

WIN over DIABETES




SingHealth **DukeNUS**
ACADEMIC MEDICAL CENTRE

Diabetes Centre



1,000

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Specialists**

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Medical Specialties

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Sub-specialties

SingHealth provides tertiary medical care across a comprehensive spectrum of over 40 medical specialties with the in-depth expertise of 150 sub-specialties.

Supported by a faculty of over 1,000 internationally-qualified medical specialists and well-equipped with advanced medical diagnostic and treatment technology, the group is recognised in the region for charting new breakthroughs in treatments.

As an Academic Medical Centre, we seek to transform patient care by integrating clinical services, teaching and research. Patients at SingHealth enjoy the benefit of treatment with a focus on quality and holistic medical care, in an integrated and multidisciplinary setting.



PATIENTS. AT THE HEART OF ALL WE DO.®



Diabetes in Singapore is a growing concern. It can deeply affect your quality of life if not well-controlled, and cause complications. The Ministry of Health has declared 'war on diabetes' and has committed to help Singaporeans live free from diabetes, as well as help those with the condition control it better. SingHealth fully supports this.

The SingHealth Duke-NUS Diabetes Centre aims to deliver better care and outcomes for our patients by adopting a new, transformational model of care.

We bring together different specialists and allied health professionals across SingHealth to organise care around you and your needs. This integrated model of care enables us to set new standards for diabetes-related patient care, education and research.

This booklet helps you to understand and manage your diabetes better. Contributed by the team from the SingHealth Duke-NUS Diabetes Centre of clinical specialists, advanced nurse practitioners and allied health professionals, the information and resources guides you through the decisions and challenges you may face. Learning as much as you can about diabetes is very important for your health and gives you the power to control it.

This booklet also serves as a ready reference for General Practitioners who manage patients with diabetes.

Together, we can **WIN OVER DIABETES!**

Dr Bee Yong Mong

*Head, SingHealth Duke-NUS Diabetes Centre
Senior Consultant, Department of Endocrinology,
Singapore General Hospital*



Diabetes Centre

The SingHealth Duke-NUS Diabetes Centre was formed in 2015 to oversee and coordinate the delivery of diabetes care within the SingHealth Hospitals and National Specialty Centres, including Singapore General Hospital (SGH), Changi General Hospital (CGH), Sengkang General Hospital (SKH), KK Women's and Children's Hospital (KKH), Singapore National Eye Centre (SNEC), and SingHealth Polyclinics (SHP). The Centre forms a unique platform for the collaborative work of a multidisciplinary team of healthcare professionals.

The Centre aims to meet the needs of our patients throughout the diabetes continuum of care; from prediabetes to late-stage diabetes with complications. We are dedicated to achieve the best outcomes for our patients by combining clinical expertise with the latest advances in treatment, research and education.

Our team of primary care physicians and specialists are experienced in the assessment and management of diabetes and the associated complications. They are supported by a strong and dedicated team of diabetes nurse educators, dietitians, pharmacists, podiatrists, medical social workers and psychologists.

Our multidisciplinary approach ensures that people with diabetes get comprehensive medical care, patient education, and aggressive prevention and management of complications.

Our clinical services are offered at the following locations:

- 1. Singapore General Hospital
Diabetes and Metabolism Centre (DMC)**
Tel: 6321 4377
- 2. Changi General Hospital**
Tel: 6850 3333
- 3. Sengkang General Hospital**
Tel: 6472 2000
- 4. KK Women's and Children's Hospital
Obstetrics Day Assessment Centre**
Tel: 6394 2097 / 6394 2098
- 5. Singapore National Eye Centre**
Tel: 6227 7266
- 6. SingHealth Polyclinics
(Bedok, Bukit Merah, Marine Parade, Outram, Pasir Ris,
Sengkang, Tampines, Punggol*)**
Tel: 6643 6969

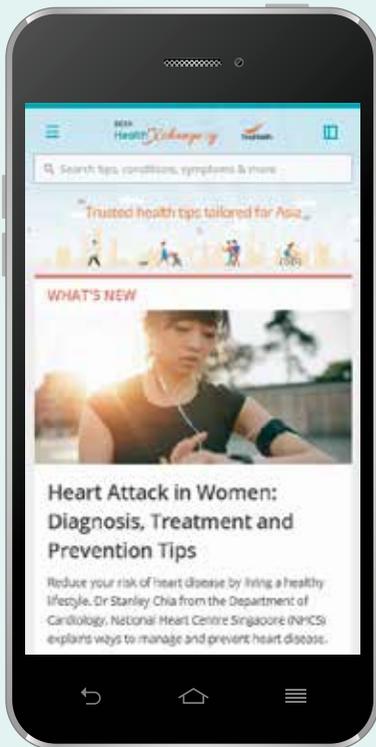
**Punggol Polyclinic will be opening in 2018.*

Find out more about the SingHealth Duke-NUS Diabetes Centre at

 [**www.singhealth.com.sg/diabetescentre**](http://www.singhealth.com.sg/diabetescentre)

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Disclaimer: All information provided within this publication is intended for general information and is provided on the understanding that no surgical and medical advice or recommendation is being rendered. Please do not disregard the professional advice of your physician.

THE BASICS OF DIABETES

What is diabetes?

Diabetes is a condition characterised by high glucose levels. Glucose comes from our food and is also produced by the liver. Glucose is the main source of energy for the body's cells and is transported through the blood stream. Glucose needs to enter cells to be used.

Insulin is the hormone that acts like a 'key' to allow glucose to enter cells. This uptake of glucose usually takes place in the liver and muscles.

If the pancreas does not produce enough insulin, or cells are not able to respond well enough to insulin, glucose is not able to enter the cells.

Glucose levels in the blood stream rise, resulting in diabetes.

Diabetes in Singapore

Singapore has the second-highest proportion of diabetes patients among developed nations.¹ Around 1 in 9 (or 11.3%) people in Singapore aged 18-69 have diabetes.²

1 in 3 Singaporeans have a lifetime risk of developing diabetes.³

3 Main types of diabetes

Type 1 diabetes occurs when the body is unable to produce insulin. It usually presents in children and young adults, but may also present in older adults.

Type 2 diabetes occurs when the body does not produce enough insulin or when the insulin produced does not work properly.

Gestational diabetes occurs when hormones produced during pregnancy result in the body cells being more resistant to the action of insulin.



¹ International Diabetes Federation (IDF), 2015

² The Ministry of Health Singapore, 2010

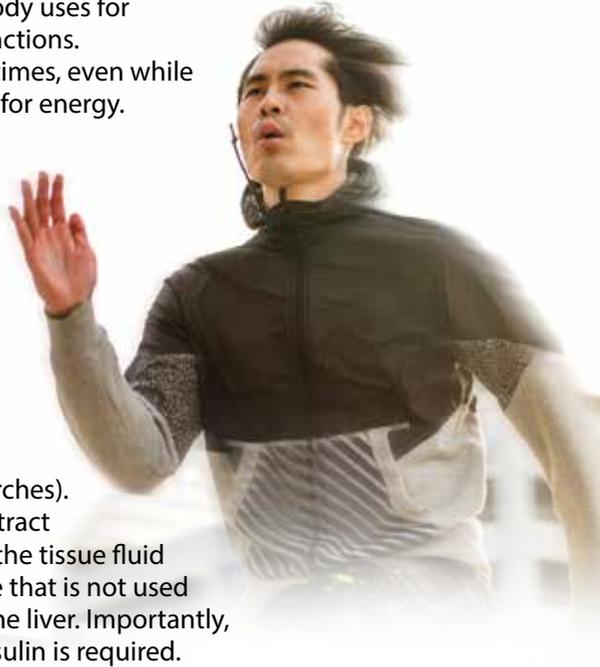
³ The Ministry of Health Singapore, 2017

Glucose - The body's fuel

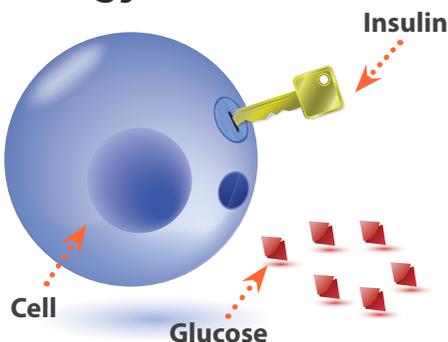
Glucose is a type of sugar that our body uses for energy required to perform body functions. Glucose is present in our body at all times, even while sleeping, since all cells need glucose for energy.

Without diabetes, glucose levels are kept very tightly between 4.0-6.0 mmol/L. **However, once diabetes develops, it becomes challenging to keep glucose levels within this range whilst avoiding frequent hypoglycaemia (low blood glucose).**

Glucose comes largely from carbohydrates (simple sugar and starches). Upon absorption from the digestive tract into the blood stream, it moves into the tissue fluid and eventually into the cells. Glucose that is not used immediately for energy is stored in the liver. Importantly, for glucose to move into the cells, insulin is required.



Insulin - The key to using glucose for energy



Insulin is a hormone produced by our pancreas. In those without diabetes, there is a constant supply of insulin produced so that glucose may enter into the cells. **When insulin is not available, glucose stays in the blood and tissue fluid.**

In those without diabetes, the pancreas produces insulin almost continuously, and in response to the amount of glucose in the blood. This is so precise that exactly the right amount of insulin is produced to keep blood glucose levels in a tight range.

5 Diabetes signs and symptoms

Early symptoms of diabetes may not be obvious, or there may not be any symptoms at all. Some of the symptoms of diabetes are listed below. You may want to consider seeing your doctor to find out whether you have diabetes if you have some of the following symptoms:

1 Excessive thirst and urination

Excessive thirst and urination are classic symptoms of diabetes.

When you have diabetes, there is too much glucose in your blood. Your kidneys usually filter glucose, but most of the glucose is reabsorbed, so that in those without diabetes, no glucose appears in the urine. But if the blood glucose levels are too high, the kidneys are unable to keep up and excess glucose will appear in the urine.

Glucose excretion into the urine will also draw out water into the urine. This increases urination and leads to dehydration, with more thirst to compensate for this fluid loss.





2 **Fatigue**

This can be due to many factors. Dehydration as a result of increased urination can cause fatigue. Moreover, the body's inability to use glucose for energy needs can cause fatigue.



3 **Weight loss**

Uncontrolled diabetes with high blood glucose levels can lead to weight loss. This is because you lose glucose (and therefore calories) through your urine.



4 **Blurred vision**

High levels of blood glucose pulls the fluid from the lenses of your eyes. This can affect the ability to focus.

In addition, uncontrolled diabetes for prolonged periods of time can cause significant damage to the retina. This in turn can also affect your vision.



5 **Slow-healing sores and frequent infections**

High glucose levels can lead to frequent infections and slow-healing wounds.

How to diagnose diabetes?

You can discuss with your doctor about having blood tests done to find out whether you have diabetes. The blood tests are:



1. Random blood glucose

This is a blood glucose sample that is taken without fasting. A random blood glucose of greater than 11.1 mmol/L is suggestive of diabetes.



2. Fasting blood glucose

A fasting blood glucose is normally measured after an overnight fast. A fasting blood glucose of 7.0 mmol/L or higher on separate occasions indicates that you have diabetes. Fasting blood glucose measured in an accredited laboratory is the preferred test for the diagnosis of diabetes. This test is easy to perform and is supported by strong evidence.



3. Oral glucose tolerance test (OGTT)

In this test, you will have a fasting blood glucose level taken, and asked to drink a standard amount (75 g) of a sugary drink. A fasting reading of > 7.0 mmol/L or a glucose reading of > 11.1 mmol/L 2 hours after this drink indicates that you have diabetes.

TYPE 2 DIABETES

Type 2 diabetes is caused by the body not producing enough insulin, or the insulin is there but it is not working properly. Hence, the blood glucose level is high.

7 Risk factors for type 2 diabetes

Researchers do not fully understand why some people develop type 2 diabetes and others do not. However, it is important to take note of some of the risk factors:

1. Weight

The more fatty tissue you have, the more resistant your body is to the action of insulin.

2. Inactivity

The less active you are, the greater your risk of developing diabetes. Physical activity helps you to control your weight, uses up glucose as energy and makes your cells much more sensitive to insulin.

Hence, it is important to have a healthy lifestyle to reduce the risk of developing type 2 diabetes.

3. Family history

Your risk increases if a parent or sibling has type 2 diabetes.

4. High blood pressure

High blood pressure of greater than 140/90 millilitres mercury (mmHg) is recognised as a risk factor for developing type 2 diabetes.

5. Abnormal cholesterol and triglyceride levels

If you have low levels of high-density lipoprotein (HDL) or good cholesterol, your risk of developing type 2 diabetes is higher.

Triglyceride is another type of fat carried in the blood. People with high triglyceride levels are at increased risk of developing type 2 diabetes. You can discuss with your doctor about checking your cholesterol and triglyceride levels.

6. Gestational diabetes

Your risk of developing diabetes is greater if you have had gestational diabetes. You are also at risk of developing diabetes if you have given birth to a baby weighing more than 4 kg.

7. Polycystic ovary syndrome

This is a condition associated with irregular menstrual periods, excessive hair growth and being overweight.

REVERSING

PREDIABETES

Healthcare professionals sometimes refer to prediabetes as impaired glucose tolerance (IGT) or impaired fasting glucose (IFG), or both, depending on what test was used for the detection and diagnosis.

