

Learn Basics About

DIABETES

This document is for early education of newly diagnosed diabetic or pre-diabetic patients as well as for caregivers and family members for a basic understanding purpose only.

1. What is diabetes?

Diabetes is a condition in which the level of sugar (glucose) in the blood is high. The body produces insulin, a hormone secreted by the pancreas, which breaks down the sugar consumed in food. A reduction in the production and/or utilization of insulin causes diabetes. If left untreated or uncontrolled, diabetes can lead to serious problems, such as heart disease, stroke, blindness, kidney failure and others. Some of these may be life-threatening.

2. What is type 1 diabetes?

In the type 1 diabetes, the body completely stops producing insulin due to the destruction of the insulin-producing pancreatic cells by the body's immune system. It was previously referred to as juvenile diabetes because it is usually diagnosed in young adults or children, or insulin-dependent diabetes, as insulin therapy is essential for survival and maintenance of good health.

3. What is type 2 diabetes?

This is the more common form of diabetes, accounting for about 95% of cases. In type 2 diabetes, the pancreas either produces inadequate amounts of insulin, or the body is unable to use the available insulin properly. Type 2 diabetes usually occurs in adults and is more common in people who are overweight or obese. Type 2 diabetes was previously known as maturity-onset or non-insulin-dependent diabetes. It is treated mostly with diet, exercise, and oral medication. Insulin is given only if the blood sugar levels cannot be controlled by oral medication. More than 80% of type 2 diabetes can be prevented or delayed by reducing the risk factors that may lead to its development and adopting healthier lifestyles.

4. What tests can be done to check diabetes?

What are the normal values?

Several tests can be done to estimate the blood sugar level. All these tests estimate the amount of sugar in a certain quantity of blood.

- **RPG (Random Plasma Glucose):** this is a blood test done at any time of the day to check the blood sugar level at that point in time. If the RPG value is ≥ 200 mg/dL (11.1 mmol/L) of blood, it indicates that the person has diabetes. Further tests may be required for confirmation.
- **FPG (Fasting Plasma Glucose):** this tests the amount of sugar in the bloodstream after one has not eaten for 8–10 hours (overnight fasting). This is usually done first thing in the morning before breakfast. An FPG value ≥ 126 mg/dL (≥ 7.0 mmol/L) indicates that the person has diabetes.
- **Glycated Hemoglobin (HbA1C):** this test measures how well the blood sugar has been controlled over the past 3 months. If the HbA1C is $\geq 6.5\%$ (47.0 mmol/mol), it indicates the presence of diabetes.
- **OGTT (Oral Glucose Tolerance Test):** this is another type of test for diabetes. The blood sugar level is checked in the fasting state and then 2 hours after drinking a certain amount of glucose. It shows how the body processes glucose. If the 2-hour value is ≥ 200 mg/dL (11.1 mmol/L), it indicates the presence of diabetes.

5. What is prediabetes?

Prediabetes is a condition in which the blood glucose levels are higher than normal but not high enough for a diagnosis of diabetes. Millions of people worldwide do not know that they have prediabetes. That is why it is important to get screened for prediabetes. If the HbA1C is between 5.7% and 6.4%, or the FPG is more than 110 mg/dL but less than 126 mg/dL, or the OGTT (2-hour glucose test) is between 140 and 199 mg/dL, the condition is termed as prediabetes. Pre-diabetic persons may develop type 2 diabetes in later life. There is a rule of “thirds” – about one third of prediabetic people will develop diabetes in the next five years, one-third will remain prediabetic, while one third will revert to normal.

Those who have prediabetes are at a higher risk of cardiovascular disease. Following proper diet and exercise programs to control weight can help prevent progression from prediabetes to diabetes and avoid cardiovascular problems. Screening for diabetes and prediabetes should not be delayed; it is better done early rather than late.

