hypoglycemia can be life threatening and needs to be treated right away.

Routine Medical Check Ups

In addition to lifestyle changes and regular medication, routine medical health check-ups are also important for long-term health in people with diabetes, particularly for preventing, detecting, and slowing the progression of complications.

Your doctor may also recommend screenings to detect health problems that do not cause symptoms in the early stages.

These screenings include:

- ∂ FBS/PP₂BS/HBA1c every three months
- ∂ Yearly urine microalbumin test
- ∂ Yearly fundoscopic eye examinations
- ∂ Yearly foot examinations
- ∂ Yearly dental examinations
- ∂ Yearly electrocardiograms / 2D – Echo / TMT
- ∂ Yearly lipid profile test
- ∂ Yearly kidney and liver function tests



Prepare for Your Appointment

- ∂ When you go for your routine follow up with your doctor, take all your medicines with you.
- ∂ Make a list of them along with dose and frequency. Discuss if you're having any problems with your current treatment.
- ∂ Take your blood glucose chart with your doctor so they can see how the medicines are working for you.

Converse With Your Doctor

- ∂ If you're starting new medicines, ask your doctor the following questions:
 - How many pills do I take?
 - How often should I take them, and when?
 - Should I take my medicine on an empty stomach or with food?
 - What if I forget to take my medicine and remember later?
 - What side effects could I have?
 - What should I do if I have side effects?
 - Will my diabetes medicine cause a problem with any of my other medicines?



Preventing Complications of Diabetes

∂ Preventing Heart Complications

Diabetes is an added risk for developing heart disease. Sometimes a person with diabetes does not feel the normal symptoms of a heart attack. This is called a '**silent heart attack**'. This is because of the nerve damage caused by high blood glucose. A person may not feel any symptoms at all or may just feel heartburn type mild discomfort.

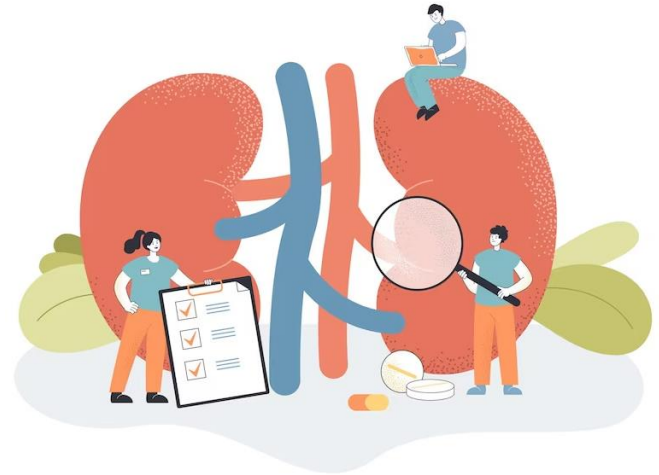
Here are some things you can do to help decrease your risk:

- Maintain your blood glucose level as discussed with your doctor
- Maintain your blood pressure < 130/80mmHg
- Make sure your cholesterol is in control; LDL < 70
- Make sure your weight is appropriate for your height
- Take a high fibre diet
- Drink adequate water
- Regular exercise 150 minutes/week
- Get a regular health check up every year



० Preventing Kidney Complications

- Kidney issues related to diabetes are referred to as ‘**diabetic kidney disease**’ or ‘**diabetic nephropathy**’.
- Over time, diabetic kidney disease can lead to chronic kidney disease and even kidney failure.
- To monitor your kidney function, your doctor will check your blood creatinine level and urine for microalbumin.
- You can help slow the rate of progression by managing your blood glucose and your lipid (cholesterol and triglycerides) levels.

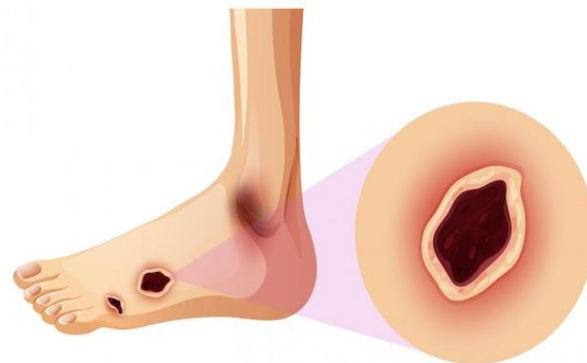


० Preventing Foot Complications

In diabetes, the sensations over the soles of the foot are less. As a result, there are chances of small injuries going unnoticed. This can result in a more complicated **diabetic foot or diabetic ulcer**, in adequate care is not taken.

The steps to be taken to prevent diabetic foot are:

- **Self-exams** - It is important to examine your feet every day.
Look for broken skin, ulcers, blisters, areas of increased warmth, redness, or changes in callus formation.
- **Avoid activities** that can injure the feet, include walking barefoot.
- **Use care when trimming the nails** — Trim your toenails straight across. Never cut your cuticles. See a foot care provider (such as a podiatrist) if you need treatment of an ingrown toenail or callus.
- **Wear cotton socks** that fit well, and be sure to change your socks every day.