Before people develop type 2 diabetes, almost all pass through the stage of prediabetes where the blood glucose levels are higher than normal, but not high enough to be considered as frank or overt diabetes.

Importantly, having prediabetes means that you are likely to progress on to diabetes in the near future. You can however take steps to reduce these risks.

There are no clear symptoms of prediabetes.

The only reliable method of diagnosis is by having blood tests done.

Some people may have a few of the symptoms of diabetes such as:

- Excessive thirst and urination
 - Fatigue
 - Weight loss
 - Blurred vision
- (Refer to pg 10 for diabetes signs and symptoms)*

How do I know if I have prediabetes?

	Normal	Prediabetes	Diabetes
Fasting glucose	< 6.1 mmol/L	6.1-6.9 mmol/L	≥ 7.0 mmol/L
2-hour plasma glucose level after oral glucose tolerance test (OGTT)	< 7.8 mmol/L	7.8-11.0 mmol/L	≥ 11.1 mmol/L

* **OGTT (oral glucose tolerance test):** 75 g of glucose, with blood glucose levels checked 1) after fasting, before the ingestion of glucose and 2) 2 hours after the ingestion of glucose

What can I do if I have prediabetes?

Lifestyle changes with modest weight loss (5-10% of body weight) and moderate-intensity physical activity (~30 minutes daily) are good recommendations to start with.

How to exercise

A reasonable target is 150 minutes per week of moderate-intensity exercise such as brisk walking and strength training.

You should start any new activity slowly and increase intensity and duration gradually as you become accustomed to the routine.

Other lifestyle tips:

Eat healthily and sensibly, avoid fad diets, and get adequate sleep and rest.



It has been shown unequivocally that structured programmes and intensive lifestyle modification programmes can help people learn proper techniques, establish goals, stay motivated, and can lead to a sustained reduction in the conversion from prediabetes to overt type 2 diabetes.



TYPE 1 DIABETES

What is type 1 diabetes?

Type 1 diabetes (T1D) is usually diagnosed in children and young adults and affects just 5% of all individuals with diabetes. However, it may also present in older adults.

In type 1 diabetes, the body is unable to produce insulin. The body breaks down the sugars and starches into simple sugar known as glucose, which is required for energy. Insulin is the hormone that allows glucose to enter into various parts of the body from the bloodstream.

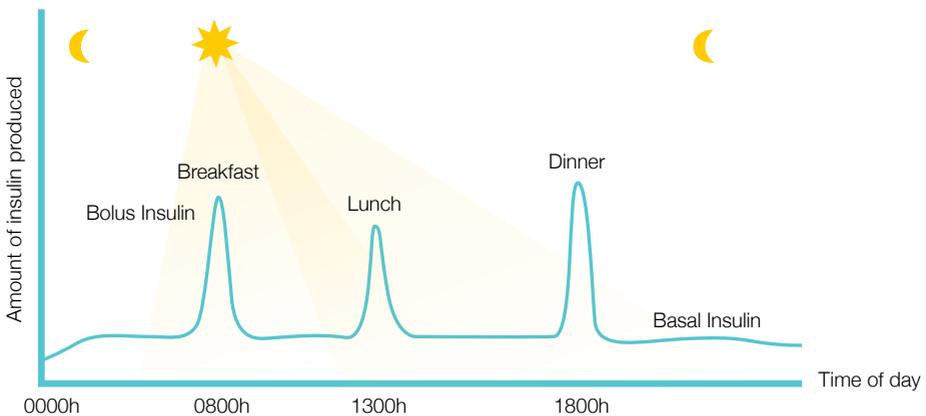
Whilst type 1 diabetes is irreversible, with insulin replacement, individuals may learn to manage their condition and live long, healthy lives.



Insulin replacement: Basal and bolus insulin

During sleep or in between meals, small amounts of insulin are produced every few minutes (**basal insulin**), 24 hours of the day.

During mealtimes, larger amounts of insulin are produced in response to glucose loads (**bolus insulin**). *See figure below.*



Insulin production over 24 hours, during the fasting state (basal insulin) and in response to food intake (bolus insulin)

In those with type 1 diabetes, there are thus 2 components to insulin replacement: the basal insulin dose and the bolus insulin dose.

Basal (or background) insulin provides the constant supply of insulin between mealtimes and during sleep, while the bolus insulin is used to cover the post-meal glucose rise following ingestion of carbohydrates at mealtimes.

Individuals with type 1 diabetes ought to be on a basal-bolus regimen with quick-acting insulin delivered in multiple doses throughout the day.

(Refer to pg 52 for the types of basal and quick-acting insulins available)

Another mode of delivery of insulin is through continuous subcutaneous insulin infusion via an insulin pump.

(Refer to pg 65 for more information on insulin pumps)



Type 1 diabetes Guide to self-management

As the individual with type 1 diabetes has to make a decision about his/her mealtime insulin doses at every single meal/snack, it is important that he/she is equipped with the knowledge and skills for self-management.

This would include knowing how to deal with situations like:

- Hypoglycaemia (low blood glucose)
- Sick days
- Diabetes and exercise
- Diabetes and alcohol consumption

Most individuals with type 1 diabetes spend only a sum total of 4 hours on healthcare professional encounters per year.

The rest of the time, they are left to self-manage and make decisions on a daily basis, 24 hours of the day.

Knowing how to self-manage proficiently becomes crucial.



How to self-manage type 1 diabetes well

In order to effect self-management well, the person with type 1 diabetes needs to know:

- 1 What blood glucose targets they ought to aim for pre-meals
- 2 How their insulin works to lower their blood glucose level
- 3 The carbohydrate content of their food and the amount of quick-acting insulin required to cover this

This is because carbohydrates are the main macronutrient that result in increased glucose levels post-meals. Hence, knowing exactly how much carbohydrates are in each meal becomes important for deciding on the mealtime quick-acting insulin dose.

Checklist for type 1 diabetes

- Get your blood glucose levels measured**
 This is known as HbA1c and should be done at least annually, preferably every 3 to 4 months. The HbA1c measures your overall glucose control over the preceding 3 months and helps you and your diabetes healthcare team to set your own target.
 In addition, performing regular self-monitoring of capillary blood glucose levels will allow you to observe your glucose levels daily and manage your insulin dose titrations well.
- Have your blood pressure measured and recorded at least once a year — know your personal target**
- Have your blood fat profile (cholesterol and triglycerides) measured at least every year**
- Have your eyes, kidneys, legs and feet checked**
(Refer to pg 80 for diabetes complications annual screening)
- Get individual, ongoing dietary advice**
 Counting carbohydrates is an important part of ongoing self-management and insulin dose titration. In addition, you should have ongoing support and information you need to manage your weight and to maintain a healthy, balanced diet.
- Get emotional and psychological support**
 Living with a long-term condition can be difficult. Don't be afraid to talk about your issues and concerns with your specialist healthcare team.
- See diabetes healthcare professionals**
 Managing type 1 diabetes is complex and requires input from various healthcare team members, including the diabetes physician, diabetes nurse educator, and dietitian.
- If you smoke, get support and advice on how to quit**
 Diabetes itself increases your risk of heart disease and stroke, and smoking further increases this risk.
- If you have type 1 diabetes and are planning to have a baby, get guidance and specialist care on planning for a healthy pregnancy**
 Some medications may need to be stopped or changed prior to pregnancy. Your diabetes control has to be a lot tighter before and during pregnancy, and you will need to be monitored closely throughout pregnancy.

The SgDAFNE Programme

(Dose Adjustment For Normal Eating)

At Singapore General Hospital (SGH), we conduct a structured education programme in both self-management and advanced carbohydrate counting known as the SgDAFNE (Dose Adjustment For Normal Eating) course.

We are currently the only centre in Asia that runs this programme. This course is accessible to all those with type 1 diabetes.



Singapore
General Hospital
SingHealth

For more information on the SgDAFNE Programme:
Email: gsodia@sgh.com.sg



HYPOGLYCAEMIA

(LOW BLOOD GLUCOSE)

Hypoglycaemia (low blood glucose) happens when blood glucose falls below normal levels. **A blood glucose level of < 4.0 mmol/L is considered hypoglycaemia.**

Hypoglycaemia may happen to anyone with diabetes, but is more common in people who take insulin and certain types of oral diabetes medications.

If you are on treatment for diabetes, hypoglycaemia may occur when you:

- Take too much insulin, or certain oral glucose-lowering pills
- Do not eat enough food
- Wait too long between meals, or skip a meal
- Exercise more than usual
- Drink excessive alcohol, or drink alcohol without food

Symptoms of hypoglycaemia are unpleasant and may interfere with your daily activities. Serious hypoglycaemia may cause accidents, seizures, coma and death. Fortunately, there are ways to recognise, treat, and prevent hypoglycaemia.



Hypoglycaemic symptoms are important warning signs that you have low blood glucose.

Early signs and symptoms of hypoglycaemia include:

- Shakiness
- Sweating
- Fast heartbeat
- Headaches
- Dizziness
- Tingling sensation in your fingers, lips or tongue
- Feeling hungry or nauseous
- Feeling nervous or anxious
- Feeling irritable

Severe symptoms can include:

- Weakness and difficulty walking
- Blurred vision
- Confusion and abnormal behaviour
- Unclear speech
- Loss of consciousness
- Seizures

If you have severe symptoms, you or the people around you should call for an ambulance immediately.

Hypoglycaemia may happen while you are sleeping. Some clues that you may be experiencing hypoglycaemia while asleep include:

- Profuse sweating while sleeping
- Seizure
- Feeling tired or confused, or having a headache after waking up

How to be prepared to deal with hypoglycaemia:

- ✓ Monitor your blood glucose levels frequently
- ✓ Carry quick-acting carbohydrates with you at all times, so that you are always prepared to treat hypoglycaemia
- ✓ Tell your family and friends what symptoms to look out for and what to do, in case you are not able to treat hypoglycaemia yourself

How to treat low blood glucose using the 15/15 rule

STEP 1 If you experience symptoms of hypoglycaemia, check your blood glucose using your glucometer. If your blood glucose is < 4.0 mmol/L, eat or drink 15 g of fast-acting carbohydrates.

Examples of fast-acting carbohydrates include glucose tablets, regular soft drinks and fruit juice. If you have symptoms of low blood glucose, but cannot check your blood glucose immediately, eat or drink 15 g of fast-acting carbohydrates to be safe.

Avoid using these types of foods to treat low blood glucose, as it will take too long to increase your blood glucose levels:

- Any food or drink containing fat or protein
- Any item that requires a lot of prolonged chewing/sucking

STEP 2 Wait for 15 minutes, and then re-test your blood glucose.

STEP 3 If your blood glucose is still low (< 4.0 mmol/L), repeat steps 1 to 3. If your blood glucose is 4.0 mmol/L and above, proceed to step 4.

STEP 4 Blood glucose levels may fall again about 1 hour after you have treated your hypoglycaemia. **If your next meal is more than 1 hour away, eat an additional snack containing 15 g of longer-acting carbohydrate.**

Examples of these include:

- 3 pieces of biscuits
- 1 slice of bread



When should I go to the hospital?

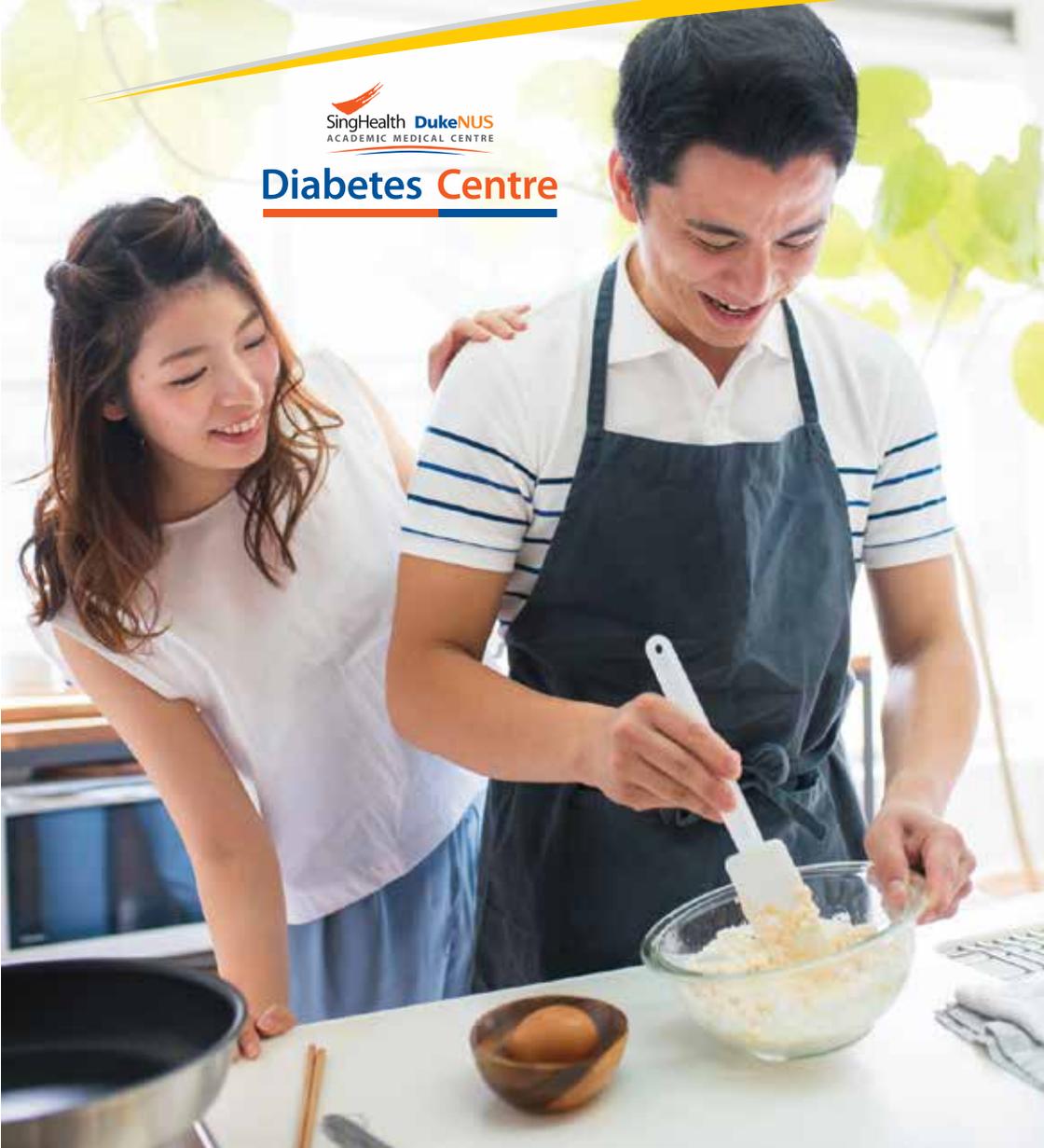
A family member or friend should take you to the hospital or call an ambulance (995) immediately if you:

- Continue to have low blood glucose (< 4.0 mmol/L) after repeated treatments with fast-acting carbohydrates
- Have a seizure
- Are unconscious because of a hypoglycaemia episode

LIVING WELL WITH DIABETES


SingHealth DukeNUS
ACADEMIC MEDICAL CENTRE

Diabetes Centre



KNOWING

MY ABCs

What are the ABCs of diabetes?

If you have diabetes, the most important thing you can do is to control your 'ABC':

- **A stands for HbA1c**

HbA1c is a blood test that shows what your average blood glucose has been over the last 3 months.

- **B stands for Blood Pressure**

If you have diabetes, controlling your blood pressure is just as important as controlling your blood glucose. High blood pressure puts you at risk for kidney disease, heart attack and stroke.

- **C stands for Cholesterol**

Cholesterol is a substance found in the blood. LDL or 'bad' cholesterol can build up and clog your blood vessels. It can cause a heart attack or a stroke. HDL or 'good' cholesterol helps remove cholesterol from your blood vessels.

What should my diabetes ABC targets be?

Your ABC targets will depend on:

1. How severe your diabetes is
2. How old you are
3. What other health problems you have

Ask your doctor what your targets should be. Many people with diabetes aim for:

- A1c level < 7%
- Blood pressure < 140/90 mmHg or lower in some cases
- LDL cholesterol level < 2.6 mmol/L (100 mg/dL) or lower in some cases

Why are my diabetes ABCs so important?

Compared with people who do not have diabetes, **people who have diabetes are 2-3 times more likely to have a heart attack or a stroke. People with diabetes are also much more likely to get kidney disease.**

By keeping your ABCs under control, you lower your risk of these problems.



How can I control my diabetes ABCs?

You should work together with your doctor to create a plan to keep your ABCs under control. Your plan might include:

1. Make the right choices for you

Choices you make everyday about the foods you eat and physical activities can have a big impact on your ABCs and your general health.

Here are some things you can do:

- ✓ Make healthy food choices
- ✓ Be active
- ✓ Lose weight
- ✗ Stop smoking
- ✗ Avoid alcohol

Many of the lifestyle changes above can improve all 3 ABCs. For instance, being active and losing weight can help control blood glucose, blood pressure and cholesterol levels.

2. Take your medications

Most people with diabetes take medications everyday to control their blood glucose, blood pressure and cholesterol levels.



Ask your healthcare team:

1. What your HbA1c, blood pressure and cholesterol levels are
2. What your ABC targets should be
3. What can you do to reach your targets



WINNING WAYS IN NUTRITION



What should I eat if I have diabetes?

Nutrition is an integral part of diabetes care. Rather than a restrictive diet, a diet suitable for diabetes is simply a healthy eating plan that is individualised according to your requirements and lifestyle.

People with diabetes do not need to go on a special diet.

You may have to modify your diet, rather than overhaul it. If you have diabetes, your doctor would likely recommend that you see a dietitian to guide you on dietary changes that can help you control your blood glucose levels and manage your weight.

It is important that you understand how different foods affect your blood glucose levels, especially carbohydrates, since it is the nutrient that has the greatest effect on your blood glucose levels.

Steps to effective diabetes nutrition:

- ✓ **Understand the role of the various food nutrients** in diabetes management and how they affect blood glucose levels (pg 27)
- ✓ **Keep track of the amount of carbohydrates you consume** by using carbohydrate counting techniques (pg 29)
- ✓ **Reduce and maintain weight** within the desirable weight range to improve insulin resistance and achieve better blood glucose control (pg 33)

3 Steps to effective diabetes nutrition

1

Understand how food affects blood glucose levels



Carbohydrates

Carbohydrates give you energy and should not be avoided. They should be included as part of a healthy eating plan.

For optimal diabetes control, one must recognise that **quantity and quality of carbohydrates are to be considered**. Not all carbohydrates affect your blood glucose levels the same way.

The more refined the carbohydrate, such as sugar, the faster the glucose is released into your blood stream. This can cause a surge in blood glucose levels, resulting in unstable blood glucose profiles. Thus, you have to watch out for refined carbohydrates such as sugary drinks and sweets.



Choose starchy carbohydrates

Starches release glucose into the blood stream at a slower rate compared to sugars, thus providing more stable and sustainable energy levels. This not only results in better blood glucose profiles, it is also better for appetite control.

Examples of starchy carbohydrates include rice, noodles, pasta, cereals and starchy vegetables such as potatoes.





Protein

It is also important to pay attention to the other nutrients in your diet. Protein foods like chicken and fish do not contain carbohydrates, so they will not raise your blood glucose levels.

Some foods contain a combination of protein and carbohydrates. These include milk and dairy products and plant-based protein foods such as beans, dhal and lentils.

These should be accounted for as part of your carbohydrate intake and allowance.



Fibre

It is also important to increase fibre intake as fibre is known to slow carbohydrate digestion and glucose absorption, leading to better blood glucose control.



Small changes such as switching to brown rice and wholegrains will help.

Opt for brown rice, wholewheat noodles and pasta, wholegrain breads and oats in your diet, as these contain more helpful fibre.



Fat

Fat does not convert to glucose when digested but delays stomach-emptying and slows the digestion of carbohydrate in a meal.

This keeps blood glucose levels elevated for longer, making it difficult to keep your blood glucose levels within the desirable range.

Fat is also very calorie-dense. Reduce your total fat intake!

2

Keep track of carbohydrate intake

Knowing your individualised requirements for daily caloric intake, including carbohydrate portions, is important when you have diabetes. There are a few different approaches and methods to planning a diabetes eating plan to help you keep your blood glucose levels within the normal range.

Your dietitian will help you find a method that best works for you, paying special attention to serving size of carbohydrates. Using household measures is one approach for carbohydrate estimation.

Carbohydrate counting is the most widely used method of meal planning today. It is based on the principle that all types of carbohydrates are digested, with the majority being absorbed into the blood stream as molecules of glucose. There are 2 main types of carbohydrate counting:

1. Basic carbohydrate counting involves following a meal plan with consistent carbohydrate distribution throughout the day. The even distribution of your carbohydrate intake allows for stable blood glucose levels. Carbohydrate alternatives/ portions will be available to you to provide for a flexible meal plan.

2. Advanced carbohydrate counting (adjusting insulin for carbohydrate intake) is a system that may be used in individuals with type 1 diabetes or type 2 diabetes (who are on basal and bolus insulin regimens). This allows for an individual to adjust mealtime insulin boluses for variable amounts of carbohydrate eaten at each meal. Accurate carbohydrate counting is essential for accurate insulin dosing.

The method that will best suit you will depend on:

- The type of diabetes you have
- The type of medications you may be on for your diabetes treatment

A dietitian can calculate your individualised requirements and teach you carbohydrate counting techniques for more food choices in your diet. If you are on insulin, he or she can teach you how to count carbohydrates at each meal or snack and adjust your insulin dose accordingly.

What is glycaemic index?

Glycaemic index (GI) is a relative ranking of carbohydrates, based on a scale of 0 to 100, according to the extent and rate at which they raise blood glucose levels after consuming carbohydrate food.

Carbohydrates with low GI values (55 or less) are more slowly digested, absorbed and metabolised, and result in smaller fluctuations in blood glucose and insulin levels. This results in favourable blood glucose profiles.

In reverse, foods with high GI values such as soft drinks and juices are those which are rapidly digested, absorbed and metabolised. This results in large fluctuations and peaks in blood glucose levels which may lead to unstable and less desirable blood glucose profiles.



The glycaemic index (GI) of food is extremely variable from one hawker to the next.

Recipes differ. The amount of fat used during cooking will vary, and the amount of sauces and gravies used during cooking and at the point of service will differ.

The GI of foods can change, depending on factors such as how they are processed and prepared, ripeness, and other foods they are eaten with. *(Refer to pg 31 to learn more about the factors affecting GI)*

What affects the GI of a food item?

Not all carbohydrates are created equal with respect to their immediate impact on our blood glucose levels. There are several factors that affect GI of a food item.



1 Processing

Food processing affects the GI of a particular food. The more processed a food product is, the faster it digests.

The cell structures of some grains such as legumes are relatively resistant to disruption and help prevent breakdown of the starches inside their cells. Therefore, legumes have lower GI values, provided that they have not been overcooked.

Similarly, the sturdiness of the cell structures of wholegrains tends to give them lower GI values too. Wholegrains, when ground into flour, make the starch more susceptible to breakdown, increasing their GI value.

The more the natural integrity of a grain becomes disrupted by processing or cooking, the more its GI value is likely to increase.

2 Cooking methods

The GI of a carbohydrate food item is greatly impacted by cooking processes.

Consider steamed rice and rice porridge: 1 bowl of steamed rice and 2 bowls of rice porridge both contain similar amounts of carbohydrate in the form of starch, but the nature and form of the starch in the porridge allows more of the starch to be exposed to salivary enzymes and the digestive system.

This allows for the starch to be broken down to glucose and absorbed into our blood stream at a faster rate than the starch from the white rice. Therefore, comparing equal portions of rice and rice porridge (gram for gram of carbohydrate content) the rice porridge will have a higher GI than white rice.

Overcooking your carbohydrate food will also alter the GI of that carbohydrate food itself.

Pasta that is cooked al dente has a lower GI than pasta cooked for a longer duration. The choice of sauce used will alter the GI of the dish further.

3 Degree of ripeness

For natural foods such as fruits, even the **degree of ripeness of the particular fruit can affect its GI.**



Are there any limitations to using GI?

- 1. Individual variations in GI response:** Rate at which different individuals digest carbohydrates can vary, leading to individual differences in glycaemic response. This means that GI lists may not be reliable.
- 2. Combining different carbohydrate foods** with different individual GIs also alters the overall GI of that meal.
- 3. A composite meal with protein and added fat** for cooking also alters the GI of the meal itself.
- 4. Not all low GI foods are healthy food choices.** Fat lowers the GI of a food. Take chocolate for example. Chocolate has a lower GI because of its fat content, which slows the absorption of glucose into the blood stream but chocolate is very energy-dense and very calorific, also because of its fat content. This will not be to your favour, especially if you are trying to lose weight.

So, is it ok to focus on GI alone?

Relying and focusing on GI alone is not a foolproof method to achieving optimal glycaemic control.

Focusing on GI alone could lead to your diet being high in fat and calories, and being unbalanced.

This is because GI does not consider total macronutrient intake. It is the total amount of caloric intake that leads to weight gain and increased insulin resistance, and makes it harder to achieve optimal glycaemic control. In addition, it may increase your risk of heart disease.

Monitoring the total amount of carbohydrates you consume has a far greater and positive impact on overall blood glucose control than focusing on GI alone.

Try not to exceed your carbohydrate requirements for the day.

3

Manage weight for better blood glucose control

A great number of individuals are overweight when they are newly-diagnosed. The extra body fat increases insulin resistance, making it difficult for your body to utilise insulin effectively.



Losing just 5-10% of your weight can help you lower your blood glucose levels, blood pressure and cholesterol levels, as well as HbA1c.

Keeping your weight within the ideal weight range or achieving a significant weight loss is recommended particularly if you have type 2 diabetes.

For Asians, a body mass index (BMI) of $> 23 \text{ kg/m}^2$ is considered overweight.

Losing weight and eating healthier can have profound effects on your overall mood and sense of wellbeing.