6. What is insulin resistance?

Insulin resistance is a condition in which the body's ability to respond to the effects of insulin is decreased. Insulin has many actions within the body, such as the breakdown of carbohydrates (sugars and starches), fats and proteins into glucose. As cells must have glucose to survive, the body compensates for the inadequate response to insulin by producing additional amounts of insulin. This results in high level of insulin in the blood, which is one of the signs of insulin resistance.

7. What is gestational diabetes?

Gestational diabetes is a temporary type of diabetes that develops during pregnancy (gestation). A woman who had gestational diabetes in one pregnancy has a higher risk of developing gestational diabetes in future pregnancies. Although gestational diabetes reverts to normal after pregnancy, it increases the risk of type 2 diabetes in future. Therefore, regular and timely screening for type 2 diabetes is essential for women who have had gestational diabetes.

8. Who is at high risk of developing gestational diabetes?

Any woman can develop gestational diabetes, but some women are at higher risk. There are a number of factors that increase a woman's chances of developing gestational diabetes. These factors include: being older than 25 years of age, being overweight prior to pregnancy, having a family history of diabetes, previous history of raised blood glucose level, history of repeated abortions or stillbirth, or a previous history of delivering a big baby and having a polycystic ovarian syndrome. A sedentary lifestyle, hypertension and other cardiovascular diseases also increase the risk of developing gestational diabetes. Hence, screening of all pregnant women for diabetes is recommended as a standard protocol.

9. Why does being overweight or obese put one at risk for developing diabetes?

Body weight affects health in many ways. Being overweight can keep the body from producing and utilizing insulin properly. It can also cause high blood pressure. Overweight people are twice as likely to develop type 2 diabetes as people with normal weight. Losing weight and increasing physical activity reduces the risk of developing this type of diabetes.

10. Who is at risk of developing type 2 diabetes?

We do not know why some people develop type 2 diabetes and others do not. However, certain factors increase the risk, some of which are given below:

- **Family history:** if one has a parent or sibling with type 2 diabetes, the risk of getting diabetes increases.
- **Irregular lifestyles:** In current modern day lifestyle majority of adults and children are at risk of developing diabetes. Severe mental stress, lack of physical activities, irregular and unhealthy (high gluten, fat, sugar, GMO) dietary choices as well as lack of knowledge and access to natural remedies (herbal, meditation, yoga, naturopathy) for preventative care increases the risk of diabetes.
- **Age:** the risk of type 2 diabetes increases with age, especially after the age of 40 years. This may be associated with decreased exercise, loss of muscle mass and weight gain as age increases. Despite the known association of type 2 diabetes with age, in recent years, the incidence of type 2 diabetes has been increasing dramatically among children, adolescents and young adults.
- **Race:** people from certain racial backgrounds are found to have a higher risk of developing diabetes, although the reason is not known.
- **Overweight/obesity:** being overweight is a primary risk factor for type 2 diabetes. The more fatty tissue one has, the more resistant the cells become to insulin. However, one does not have to be overweight to develop type 2 diabetes.
- **Inadequate physical activity:** the less active one is, the more likely one is to develop type 2 diabetes. Physical activity helps one control weight, use glucose as energy and increase the sensitivity of the cells to insulin.
- **Unhealthy diet:** a diet rich in calories, saturated fats and sugar, and low in fiber can lead to an increase in body weight and thereby increase the risk of developing diabetes. Having high blood pressure or a high lipid level also puts a person at risk of developing diabetes.

- **Gestational diabetes:** women who developed diabetes during pregnancy have a higher risk of developing type 2 diabetes. If the baby born to such a woman weighed more than 9 pounds (>4 kg), one is also at risk of developing type 2 diabetes in future.

11. What are the common signs and symptoms of type 2 diabetes?

One of the most important things to remember is that diabetes does not always produce symptoms until the disorder is fairly advanced. If one has a few of the following symptoms, one may suspect diabetes:

- Diabetes can affect the eyes. High blood sugar levels can cause the lens to swell, and the vision may become blurred or foggy.
- An affected person may become easily tired for no apparent reason.
- One may pass urine more frequently than before.
- Hunger may increase and the person may eat more than usual.
- There may be weight loss despite a good appetite.
- A person may become overly thirsty and tend to drink excessive amounts of water. This is because the body tries to compensate for the water lost through the urine.
- A high blood sugar level makes it hard for the body to fight infections. Wounds do not heal easily, there may be frequent infections of the skin, bladder or gums, and itching in the genital area.
- There may be numbness or tingling in the hands and feet.