Regular foot exams to check for problems or changes are a critical part of managing your diabetes.

० Preventing Eye Complications

There are several eye problems related to diabetes.

- The most common affects the retina, a layer at the back of the eye; this is called '**diabetic retinopathy**'. In diabetic retinopathy, the small blood vessels in the retina grow abnormally and leak, leading to vision loss and eventually blindness if not treated.

Other eye problems associated with diabetes include:

- Diabetic macular edema (swelling of the central area of the retina that has the sharpest vision)
- Glaucoma (high pressure in the eyeball)
- Cataracts (clouding of the lens of the eye)



Regular eye exams is essential for detecting retinopathy and other eye problems at an early stage, when the condition can be monitored and treated to preserve vision.

० Prevention of Diabetes From the Get-Go

Type 1 diabetes can't be prevented. But the healthy lifestyle choices that help treat prediabetes, type 2 diabetes and gestational diabetes, can also help prevent them.

- **Eat healthy foods.**

Choose foods lower in fat and calories and higher in fibre. Focus on fruits, vegetables and whole grains. Eat a variety to keep from feeling bored.

- **Get more physical activity.**

Try to get about 30 minutes of moderate aerobic activity on most days of the week. Or aim to get at least 150 minutes of moderate aerobic activity a week. If you can't fit in a long workout, break it up into smaller sessions throughout the day.

- **Lose excess pounds.**

If you're overweight, losing even 7% of your body weight can lower the risk of diabetes. To keep your weight in a healthy range, work on long-term changes to your eating and exercise habits. Remember the benefits of losing weight, such as a healthier heart, more energy and higher self-esteem.



- **Manage your Diabetes' ABCs**

Working toward your ABCs can help lower your chances of having a heart attack, stroke, or other diabetes problems.

A for the A1C test

The HBA1C test shows your average blood glucose level over the past 3 months. The A1C goal for many people with diabetes is below 7%.

B for Blood pressure

The blood pressure goal for most people with diabetes is below 130/80 mm Hg.

C for Cholesterol

Try and keep the target LDL cholesterol below 70 mg/dl. Also, keeping HDL above 50 mg/dl helps protect the heart in diabetics





S for Stop smoking

Not smoking is especially important for people with diabetes because both smoking and diabetes narrow blood vessels. Blood vessel narrowing makes your heart work harder.

If you quit smoking:

- You will lower your risk for heart attack, stroke, nerve disease, kidney disease, diabetic eye disease, and amputation.
- Your cholesterol and blood pressure levels may improve.
- Your blood circulation will improve.
- You may have an easier time being physically active.

When to Visit the ER

If you have any of the following, call emergency number or have a relative or friend take you immediately to the emergency room:

- ∂ Home blood glucose level > 350mg/dl or <70 mg/dl
- ∂ Clammy skin
- ∂ Profuse sweating
- ∂ Drowsiness or confusion
- ∂ Weakness or feeling faint
- ∂ Sudden loss of responsiveness
- ∂ Difficulty in breathing



Call **108** or call us on **9924343344** for emergency help.

FAQ's of Diabetes



- ∂ **If I have type 2 diabetes, can I stop taking diabetes medications if I eliminate candy and cookies from my diet?**

Everyone with type 2 diabetes will benefit from an improved diet, but you may still need other interventions, such as increased physical activity, weight loss or medications to keep your blood glucose in the target range. Check with your doctor about any diabetes medication dose adjustments that may be required if you change your diet.

- ∂ **Can type 2 diabetes go away? And if my blood glucose becomes normal, do I still have diabetes?**

When your blood glucose is normal with no treatment, then the diabetes is considered to have gone away. However, diabetes can come back. If you have type 2 diabetes and the blood glucose is controlled during treatment, it means that the treatment plan is working. You will need to continue your treatment; otherwise your blood glucose will go back up.



∂ **Do I need to monitor my blood glucose when I have type 2 diabetes?**

You may feel fine, but that is no guarantee that your blood glucose levels are in the target range. Remember, diabetic complications do not appear right away. Regular blood glucose monitoring can help you keep your blood glucose in control and prevent serious damage to your eyes, kidneys and nerves. If your glucose levels are out of range, consult your doctor.

∂ **Are my children at risk?**

Yes. Type 2 diabetes is a genetic disease. The risk is highest when multiple family members have diabetes, and if the children are overweight, sedentary and have the other risk factors. Your child has a 10-15% chance of developing type 2 diabetes if you have it.





Please use the space below to write down any further questions to ask the doctor when you come to the hospital for your appointment.

We hope this information will help you clear all your doubts about diabetes.

Jai Sat Chit Anand