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)} \times \text{Height (m)}}$$

BMI Categories (Singapore)

BMI (kg/m ²) for adults	Weight categories	Health risk
27.5 and above	Obese	High risk
23-27.4	Overweight	Moderate risk
18.5-22.9	Normal weight	Low risk
Below 18.5	Underweight	Risk of nutritional deficiency diseases and osteoporosis

Calorie counting for weight loss

Calories are a measure of energy normally used to measure the energy content of the food and beverages you consume. If you have diabetes, make a positive difference to your health by learning to count calories.

It is important to know how much calories you require daily – regardless of whether you need to lose weight or maintain your weight.



The exact amount of calories that individuals with diabetes should consume depends on a number of factors including:

- Gender
- Age
- Activity level
- Current weight and height
- Weight history
- Medical condition

Your dietitian can help you finetune the ideal caloric target for you to achieve a sustainable weight loss while managing your blood glucose levels.

Just because a particular food is carbohydrate-free does not mean that one should eat unlimited amounts of it.

Carbohydrate intake is not the only consideration for individuals with diabetes. Knowing your requirements for protein and fat is important too. Excessive intake of any macronutrient will lead to weight gain.

The optimal balance of macronutrients should be planned in consideration of delaying or preventing diabetes-related complications.



Avoid making drastic changes to your meal plan on your own.

Attempting to do drastic adjustments to your total caloric intake, including carbohydrate intake without proper guidance, may result in undesirable blood glucose levels, including hypoglycaemia (low blood glucose).

As such, a weight-reducing diet plan should ideally be planned under supervision.



Food labels - Count it right

If you are eating packaged food, you can tell how much carbohydrate it contains and decide how much of it you can eat by looking at the food labels.

PAY ATTENTION TO:

Look at the **servicing size**. There can be more than one serving in the package, so if you are eating a larger serving, you will need to multiply the information on the label accordingly.

Look at the **total carbohydrate** per serving. This includes carbohydrate from sugar, fibre and starch.

Nutrition Facts	
Serving Size 100 g	
Amount Per Serving	
Calories 250	Calories from fat 10
% Daily Value*	
Total Fat 4%	4%
Saturated Fat 1.5%	4%
Trans Fat	
Cholesterol 50mg	28%
Sodium 150mg	15%
Total Carbohydrate 10g	3%
Dietary Fiber 5g	
Sugars 3g	
Protein 16%	
Vitamin A 1%	Vitamin C 3%
Calcium 2%	Iron 2%
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.	

WATCH OUT FOR:

If you are trying to lose weight, choose foods that are low in **calories**.

To reduce the risk of heart disease and stroke, look for foods that are low in **saturated and trans fats**.

If you have high blood pressure, look for foods that are low in **sodium**.

'Sugar-free' or 'No sugar added' labels do not mean that the food is carbohydrate-free.

HEALTHY NUTRIENTS TO LOOK OUT FOR:

Look for foods with > 4 g of **fibre** per serve. High-fibre foods slow the digestion of carbohydrates.

Choose **monounsaturated and polyunsaturated fats**, over saturated or trans fat.



Can I have alcohol if I have diabetes?

Alcohol can interfere with your meal plan and blood glucose control, especially if you're taking insulin or medication for your diabetes.

If you must drink, limit yourself to:

- 1 drink or 1 unit of alcohol a day (for women)
- 2 drinks or 2 units of alcohol a day (for men)

1 unit of alcohol is defined as any drink that provides 10 g of alcohol.

This translates to:



or



or



If you have sub-optimally controlled diabetes, try to abstain from alcohol.

It is important to note that alcohol consumption can increase your risk of hypoglycaemia (low blood glucose levels). This is dangerous particularly when coupled with some diabetes medications. Consult your doctor or dietitian before consuming alcohol.



Can I have durians if I have diabetes?

Yes, as with all fruits, durians can be consumed if you have diabetes. Two medium seeds is approximately one serving and would provide 15 g of carbohydrate. **Exercising portion control is essential!**



10 COMMON DIABETES DIET MYTHS AND FACTS

1 MYTH **Starchy foods are off limits and should be avoided.**
FACT Carbohydrate foods, particularly starchy foods such as rice, bread, noodles and cereals, form a major component of the body's energy source. All starchy foods break down to glucose, which is the body's preferred source of energy. The key is knowing how much your personalised requirements for carbohydrates are. **Choose starchy foods that are high in fibre such as wholegrains.**

2 MYTH **All 'sugar-free' products are calorie-free food.**
FACT **Not all 'sugar-free' products are calorie-free.** Some sugar-free products such as sugar-free biscuits also contain carbohydrate in the form of starch and can still increase your blood glucose levels upon consumption.

Don't fall trap to marketing gimmicks. There is no need to purchase specialty 'diabetic products'. You may be able to consume regular food as part of a sensible eating plan.

3 MYTH **People with diabetes should never consume sugar.**
FACT With good diabetes control (evidenced by good HbA1c and overall good capillary blood glucose levels), and **by learning carbohydrate counting with the added knowledge of your personalised requirements, you may be able to include some sugar as part of your daily eating plan**, without compromising on your glycaemic control. Work with your dietitian.

4 MYTH **Bitter-tasting food will help lower blood glucose levels.**
FACT **Bitter-tasting foods such as bitter melon will not help lower your blood glucose levels.** Glucose levels in your blood are driven by the amount of carbohydrates consumed. The key to controlling your blood glucose levels is to have a good understanding of your individualised carbohydrate requirements and keeping to it.

5 MYTH FACT

Switching to wholegrain rice means I can eat more rice.

The carbohydrate content of wholegrain rice is similar to regular rice. Wholegrain rice provides more fibre, making it a better choice for diabetes.

Wholegrain rice is a better choice for diabetes as it provides more fibre.



6 MYTH FACT

I can eat as much protein as I want, as long I cut down on my carbohydrate intake.

Excessive intake of any nutrient can lead to weight gain. Increased protein intake will also invariably increase your intake of fat. The key is to have a good understanding of your personalised requirements for protein and to keep within limits.

7 MYTH FACT

It's ok to eat my favourite sweets when I have hypoglycaemia.

Hypoglycaemia should be treated appropriately with only 15-20 g of carbohydrates (for a blood glucose reading of < 4.0 mmol/L).

This carbohydrate should be fast-acting carbohydrates in the form of juice, soft drinks, sugar or appropriate jellied sweets. **A hypoglycaemia episode is not an excuse to eat your favourite sugary snacks uncontrollably. You will be at risk of over-treating and causing a spike in your blood glucose levels.**

8 MYTH FACT

Fat does not matter, so I can ignore the fat content in my meals.

Fat does not have a direct impact on blood glucose levels. However, a large amount of fat in a meal can delay stomach-emptying and slow the digestion of carbohydrate, keeping your blood glucose levels elevated for longer, making it difficult to keep your blood glucose levels within the desirable range.

Fat provides nearly twice as many calories than carbohydrates and protein (gram for gram). This is not helpful for individuals hoping to shed some weight. Consuming too much saturated fat may also lead to undesirable lipid profiles, increasing your risk of cardiovascular disease.

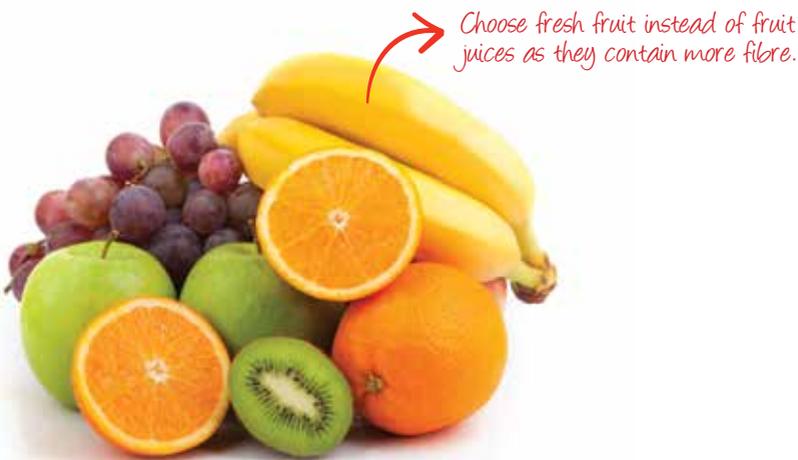
9 MYTH FACT

People with diabetes shouldn't eat fruits.

People with diabetes should eat fruits. Though fruits contain carbohydrates, they should be eaten as they are rich sources of antioxidant vitamins, minerals and are also a source of fibre.

There is no 'best' or 'worst' fruit to eat for diabetes. Learning carbohydrate counting techniques will allow you to fit any fruit into your daily eating plan.

- Consume 2 portions of fresh fruit a day.
- Choose fresh fruit instead of canned fruit and juices.



10 MYTH FACT

Losing weight will definitely cure my diabetes.

If you are overweight, losing weight may not definitely cure your diabetes. Losing 5-10% of your initial weight may help you control blood glucose levels by improving insulin resistance. In addition, keeping the weight off may also help control your blood lipids and blood pressure.

8 GOLDEN RULES FOR A HEALTHY DIET

Consult your dietitian for help with your daily caloric requirements. This is very individual, and would depend on several lifestyle factors as well as your current medical condition.

1

A balanced diet is key. Fill half your plate with fruits and vegetables, a quarter with starchy carbohydrates and another quarter with protein or dairy products.

2

Your total caloric intake matters! Opt for healthier cooking methods and cut back on the use of fats and oils.

3

Count your carbohydrate intake to prevent from eating beyond your carbohydrate targets.

4

Choose wholegrain starchy foods such as brown rice, chapatti, oats and wholegrain cereal and noodles/pasta made of wholewheat as they are high in fibre and will allow glucose to be released into the blood stream at a slower rate, resulting in better blood glucose profiles.

5

Keep foods whole e.g. choose wholegrain over white rice and whole fruit over fruit juice.

6

People with diabetes can eat fruit. Choose whole fruit rather than juices. Keep within the recommended portions for the day.

7

Watch out for sauces, gravies and starchy soups as these also contain carbohydrates.

8

Remember that not all low GI foods are healthy choices. You will need to also consider the fat content and calories.



PLUS:



Choose water



Use healthier oils



Be active

'My Healthy Plate' is a friendly visual tool on healthy eating habits designed for Singaporeans by the Health Promotion Board (HPB).

EXERCISE

A WINNING WEAPON AGAINST DIABETES

Maintaining regular weekly exercise and physical activity is a key part of living well with diabetes along with a proper meal planning approach and taking your diabetes medications as prescribed.

Physical activity increases your body cells' sensitivity to insulin, making insulin work better for you in moving glucose from your bloodstream into the cells to be used as energy.

Your body cells can also remove glucose from your blood using a mechanism totally separate from insulin during exercise. Exercise has the potential to consistently lower your blood glucose levels and eventually lower HbA1c. This may result in you requiring fewer diabetes medications or less insulin.

Special note: **Exercise and risk of hypoglycaemia**

If you have **type 1 diabetes or type 2 diabetes and you are on insulin therapy**, you are at risk of early (during exercise) and late onset (hours after or overnight) hypoglycaemia (low blood glucose) after exercise.



How your blood glucose levels behave will also depend on the following factors:

- Type of exercise (aerobic or anaerobic)
- Duration of exercise
- Intensity of exercise

Depending on these factors and your pre-exercise blood glucose levels, you may be required to take additional carbohydrates or reduce insulin, or do both.



How much exercise is recommended?

If you have type 2 diabetes, at least 150 minutes of accumulated moderate intensity aerobic physical activity per week as well as resistance strength training is recommended.

To achieve 150 minutes of physical activity in a week, try to do 30 minutes of exercise 5 times a week.

In addition, physical activity paired with a well thought-out meal planning approach and nutrition intervention for weight loss has been shown to help people achieve:

- Weight control
- Improved blood glucose levels
- Improved blood pressure
- Improved lipid profile

Before embarking on an exercise regimen, it is essential that you receive prior education on exercise management strategies.

If you want to be active, or you are experiencing hypoglycaemia with activity, you should seek advice from your diabetes care team.



BLOOD GLUCOSE

MONITORING

Why do I need to monitor my blood glucose levels?

One of the main aims of diabetes treatment is to keep your blood glucose levels within target range.

Blood glucose monitoring will:

1. Provide a measurement of your blood glucose level at a given time
2. Determine if you have hypoglycaemia or hyperglycaemia at a given time
3. Enable you to know how your lifestyle and medicine regimen affect your blood glucose control
4. Help you and your diabetes health care team to evaluate and determine the best management strategy for your diabetes

Which blood glucose meter (glucometer) should I use?

Glucometers (blood glucose meters) are available for sale in the retail pharmacy of hospitals and polyclinics. Glucometers come in a variety of sizes, different storage capacity and features.

Some glucometers can also be used to check for the presence of ketones which is useful for people with type 1 diabetes or those who are otherwise susceptible to ketoacidosis.

Choose a glucometer that suits your needs. If you are unsure which glucometers to buy, ask your doctor or nurses for a recommendation.

5 Steps of blood glucose monitoring



STEP 1

Wash your hands.



STEP 2

Insert test strip.



STEP 3

Use your lancing device on the side of your fingertip to get a drop of blood.



STEP 4

Touch and hold the edge of the test strip to the drop of blood, and wait for the result.



STEP 5

Your blood glucose level will appear on the glucometer's display.

When should I check my blood glucose levels?

Blood glucose levels can be checked pre-meals or post-meals, depending on your discussion with your diabetes healthcare team.