The symptoms of type 1 diabetes are more sudden and severe. Children with diabetes complain of tiredness, weakness and may sometimes exhibit irritable behaviour.

12. Why is it important to go for regular check-ups?

The symptoms of type 2 diabetes may be so mild that it may not be noticed for years, and therefore remains untreated. This may lead to complications. As one cannot always rely on symptoms, the only way to know whether one has diabetes is to be screened (tested) for it.

Screening for diabetes is done in a doctor's office, clinic or laboratory under the supervision of a health-care provider. The health-care provider may do one or several blood tests to look for diabetes. High-risk individuals should be screened for diabetes at regular intervals, beginning at the age of 35 years.

13. What are the types of treatment for diabetes?

The aim of treatment is to maintain the blood sugar level as close to normal as possible. The type of food and level of physical activity play an important role in controlling blood sugar, as do medicines. Various medicines can be used to treat diabetes. Medicines for diabetes should be prescribed only by a health-care provider. However, it is important for the person with diabetes to understand how the medicines work.

Apart from taking medicines by mouth, injectable medicines may also be used. Insulin is currently not available in pill form, and hence it must be injected. There are also non-insulin medicines that are injectable. There are many delivery devices for injectable insulin, such as needle, syringe and insulin pumps. Insulin is mandatory for people with type 1 diabetes. Type 2 diabetes is usually treated with oral medicines but insulin injections may be prescribed if oral medications do not adequately control the blood sugar level.

Treatment depends on the type of diabetes, complications, presence of other risk factors, coexisting active medical problem, age and general health at the time of diagnosis. The health-care provider will decide which medicine will work best for the individual patient. The advantages and disadvantages of each of these medicines can be explained by the health-care provider. For treatment to be successful, the patient must carefully manage the diet, be physically active, take oral medication and/or insulin, and be well informed about the disease.

14. How do patients with diabetes know that their disease is well controlled?

A glycated hemoglobin (HbA1c) test accurately assesses how well the blood glucose has been controlled over a period of 2–3 months. For non-diabetic individuals, the normal HbA1c level is usually below 5.5%. In people with diabetes, an HbA1c level below 7.0% indicates good control.

15. What are the complications and consequences of diabetes?

The complications of diabetes develop gradually. When too much sugar stays in the bloodstream for a long time, it can affect the blood vessels, nerves, eyes, kidneys and cardiovascular system. Complications include heart attack and stroke, severe foot infections (leading to gangrene, which may result in amputation), end-stage kidney failure and sexual dysfunction. After 10–15 years of onset, the prevalence of all diabetes-related complications increase markedly.

16. Can the complications of diabetes be prevented?

The good news is that the complications of diabetes can be prevented by doing the following important things:

- Take medicines regularly as prescribed by the health-care provider.
- Keep a track of the blood sugar level by going for regular tests and check-ups.
- Eat healthy – more vegetables and fruit, less fatty, sugary and salty food.
- Stay physically active.
- Stay alert for skin infections and skin disorders.
- Go for regular eye check-ups.
- Watch for any tingling, burning, loss of sensation, and wounds on the bottom of the feet.

Talk to the health-care provider and discuss how to avoid complications and how to deal with these if one already has some complication.

17. Why do individuals with diabetes need to take special care of their feet?

Foot problems are an important cause of complications in individuals with diabetes. Over the years, the blood circulation in the legs and feet may become poor and the nerves become less sensitive. Individuals with diabetes can unknowingly injure their feet due to the reduced sensation. Patients at risk for developing problems of the feet are often more than 40 years of age, use some form of tobacco, have decreased sensation in and blood flow to the legs and feet, anatomical deformities or a history of foot ulcers or previous amputation. To prevent foot complications, individuals with diabetes should check regularly for various foot conditions, such as bleeding corns and calluses, blisters, ingrowing toenails, dry and cracked skin, redness, swelling, warmth, pain over the legs, slow healing of wounds, and loss of sensation. With proper foot care, it is estimated that as many as half of the foot and leg amputations could be prevented. In addition, proper selection of footwear is very important.

18. Does the diet for those with diabetes differ from that of non-diabetic persons?

The diet for diabetic individuals is unique for each person. Diabetic people do need a special curated diet. Make sure that the diet is organic, healthy, gluten-free and maintains a healthy eating habit to control the blood sugar level. A healthy diet comprises complex carbohydrates (whole grain cereal) low in fat and has plenty of green leafy vegetables and fruits with rich intake of proteins. With proper planning, one can still enjoy a wide variety of favourite food in a disciplined meal plan.

19. Why it is important for people with diabetes to be physically active?

Physical activity delays or prevents the onset of type 2 diabetes. Studies have shown that physically active individuals have a 30–50% lower risk of developing type 2 diabetes compared to sedentary individuals. Physical activity helps to control the blood glucose level, weight, and blood pressure, reduce the cholesterol level and prevent cardiovascular disease.

20. Can diabetes lead to serious emergencies?

Yes, it can lead to serious and life-threatening medical emergencies. These can occur if the blood sugar is too high or too low. Diabetic emergencies are best treated in a hospital as quickly as possible.

21. What is hypoglycaemia and how can it be prevented and managed?

Hypoglycaemia (low blood sugar) is the most common complication seen in individuals with diabetes. The blood sugar level may suddenly become too low for various reasons, including vigorous physical activity, taking the wrong dose of insulin/anti-diabetic medicine or not eating enough or eating too late. It is usually mild and can be treated quickly by eating or drinking something with a high sugar content.

The symptoms of low blood sugar are usually non-specific and patients may feel some discomfort, sweating, palpitations, weakness, and giddiness. If possible, it is advisable to check the blood sugar at this time. If not, the patient should be given some sugar drink or fruit juice. Sugar or glucose is also useful in correcting low blood sugar. If the patient is unconscious, it is best to give intravenous glucose under medical supervision. Frequent falls in blood sugar are best avoided in all diabetic patients, especially in children and the elderly, by adjusting the dose of the anti-diabetic medications. If left untreated, it can get worse and lead to confusion or even coma.

22. How can diabetes be prevented and controlled?

The cause of type 1 diabetes is not known and it cannot be prevented with the current state of knowledge. Simple lifestyle changes can help in the preventing or delaying the onset of type 2 diabetes.

What can individuals do?

- Test your sugar levels daily. Non-invasive saliva and/or Blood Glucose test.
- Achieve and maintain a healthy body weight.
- Be physically active – at least 45 minutes of regular, moderate-intensity activity on most days. More activity is required for weight control.
- Eat a healthy diet of three and five servings of fruit and vegetables a day, and reduce the intake of sugar, salt, and saturated fats. Adopt vegetarian diet.
- Avoid tobacco use and harmful use of alcohol.
- Manage stress and other lifestyle irregularities.
- Test your glycated haemoglobin levels regularly.

What can communities and civil societies do?

- Create and maintain safe neighbourhoods for physical activity, and improve access to parks and playgrounds.
- Create awareness about diabetes, its complications, and prevention.
- Identify and support high-profile champions of change and community leaders, who will speak strongly for the needs and rights of people with diabetes.
- Advocate for physical activity and healthy diets in educational institutions and workplaces.

What can the private sector do?

- Ensure that healthy and nutritious choices are available and affordable for all consumers.