Recommended timing	Rationale
 <p>After fasting In the morning after an overnight fast (8-12 hours) before you eat or drink anything</p>	<p>It determines what is going on at night, especially when coupled with a bedtime reading the night before.</p>
 <p>Pre-meals 0-30 minutes before meals</p> <p>To correctly interpret a pre-meal reading, the previous meal or snack must be more than 4 hours earlier</p>	<p>It gives you a baseline reading of your blood glucose level before you eat.</p> <p>Pre-meal readings also inform you whether the rapid-acting pill or rapid-acting insulin for your last meal was adequate.</p>
 <p>Post-meals Check 2 hours after finishing your meals</p>	<p>This gives an estimate of how much a person's blood glucose rises in response to certain food items.</p>
 <p>Bedtime Check more than 3 hours after dinner with no supper or snacks in between</p>	<p>To detect any bedtime hypoglycaemia (low blood glucose) and prevent nocturnal (night-time) hypoglycaemia.</p> <p>Your bedtime reading along with the next day's fasting reading will help you understand what happens overnight to your glucose.</p>
 <p>2-4 am</p>	<p>To detect night-time hypoglycaemia, especially if you have symptoms during your sleep.</p> <p>Your doctor or nurse may ask you to do this reading if they suspect night-time hypoglycaemia.</p>

What should my blood glucose targets be?

The blood glucose targets given below are a general guide only. Check with your doctor or nurse about your individualised blood glucose targets.

Test	Targets
Pre-meal glucose	4.0-7.0 mmol/L
2 hours post-meal glucose	< 10.0 mmol/L

The blood glucose target can be individualised in order to prevent risk of hypoglycaemia or other adverse effects associated with tight blood glucose control.

Discuss with your doctor about your blood glucose target if in doubt.



Ways to achieve better blood glucose targets

Keeping your blood glucose levels within the target range is important to reduce the risk of diabetes-related complications. Here are some tips to help you to achieve a better blood glucose target:

- ✓ Maintain healthy eating habits
(Refer to pg 26 for healthy eating tips)
- ✓ Maintain an active lifestyle
(Refer to pg 42 for active lifestyle tips)
- ✓ Adherence to diabetes treatment
- ✓ Maintain a record of your blood glucose checks and discuss the records with your doctor or nurse



TYPE 2 DIABETES

MEDICATIONS

Guide to type 2 diabetes medications

Some people who have type 2 diabetes can achieve their target blood glucose levels with diet and exercise alone, but many also need diabetes medications.

Most medications for type 2 diabetes are oral drugs. However, a few come as injections, such as insulin. Some people with type 2 diabetes may need to take insulin.

The medications presented here in this booklet are currently what is registered and available in Singapore.

Examples of possible treatments for type 2 diabetes include:

1. **Metformin**
2. **Sulphonylureas**
3. **Thiazolidinediones (TZD)**
4. **Acarbose**
5. **DPP-4 inhibitors**
6. **GLP-1 receptor agonists**
7. **SGLT2 inhibitors**
8. **Insulin**

Medications for type 2 diabetes

Medication	Side effects
<p>1. Metformin (e.g. Glucophage) Generally, metformin is the first medication used to treat type 2 diabetes. Metformin reduces the amount of sugar your liver makes.</p>	<p>Nausea and diarrhoea are side effects of metformin, but these side effects usually go away as your body becomes familiar to the medicine.</p>

Medication**Side effects****2. Sulphonylureas**

Sulphonylureas help your body secrete more insulin. Examples of medication in this class include:

- Glipizide
- Gliclazide
- Gliclazide MR (Diamicon MR)
- Glimepiride (Amaryl)

Potential side effects of sulphonylureas include hypoglycaemia and weight gain.

3. Thiazolidinediones (TZD)

Thiazolidinediones (TZD) make your body's tissues more sensitive to insulin. Pioglitazone (Actos) is an example of thiazolidinedione.

Thiazolidinediones (TZD) have been linked to weight gain and more serious side effects such as an increased risk of heart failure and fractures. Because of these risks, these medications are generally not a first-choice treatment.

4. Acarbose (e.g. Glucobay)

Acarbose works by slowing down the gut enzyme that turns carbohydrates into sugar. This results in a smaller rise in blood glucose levels following a meal.

Diarrhoea and bloating are possible side effects.

5. DPP-4 inhibitors

DPP4-inhibitors (dipeptidyl peptidase-4 inhibitors) increase levels of a group of gastrointestinal hormones called incretins, which increase insulin secretion and inhibit glucagon release. They reduce blood glucose levels without causing hypoglycaemia.

Examples of DPP-4 inhibitors are:

- Sitagliptin (Januvia)
- Vildagliptin (Galvus)
- Linagliptin (Trajenta)
- Saxagliptin (Onglyza)

They can cause flu-like symptoms such as runny nose, sore throat and headache.



Medication	Side effects
<p>6. GLP-1 receptor agonists GLP-1 receptor agonists come as injections but are not insulin. They are incretin mimetics. They slow digestion and help lower blood glucose levels. The use of GLP-1 receptor agonists is often associated with some weight loss.</p> <p>Examples of these medications include:</p> <ul style="list-style-type: none"> • Liraglutide (Victoza) • Exenatide (Byetta) • Exenatide Extended Release (Bydureon) • Dulaglutide (Trulicity) 	<p>Possible side effects include nausea, vomiting and diarrhoea.</p>
<p>7. SGLT2 inhibitors SGLT2 inhibitors are the newest oral glucose-lowering medications on the market. They work by preventing the kidneys from re-absorbing glucose into the blood. Instead, the glucose is excreted in the urine. Their use is often associated with weight loss and blood pressure reduction.</p> <p>Examples of SGLT2 inhibitors are:</p> <ul style="list-style-type: none"> • Canagliflozin (Invokana) • Dapagliflozin (Forxiga) • Empagliflozin (Jardiance) 	<p>Side effects may include genital and urinary tract infections and low blood pressure.</p>
<p>8. Insulin Some people who have type 2 diabetes need insulin therapy. In the past, insulin therapy was used as a last resort, but today it is often prescribed sooner because of its benefits.</p> <p>Insulin has to be injected because normal digestion interferes with insulin taken by mouth.</p> <p>Insulin injections involve using an insulin syringe or an insulin pen injector — a device that looks similar to an ink pen, except the cartridge is filled with insulin.</p> <p>There are many types of insulin, and they each work in a different way.</p>	<p>Side effects include hypoglycaemia and weight gain.</p>

TYPES OF

INSULIN

Types of insulin and their action profiles

There are many types of insulin available in Singapore. The ones presented in this booklet represent what is presently registered and available in Singapore.

Insulin is administered by subcutaneous (just under the skin) injection. Insulin should only be used when prescribed by a doctor and dose adjustments should be supervised.

Types of insulin preparations

Insulin preparations can be categorised according to their time action profile: quick-acting, intermediate-acting and long-acting. There are also pre-mixed insulins which contain a mixture of quick-acting and intermediate-acting insulin.

Insulin preparations are available in vials, cartridges and disposable pens.



It is important to ensure the correct dose of insulin is given and that the technique of administration is correct, since improper administration can lead to high and low glucose levels (hypoglycaemia).

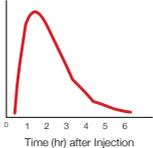
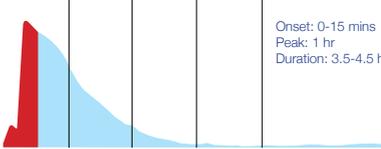
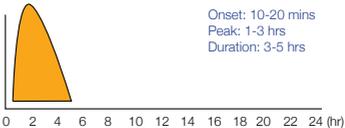
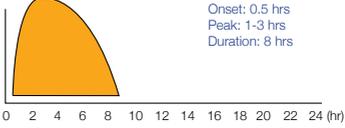
Low blood glucose levels may happen when there is a mismatch of carbohydrate intake to insulin, during exercise, after alcohol intake, or in relation to other medical conditions.



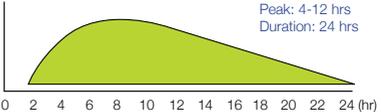
The table below shows the types of insulin available in Singapore as well as:

- Their onset of action (how quickly they start acting)
- Their peak action (greatest glucose-lowering effect)
- Duration of action (when it stops lowering glucose levels)

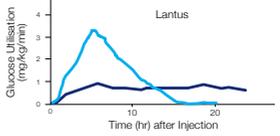
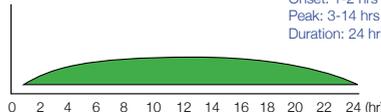
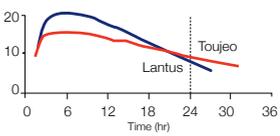
Quick-acting and short-acting insulin

Onset of insulin action	Brand and type	Generic name	Type of insulin
 <p>15 min</p>	Apidra® Solostar	Insulin Glulisine	  <p>Onset: 5-15 mins Peak: 1-2 hrs Duration: 3-4 hrs</p>
 <p>15 min</p>	Humalog® KwikPen	Insulin Lispro	  <p>Onset: 0-15 mins Peak: 1 hr Duration: 3.5-4.5 hrs</p>
 <p>15 min</p>	NovoRapid® FlexPen	Insulin Aspart	  <p>Onset: 10-20 mins Peak: 1-3 hrs Duration: 3-5 hrs</p>
 <p>30 min</p>	Actrapid®	Regular Insulin	  <p>Onset: 0.5 hrs Peak: 1-3 hrs Duration: 8 hrs</p>

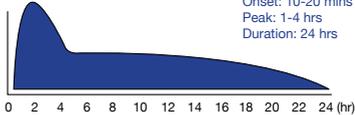
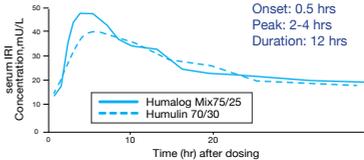
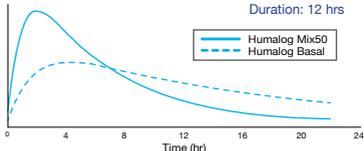
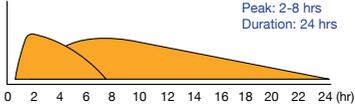
Intermediate-acting insulin

Onset of insulin action	Brand and type	Generic name	Type of insulin
 <p>60 min</p>	Insulatard®	NPH Insulin	 <p>Onset: 1.5 hrs Peak: 4-12 hrs Duration: 24 hrs</p> 

Long-acting insulin

Onset of insulin action	Brand and type	Generic name	Type of insulin
 <p>> 60 min</p>	Lantus® Solostar	Insulin Glargine	 <p>Onset: 1-2 hrs Peak: no peak Duration: 24 hrs</p>  <p>■ Lantus 0.3 Units/kg ■ NPH 0.3 Units/kg</p>
 <p>> 60 min</p>	Levemir® FlexPen	Insulin Detemir	 <p>Onset: 1-2 hrs Peak: 3-14 hrs Duration: 24 hrs</p> 
 <p>> 60 min</p>	Toujeo® SoloStar 300 units/ml	Insulin Glargine	 <p>Median insulin concentration, $\mu\text{U/mL}$</p> <p>Onset: 6 hrs Peak: no peak Duration: > 24 hrs</p> 

Pre-mixed insulin

Onset of insulin action	Brand and type	Generic name	Type of insulin
 <p>15 min</p>	<p>NovoMix®30 FlexPen</p>	<p>Biphasic Insulin Aspart</p>	  <p>Onset: 10-20 mins Peak: 1-4 hrs Duration: 24 hrs</p>
 <p>15 min</p>	<p>Humalog® Mix 75/25 KwikPen</p>	<p>Biphasic Insulin Lispro 25%/Protamine 75%</p>	  <p>Onset: 0.5 hrs Peak: 2-4 hrs Duration: 12 hrs</p>
 <p>15 min</p>	<p>Humalog® Mix 50/50 Kwikpen</p>	<p>Biphasic Insulin Lispro 50%/Protamine 50%</p>	  <p>Onset: 0.5 hrs Peak: 2-3 hrs Duration: 12 hrs</p>
 <p>15 min</p>	<p>Mixtard® 30</p>	<p>Biphasic 30% Soluble Human Insulin +70% NPH Insulin</p>	  <p>Onset: 0.5 hrs Peak: 2-8 hrs Duration: 24 hrs</p>

INSULIN SYRINGE

PREPARATION AND ADMINISTRATION

How to draw up insulin from a vial



STEP 1

Wash and dry your hands. Remove insulin vial from fridge 30 minutes (if brand new and unopened) before injection.



STEP 2

Roll the insulin bottle gently between your palms at least 10 times.

This is particularly important if you are mixing insulin. Remember that pre-mixed insulin is cloudy while the short-acting or quick-acting insulin should be clear.



STEP 3

Clean the top of the insulin vial with an alcohol swab.



STEP 4

Draw the required amount of air (equal to the dosage for insulin required) into the syringe by pulling the plunger down.



STEP 5

Inject the required amount of air into the insulin vial.



STEP 6

With the needle in the bottle, turn it upside down and withdraw the required amount of insulin into the syringe. Remove air bubbles (if present) by flicking or tapping the syringe with your finger, expelling the bubbles.

How to mix short-acting (clear) insulin and intermediate-acting (cloudy) insulin



STEP 1

Roll and clean

Wash and dry your hands. Roll the cloudy (intermediate-acting) bottle of insulin between your palms 10 times gently. Do not shake vigorously. Clean the top of vial with an alcohol swab.



STEP 2

Add air to cloudy (intermediate) insulin

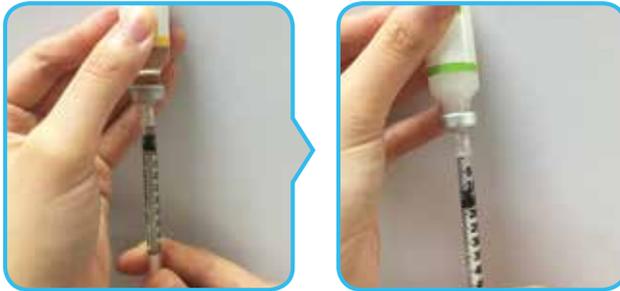
Draw the required amount of air (equal to the dosage of cloudy insulin) into the insulin syringe. Inject air into the cloudy insulin vial. Do not draw out any insulin, and remove the syringe and needle.



STEP 3

Add air to clear (short-acting) insulin

Using the same syringe and needle, draw the required amount of air (equal to the dosage for clear insulin) into the insulin syringe. Inject air into the clear insulin vial.



STEP 4

Withdraw short-acting (clear) insulin first then intermediate (cloudy) insulin

With the insulin syringe and needle attached, turn the clear insulin bottle upside down, with the needle bevel within the insulin, withdraw the required amount of clear insulin into the syringe.

Then do the same with the cloudy insulin. **Always withdraw clear insulin first before withdrawing cloudy insulin.** Ensure the total dose of clear and cloudy insulin is correct. If overdrawn, discard and repeat.



Not all types of insulin are suitable to be mixed. If in doubt, please check with your pharmacist or diabetes nurse educator.

Reminder



- ✓ Look out for the **expiry date** on the bottle
- ✓ **Write down the date and time** of opening on the bottle
- ✓ **Discard vial 4 weeks from date of opening**
Refer to manufacturer's/pharmacist's recommendation
- ✗ **Do not use** the insulin if it is discoloured, has lumps or flakes, is frozen or heated

How to administer insulin with a syringe

1. Wash both your hands with soap and water.
2. Dry your hands with a tissue paper or a hand towel.
3. Select the injection site at the abdominal area.



4. Cleanse the injection site with an alcohol swab.
5. Wait for the alcohol to dry.
6. Lift the skinfold using a thumb and the index finger.



7. Inject insulin at 90 degrees perpendicular to the injection site.



8. Inject the dose by pressing the circular tip all the way in at a steady speed.



9. Withdraw the insulin syringe and apply light pressure on the injection site using a cotton wool swab/alcohol swab.
10. Discard the used insulin syringe into a container (e.g. plastic bottle subsequently sealed with a cap) before disposing it into the rubbish bin.

How to store insulin vials

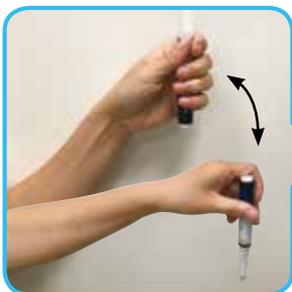
Insulin	Storage	Remarks
Insulin in-use	At room temperature (max. approximately 25-30°C) for 4 weeks	<p>Once the vial is in use, it need not be kept in a fridge.</p> <p>Label each vial with a date on the sticker.</p>
Brand new insulin	In the fridge at 2-8°C <i>Do not store insulin in the freezer!</i>	<p>Insulin should be removed from the fridge at least 30 minutes before injecting.</p> <p>Always check the expiry date before using the insulin.</p>

Note: Each insulin vial is for single patient use only.

INSULIN PEN

PREPARATION AND ADMINISTRATION

How to prepare an insulin pen for injection



STEP 1 Roll the pen and attach the needle.



STEP 2 Prime 2 units to ensure a drop of insulin appears at the tip of the needle. This confirms the needle is patent.



STEP 3 Select the dose of insulin you need.

How to administer insulin with an insulin pen

1. Wash both hands with soap and water.
7. Inject insulin at 90 degrees perpendicular to the injection site.

2. Dry hands with a tissue paper or a hand towel.

3. Select the injection sites at the abdominal area.



4. Cleanse the injection site with an alcohol swab.

5. Wait for the alcohol to dry.

6. Lift the skinfold using a thumb and the index finger.



7. Inject insulin at 90 degrees perpendicular to the injection site.



8. Inject the dose by pressing the push-button all the way in until '0'.

9. Keep the push-button fully depressed after the injection until the needle has been withdrawn from the skin. The needle must remain under the skin for at least 6 seconds to ensure that the full dose has been injected.

10. Place the outer needle cap on the table. Without holding on to the outer needle cap, direct the needle tip into the bigger outer needle cap. This is to prevent finger stick injury. When the needle is covered, unscrew the needle for disposal.

11. Discard the used pen.

How to store your insulin pen

Insulin	Storage	Remarks
Insulin in-use	At room temperature (max. approximately 25-30°C) for 4 weeks	<p>Once the pen is in use, it need not be kept in a fridge.</p> <p>Label each pen with a date on the sticker.</p>
Brand new insulin	<p>In the fridge at 2-8°C</p> <p>Do not store insulin in the freezer!</p>	<p>Insulin should be removed from the fridge at least 30 minutes before injecting.</p> <p>Always check the expiry date before using the insulin.</p>

Note: Each insulin pen is for single person use only.

INSULIN SITE ROTATION



Tips for insulin injection site rotation

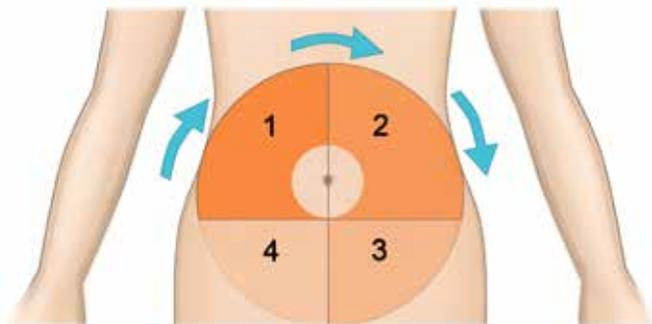
It is important to rotate your insulin injection sites in order to prevent lumps and hardened tissue from developing. Injecting into lumps or hardened tissue will affect the absorption of insulin and make it less effective.

Inject insulin into the fatty layer under your skin

- Insulin needs to be injected into the fatty layer beneath the skin and not into the muscle below the fatty layer as muscle absorbs insulin too quickly.
- Insulin is absorbed quickest and most consistently from the abdomen, followed by the arms, the thighs, and the buttocks.

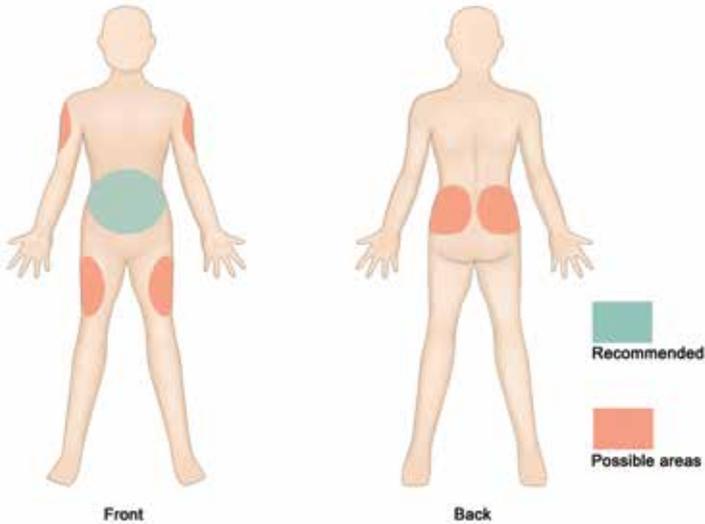
Move 2 fingers along from your last insulin injection site

- Rotate injection sites by moving 2 fingers' breadth along from your last injection site until you have used an entire area.
- Move to a new injection area every week or two (*see figure below*)



Rotate injection sites by moving 2 fingers' breadth apart from the last injection site. Use an entire area before moving to a new area.

Insulin injection sites



Areas to avoid

- ✗ Do not inject close to the **navel**, as insulin absorption will not be as consistent.
- ✗ Also do not inject close to **moles, scars, or hardened areas**.
- ✗ Do not inject in an **area that will be exercised** soon. Exercising increases blood flow, which causes insulin to be absorbed at a rate that is faster than usual.



Best spots on your upper arm and thigh to inject insulin

- ✓ If you inject in the **upper arm**, use only the **outer back** area (where there is more fat) and use a shorter needle.
- ✓ If you inject in the thigh, use a shorter needle and **avoid using the inner thighs**.

Choose your needle well

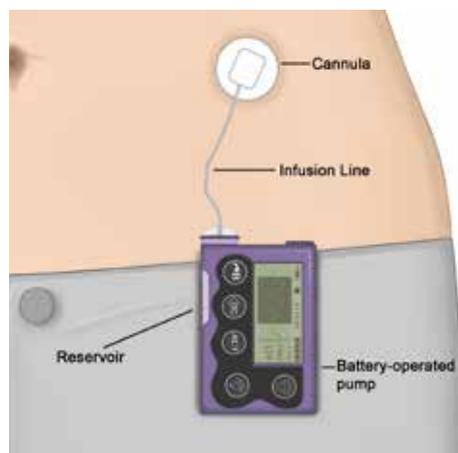
- You can reduce the pain of injection by choosing a needle length and gauge that is right for you.
- Use a new needle with each injection.

INSULIN PUMP THERAPY

(CONTINUOUS SUBCUTANEOUS INSULIN INFUSION)

How does insulin pump therapy work?

The insulin pump is a battery-operated device (see figure below), which contains a reservoir of quick-acting insulin that delivers both basal (background) and quick-acting insulin doses.



*Insulin is delivered via an **infusion set and cannula** into the subcutaneous layer of the abdomen.**

** For illustration purposes only. Actual device may differ.*

Importantly, the improved technology now allows programmable memory, the potential of multiple basal rates, and simple ways of titration and bolusing.

The insulin pump first had its beginnings in the early 1960s as a massive backpack, created by Arnold Kadish of Los Angeles, California. It was not until 1978 that the first commercial insulin pump was launched, although the idea of lugging around a 'Big Blue Brick' which needed a screwdriver for insulin dose adjustment was neither practical nor attractive.

It was not until the 1990s that advances in the field of medical device technology permitted the dramatic reductions in the size of the insulin pump to that of a handheld pager, allowing much greater portability.

An insulin pump can deliver insulin similar to a pancreas.

Whilst the insulin pump can deliver more precise doses of insulin, and in a manner more similar to a pancreas, the end user is still in ultimate control over insulin delivery.

The pump uses quick-acting U-100 insulin that delivers both basal insulin 24 hours of the day, and bolus insulin.

What is basal and bolus insulin?

Basal insulin

Basal insulin covers insulin requirements between meals and throughout the night. Each individual will require different amounts of basal insulin depending on factors like their weight and activity levels. With an insulin pump, the amount delivered can be adjusted by the hour to deliver varying amounts of insulin throughout the day.

For example, you may require greater amounts of insulin in the early morning hours than the rest of the day. Your pump will be programmed to deliver basal insulin at different rates in different time blocks to match your needs. Once programmed, these same rates continue everyday unless basal rates are altered.

Bolus insulin

Upon administering quick-acting U-100 insulin, it:

1. Enters the bloodstream within 10-15 minutes
2. Has the greater glucose-lowering effect for the first 1-1.5 hours
3. Stops lowering glucose levels 4-5 hours later

Bolus insulin may be given to:

1. Cover mealtime glucose rise from carbohydrates consumption (meal bolus)
2. Correct high glucose levels (correction bolus)

Because the insulin pump only uses quick-acting insulin, there will be a quick rise in glucose levels (within 2 hours) if insulin infusion is interrupted.

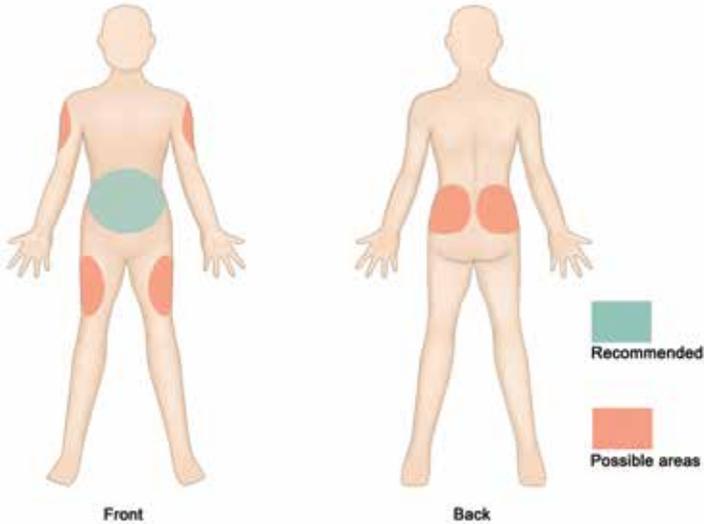
Insulin infusion should not be suspended/stopped for more than 1 hour without checking your blood glucose level.