- Voluntarily reduce the sugar, salt, gluten and fat content of processed food. Remove packaged ready to eat meals. Provide more organic and vegetarian diet varieties.
- Avoid marketing unhealthy food and beverages, particularly to children.
- Ensure the availability of healthy food choices and support the practice of regular physical activity in the workplace by providing space for outdoor and indoor games and constructing gymnasiums.
- Encourage employers to adopt policies that support physical activity, such as group activity programs.

What can governments do?

- Recognize that diabetes is an important public health and development problem.
- Create public awareness about diet and physical activity through the mass media and other means.
- Create an enabling environment to promote physical activity, such as walking and playing spaces, adequate public transport, and sports, fitness and recreational facilities.
- Improve the availability of and accessibility to healthy and nutritious food through appropriate policies, including fiscal and legislative measures to promote intake of vegetables, fruits, and whole grains, and reduce the consumption of unhealthy food and beverages.
- Take necessary action to reduce unhealthy behaviours such as smoking and harmful use of alcohol.
- Regulate the marketing of unhealthy food, processed, gluten based, sugar-based, preservative induced foods as well sugar loaded non-alcoholic beverages to children and adults.
- Promote interventions to increase physical activity and promote healthy diets at schools, workplaces, and communities.
- Increase access to early detection and treatment of diabetes by increasing access to testing and affordable anti-diabetic medicines, including insulin.



Have questions about Sensing.Sugar?

1. What is non-invasive testing for Diabetes?

Non Invasive Saliva glucose testing is alternative to blood glucose measurement method. Saliva method does not require drawing blood for each test or puncturing the skin for adults and children. Saliva glucose is newly invented and introduced a method for testing of Type 2 Diabetes patients or Pre-diabetic patients. This method is also very useful for healthy lifestyle monitoring of personal health if you are not diabetic and simply want to be aware of preventative care.

2. How accurate is non-invasive saliva glucose testing versus Blood glucose meters?

Both Blood Glucose meter and non-invasive Saliva Glucose testing strips are within similar accuracy and tolerance ranges.

The minimum required standards as approved by the medical board is:

For blood sugars over 75 mg/dL (4.2 mmol/L): Accurate within 20%. For example, if your blood sugar is 200 mg/dL (11 mmol/L), the meter must read between 160 (8.8 mmol/L) and 240 mg/dL (13.3 mmol/L) for at least 95% of the time.

For Saliva glucose test strips: All readings are within 20% accuracy limit for all readings/measurements. Ideal reading conditions are for postprandial readings, i.e. 2 hours after each meal.

For blood sugars under 75 mg/dL (4.2 mmol/L): Accurate within 15 mg/dL. For example, if your blood sugar is 60 mg/dL (3.3 mmol/L), the meter must read between 45 mg/dL (2.5 mmol/L) and 75 mg/dL (4.2 mmol/L) for at least 95% of the time.

3. Do I still need to do Blood glucose tests if I use saliva strips for testing?

If your saliva test reflects normal readings you do not need to do any additional blood glucose tests. If your saliva glucose reading is high or borderline, it is highly recommended to perform your professional blood testing at pathology labs to verify your results. For peace of mind and convenience, we do recommend an alternative double check of your readings with your home blood glucose test as well.

4. How do I know if my Glucose range is High or Normal?

For the majority of healthy individuals, normal blood sugar levels are as follows: Between 4.0 to 6.0 mmol/L (72 to 108 mg/dL) when fasting. Up to 7.8 mmol/L (140 mg/dL) 2 hours after eating.

Level	mg/dL	mmol/L	Risk
Dangerously High	315+	17.4	Very High
High	280	15.6	High
High	250	13.7	High
High	215	11	High
Borderline	180	10	Medium
Borderline	150	8.2	Medium
Borderline	120	7	Medium
Normal	108	6	No Risk
Normal	72	4	No Risk
Low	70	3.9	Medium
Dangerously Low	50	2.8	High

Mean Blood Glucose

This document is not meant to be a prescription for the cure of the diabetic condition. Diabetes is a serious disease and requires medical consultation for diagnosis and understanding of tools and tests for regular monitoring.