What advantages does insulin pump therapy have over multiple daily injections of insulin?

	Multiple daily injections	Insulin pump therapy
Injections	4-5 times daily	Cannula change once every 2-3 days
Minimum insulin dose	1 unit	0.025 units
Basal dose	1-2 a day, fixed	48/day, may be altered readily
Bolus dose	Mental math	Bolus calculator
Bolus options	None	Various bolus pattern options

Importantly, insulin pump does NOT deliver insulin automatically. The user is still in charge of the delivering the appropriate doses of bolus insulin according to the blood glucose level, and amending the basal rate according to his/her needs.

Insulin pump insertion sites



You are in charge!

There are important safety guidelines whilst using the insulin pump. Good safety practices are important to allow you to pre-empt and resolve potential problems promptly. This includes:

- Checking your blood glucose levels regularly (minimum 3-4 times daily)
- Never ignoring a low glucose level (< 4.0 mmol/L) and keeping food/drink for hypoglycaemia treatment
- Never ignoring a high glucose level (> 13.0 mmol/L)
- Re-checking a blood glucose level after a low or high glucose reading to ensure these return to target range

Singapore General Hospital (SGH) has a structured pathway and multidisciplinary team in place for initiating and managing insulin pumps in adults. Please ask your healthcare provider if you are interested in finding out more about insulin pumps.

CONTINUOUS GLUCOSE MONITORING

FOR BLOOD GLUCOSE CONTROL

Continuous glucose monitoring systems are devices that include a sensor, a transmitter and a receiver (Figure 1).

A continuous glucose monitoring system samples interstitial glucose levels every few minutes, which allows for collation of all the glucose values into glucose curves (Figure 2).

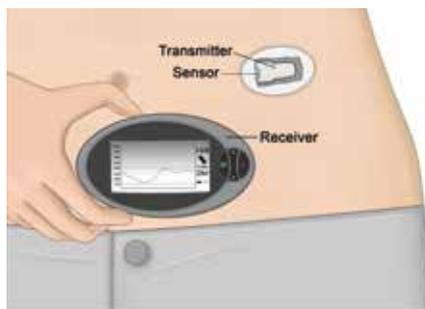


Figure 1: Components of a continuous glucose monitoring system*

*For illustration purposes only. Actual device may differ.

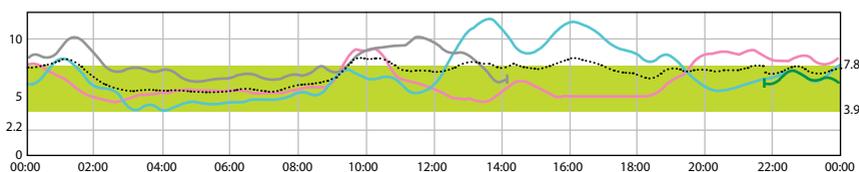


Figure 2: A continuous glucose monitoring system collates all glucose values into glucose curves.

Each sensor is able to provide readings typically for up to 6 days. This helps to fill in the gaps of missing information from doing only intermittent capillary blood glucose readings (Figure 3a).

Continuous glucose monitoring systems enable a more complete picture of glucose trends and patterns to enable more precise insulin dose titration.

As a continuous glucose monitoring system samples glucose readings every few minutes rather than snapshots of the capillary glucose at any one point of time (Figure 3a), it is able to provide information on the glucose trajectory (Figure 3b).

This allows the user and healthcare provider to overcome what would have been 'blind spots' in the glucose profile.

	0800-1030h	1130-1330h	1600h	2000-2200h
Thurs		24.3		16.0
Fri	5.6			7.1
Sat		4.8	18.8	
Sun	8.5			11.3
Mon	7.3			3.4

Figure 3a: Self-monitoring of capillary glucose readings (mmol/L) over the course of 5 days.

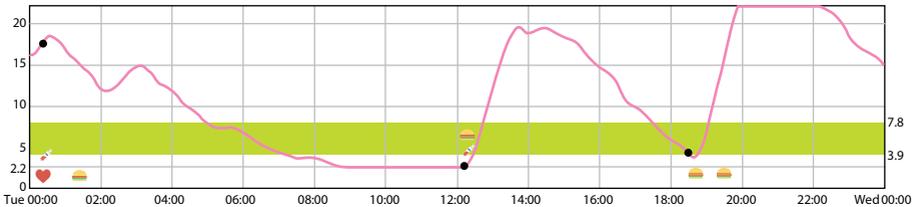


Figure 3b: Continuous glucose monitoring tracing over 1 day. With continuous glucose monitoring, glucose curves are generated that allow a more comprehensive view of glucose trajectories beyond capillary glucose readings, and how food/medication/exercise interact with glucose levels.

● : Capillary glucose reading 📌 : Insulin injection 🍌 : Food intake ❤️ : Exercise

Benefits of diagnostic and real-time continuous glucose monitoring

Continuous glucose monitoring may either be retrospective for diagnostic purposes or it may be used in real-time.

Diagnostic continuous glucose monitoring systems are blinded to the individual who is wearing it. It is used by the healthcare professional to:

- Detect asymptomatic or nocturnal hypoglycaemia, and
- Aid in titration of medications, insulin doses or nutritional adjustments.

Real-time continuous glucose monitoring also contains alarms which can alert the user if the glucose level is rising or going below a pre-set threshold. This will allow the user to make changes to prevent or correct a high or low glucose level.

Most real-time continuous glucose monitoring requires once to twice daily

blood glucose calibrations (involving fingerprick glucose tests) and each sensor lasts for up to 6 days.

Real-time continuous glucose monitoring has been shown to improve overall glucose control in terms of improvements in HbA1c and reduction of the frequency of hypoglycaemia, particularly in those with type 1 diabetes.

However, real-time continuous glucose monitoring needs to be used regularly for this improvement to be effected.

In addition, real-time continuous glucose monitoring may be combined with insulin pump therapy to allow for automated insulin suspension in response to, or prior to, a pre-set low glucose level. It may also be used in the future to control the high glucose levels by automatically controlling delivery of basal insulin.

Flash glucose monitoring

Another form of glucose monitoring, known as flash glucose monitoring, consists of a sensor and a reader.

The sensor is placed at the back of the upper arm and once inserted, may be used for up to 14 days.

Using the reader to flash across the sensor, the user is able to view:

- The current interstitial glucose level,
- The direction in which the glucose is heading, and
- The preceding 8 hours' trajectory.

Unlike real-time continuous glucose monitoring, flash glucose monitoring does not require blood glucose (fingerstick) calibrations. However, it is unable to provide alarms, and the glucose reading is only retrieved when the user flashes the reader across the sensor.

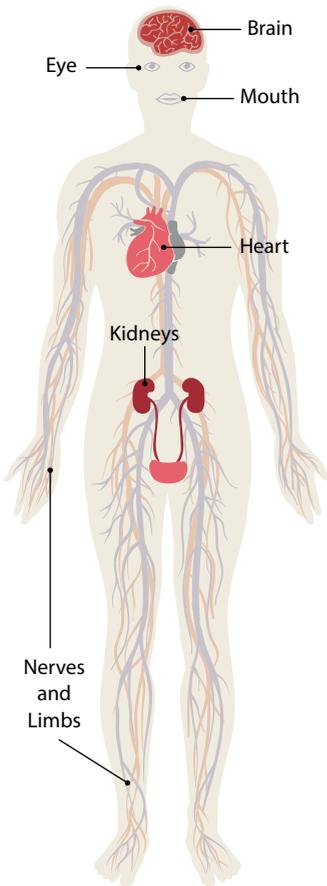


Using the reader to flash across the sensor, the user is able to know the glucose level without the need for a finger prick.

DIABETES

COMPLICATIONS

PREVENTION AND MANAGEMENT



How can diabetes complications affect me?

Diabetes, when poorly-controlled, results in multiple complications. Diabetes is a leading cause of kidney failure, blindness, limb amputation, heart attack and stroke.

Diabetes complications can be broadly divided into those affecting the small blood vessels (microvascular) and those affecting the large blood vessels (macrovascular).

Microvascular (Complications of small blood vessels)	Macrovascular (Complications of large blood vessels)
Eye (Blindness)	Heart (Heart attacks)
Kidney (Kidney failure)	Brain (Strokes)
Nerve (Amputations)	Limbs (Amputations)



How can diabetes affect my eyes?

Diabetic eye disease (diabetic retinopathy) results from reduced blood flow to the light-sensing nerve layer of the eye (retina). Over time, there is formation of fragile and leaky new blood vessels and nerve layer swelling. These changes can progress to blindness if not identified early and treated.

Diabetes affects the peripheral and central retina in different ways:

Non-proliferative diabetic retinopathy, also known as background diabetic retinopathy, is the early stage of diabetic retinopathy and occurs when the small retinal blood vessels become affected and start to leak and bleed. At this stage, vision is usually not affected.

Proliferative diabetic retinopathy is associated with a high risk of permanent loss of vision. There is growth of abnormal new blood vessels in the retina. These abnormal new vessels can rupture, causing significant bleeding that will lead to loss of vision. Progressively, the scar tissues that form can cause retinal detachment. The abnormal blood vessels can grow on the iris and block the outflow of fluid from the eye. Neovascular glaucoma can occur, with risk of optic nerve damage and blindness.

What puts me at risk of diabetic retinopathy?

All individuals with diabetes are at risk of developing diabetic retinopathy. After 20 years, most people will develop this complication to some degree. Those who have poorly-controlled diabetes are at higher risk of developing diabetic retinopathy earlier and at more severe stages.



What can I do to protect my eyes?

Reduce your risk of diabetic retinopathy by:

- ✓ Keeping your blood glucose levels in check.
- ✓ Treating and keeping other medical conditions such as high blood pressure, high cholesterol and heart disease under control.
- ✓ Quitting smoking and exercising regularly.

Although you cannot completely prevent diabetic retinopathy, vision loss can be prevented with early detection. Diabetic retinopathy often has no warning signs, hence it is important to get a comprehensive dilated eye examination annually even if you have no eye symptoms.



If you develop a gradual blurring of vision or hazy vision, please see your doctor immediately.

Eye checks can be done by taking a photo of the back of your eye, in a process known as retinal photography, at SingHealth polyclinics and hospitals. If further consultation with an eye specialist is required, you will be referred to an eye specialist at the Singapore National Eye Centre (SNEC).

Treatments available at SNEC

In most cases, laser surgery can prevent significant vision loss associated with diabetic retinopathy.

Laser photocoagulation can be performed to seal or destroy growing or leaking blood vessels in the retina:

- **Panretinal photocoagulation (PRP)** – to treat the peripheral retina to prevent or stop the growth of abnormal new vessels
- **Focal laser** – to treat the macular oedema to reduce swelling

In general, each eye requires 2-3 sessions for a PRP to be completed. You will be expected to go for regular treatments over a period of 6-12 months before diabetic retinopathy is controlled adequately.

In patients with loss of central vision due to diabetic macular oedema, intravitreal injections of medication into the centre of the eye can reduce the macular swelling and improve vision.

Medications which are injected into the eye for diabetic macular oedema include Anti-Vascular Endothelial Growth Factor (VEGF) drugs such as Avastin, Lucentis and Eylea, as well as steroids.

Often, multiple injections at intervals of 1 month or longer are required to achieve resolution of the swelling. Repeated injections at longer intervals may also be required to maintain the visual improvement.

In some people with diabetic retinopathy, the abnormal blood vessels in the retina may also result in massive bleeding into the centre of the eye (vitreous humor), causing sudden severe loss of vision. A surgical procedure called a vitrectomy can be used to remove the blood that has leaked into this part of the eye.



Singapore National
Eye Centre
SingHealth

For enquiries or more information
on treatments available at SNEC:
Tel: 6227 7266



How can diabetes affect my kidneys?

Diabetic kidney disease (diabetic nephropathy) starts with protein (albumin) leak in the urine. At this stage, the patient with diabetes may not have any symptoms due to kidney disease. However, this early stage can be identified easily by doing a urine test.

Protein leak in the urine is the earliest sign of diabetic kidney disease and if left untreated, it can progress to kidney failure, eventually requiring dialysis.



What can I do to protect my kidneys?

Urinary protein leak improves with improvement in glucose and blood pressure. Certain blood pressure medications (ACEI/ARB) are also used to reduce urinary protein leak and retard further progression of diabetic kidney disease. If you are found to have urinary protein leak, these medications will be recommended even if your blood pressure is normal.



How can diabetes affect my nerves?

Diabetic nerve disease (diabetic neuropathy) most commonly affects the nerves of the upper and lower limbs. It can also affect nerves that control the eye and nerves of the face and head.

Most common symptoms experienced are a tingling, burning, and pricking sensation or numbness of the hands and feet.

If diabetes is poorly-controlled, the nerve disease gets worse and spreads to involve larger regions of the limbs.

Many patients are unaware of their reduced ability to sense pain and touch. This puts them at risk of injuries to their limbs that go unnoticed (e.g. burns from walking barefoot on a hot surface, injury from stepping on a sharp object). These wounds are exposed to contamination from the environment and get infected.

If not identified early and treated, the infection may spread deeper to involve the muscle and bone, eventually requiring amputations.



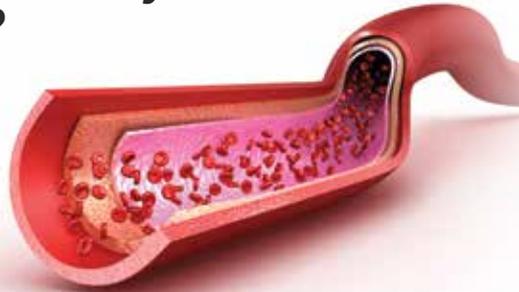
What can I do to protect my feet?

It is important to check your feet regularly for any injuries, wounds, blisters and skin thickening (callus). You should also attend an annual diabetic foot screening with your healthcare provider to check for any reduced sensation and blood flow to your feet.



How can diabetes affect my heart and blood vessels?

Heart and blood vessels (cardiovascular) diseases arise from poorly-controlled diabetes associated with high blood pressure and other risk factors, leading to heart attacks, strokes and amputation of limbs.



What can I do to protect my heart and blood vessels?

The following measures can help to reduce your risk of these complications:

- ✓ Regular exercise (at least 150 minutes per week). Consult your doctor before starting a new exercise regimen.
- ✓ Quit smoking.
- ✓ Keep your glucose in the target range with lifestyle measures and medications.
- ✓ Keep your blood pressure in the target range with lifestyle measures and medications.
- ✓ Take the medications prescribed by your doctor regularly. These may include aspirin, statin, ACEI/ARB.



How can diabetes affect my feet?

Diabetic foot complications develop due to multiple problems:

- Increased risk of infection due to high blood glucose levels
- Increased risk of dry and thickened skin
- Reduced or absent pain and touch sensation due to nerve disease
- Reduced blood flow to limbs due to narrowing of blood vessels



What can I do to lower my risk of diabetic foot complications?

To reduce your risk of diabetic foot complications, you can do the following:

- ✓ Keep your sugars and blood pressure on target.
- ✓ Check your feet daily for any cut, sores, blisters, thickened skin or ingrowing toenails on your feet. If found, keep it clean and seek early medical attention.
- ✓ Get your feet checked at least annually to identify any reduced sensation or reduced blood flow.
- ✓ Always use footwear to avoid injury within the house, and when you are outside. Wear socks and covered shoes at all times if possible.
- ✓ Dry your feet after a shower and apply a moisturiser. Do not apply moisturiser between your toes.
- ✓ Do not soak your feet in hot water and put your feet away from heaters.
- ✓ Trim toenails straight across, and avoid cutting down the sides.
- ✓ Avoid peeling/cutting the skin on your feet and avoid using corn plasters for corns or hard skin. Use a foot file gently or see a podiatrist instead.

How do I choose good footwear to prevent injury?

It is also important to recognise the role of shoes in the prevention and formation of diabetic foot wounds. Poor-fitting or unsuitable footwear may result in the development of blisters or wounds. A good pair of shoes should have the following features:

- There should be one thumb's width from your longest toe to the front of the shoe.
- The width should fit the widest part of your foot to prevent rubbing against the shoes.
- Shoes should be deep enough to accommodate any foot deformities.
- The front of the shoes should be flexible to assist you with your walking.
- The middle of the shoes should be rigid enough to give you maximum support in your arches.
- There should be a firm heel counter for increased support.
- Shoes should have laces or velcros to prevent excessive movement of the feet within the shoes. It is preferable that you choose a covered pair of shoes as this will provide better protection for your feet.
- Regular assessment of the diabetic foot may reduce risks of ulceration, infection and amputation.

Heel Counter



Supportive



Too flexible

Shank



Supportive



Too flexible

Fitting



Right-fitting



Too narrow

Bending



Bend at toes



Too flexible

Look for shoes with either:

- ✓ Shoe laces
- ✓ Velcro fastener

Do not look for:

- ✗ Slip-on shoes

When should I see my healthcare provider about foot problems?

During your daily foot checks, please seek immediate medical attention if you notice any of the following:

- Any cut, blister, or bruise on your foot which does not start to heal in a few days.
- Any redness, swelling, warmth, pain from your foot – these are signs of possible infection.
- Callus with dried blood inside, which is often a first sign of a wound developing under the callus.
- Any part of your foot that becomes black and smelly – these are signs that you may have gangrene.

Ask your healthcare provider to refer you to a podiatrist, if needed.





How can diabetes affect my mouth?

People with diabetes have a greater risk of developing gum (periodontal) disease, tooth decay, fungal infection and other problems with oral (mouth) health.

Serious gum disease may also have the potential to affect blood glucose control and contribute to the progression of diabetes. It is therefore important for you to start and maintain a regular dental care routine.



How can I help prevent dental problems associated with diabetes?

You can make sure your mouth stays healthy and pain-free with these simple steps:

- **Control your blood glucose levels**

First and foremost, control your blood glucose levels. Those with poorly-controlled blood glucose levels are more likely to develop gum disease and can lose more teeth than someone whose diabetes is well-controlled. Good blood glucose control can also help prevent or relieve dry mouth caused by diabetes.

- **Brush and floss regularly**

- Use a soft-bristled toothbrush and replace it every 3 months.
- Brush for at least 3 minutes with fluoride toothpaste.
- Brush at least 2 times a day, after each meal if you can.
- Floss at least once a day.

- **Visit a dental professional**

- Have your teeth checked by the dentist at least once a year.
- Inform the dentist you have diabetes, how your glucose control is, and the medications you are taking.

- **Alert your dentist or doctor if you notice any of the following:**

- **Bleeding, red or sore gums**
- **Gums that are pulling away from teeth**
- **Bad breath for a long period of time**
- **Loose or separating adult teeth**
- **A change in the way you bite**
- **Any mouth pain**

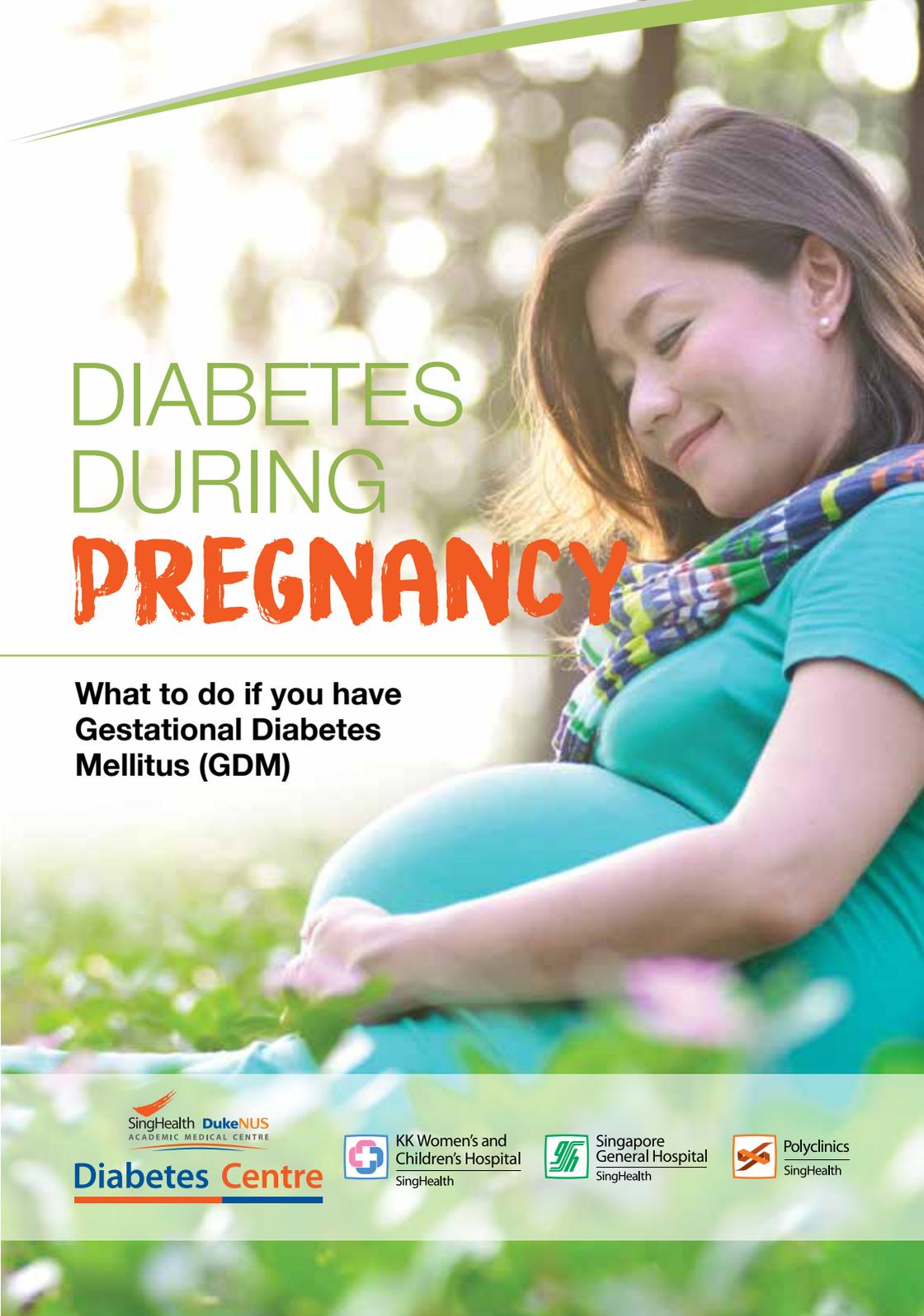
Annual screening for diabetes complications

Early stages of complications from diabetes can occur without your knowledge. That is why it is important to get yourself screened regularly for diabetes-related complications.

The purpose of this screening is to detect any potential complication at an early stage and intervene with lifestyle changes or medications to reduce the risk of progression.

Annual diabetes complication screening is recommended for all individuals with diabetes.

Annual screen	Potential finding	Potential intervention
1. Eye screen	Diabetic eye disease	Referral to eye specialist
2. Urine protein (albumin) screen Blood test (Serum Creatinine)	Diabetic kidney disease	<ul style="list-style-type: none"> • Intensification of glucose and blood pressure control • Addition of medications (ACEI/ARB) to reduce urine protein (albumin) leak • Referral to kidney specialist
3. Foot screen	<ul style="list-style-type: none"> • Diabetic nerve disease • Reduced blood flow to feet • Ulcers, calluses, ingrown or thickened nails • Foot deformities 	<ul style="list-style-type: none"> • Advise on appropriate footwear • Vascular (blood vessel) scan to detect extent and severity of narrowing • Dressing of ulcers, removal of calluses and trimming of nails by a podiatrist • Offloading and accommodation of foot deformities by podiatrist • Referral to podiatrist
4. Cardiovascular risk assessment (Risk is estimated based on your BP, lipids, age, gender and other risk factors)	High risk	<ul style="list-style-type: none"> • Intensification of glucose and blood pressure control • Initiation of medications (statin, aspirin, ACEI/ARB) to reduce cardiovascular risk



DIABETES DURING PREGNANCY

**What to do if you have
Gestational Diabetes
Mellitus (GDM)**


SingHealth **DukeNUS**
ACADEMIC MEDICAL CENTRE

Diabetes Centre



KK Women's and
Children's Hospital
SingHealth



Singapore
General Hospital
SingHealth



Polyclinics
SingHealth

DIABETES DURING PREGNANCY

What is gestational diabetes mellitus (GDM)?

In Singapore, about 15-20% of all pregnancies are complicated by GDM.

Pregnancy increases your risk of developing diabetes because of placental hormones. These increase your glucose levels and your body's resistance to insulin, which is important for the controlling of blood glucose. GDM usually starts in the second or third trimester.

It usually disappears after delivery.

What are the risk factors for GDM?

You are at a higher risk of GDM if you have:

- A body mass index (BMI) of 23 kg/m² and above
- First degree relatives (parents, siblings or children) with diabetes
- Personal history of previous GDM, or large babies weighing over 4 kg
- Previous poor pregnancy (obstetric) outcomes that are usually associated with diabetes, such as stillbirth



How does GDM affect me and my baby?

Most women diagnosed with GDM will have normal pregnancies and babies. However, if not well-controlled, GDM has potential risks for both mother and baby.

There will be a higher chance of risk at these stages:

FOR MOTHER

In pregnancy:

- Miscarriage
- Pre-eclampsia (high blood pressure during pregnancy)

At delivery:

- Induction of labour
- Forceps/vacuum-assisted delivery
- Caesarean section
- Difficult/traumatic delivery

After delivery:

- Wound complications
- Bleeding problems
- Risk of type 2 diabetes in future

FOR BABY

In pregnancy:

- Premature birth
- Stillbirth
- Birth defects
- Excessive amniotic fluid
- Large for gestational-age baby

At delivery:

- Shoulder dystocia
- Birth injury
- Breathing difficulties

After birth:

- Low blood glucose levels
- Blood mineral imbalances
- Jaundice
- High-dependency or intensive care unit admission
- Risk of obesity and/or diabetes in future

It is therefore important to diagnose and treat gestational diabetes mellitus optimally to reduce these risks.

Who should test for GDM?

Although the risk of GDM is higher in certain groups of women, it can happen to any woman in her pregnancy. In Singapore, all pregnant women will be offered screening for GDM with an oral glucose tolerance test between 24 and 28 weeks of pregnancy.

If you have had GDM before, have glucose in the urine, or symptoms suggestive of diabetes, the oral glucose tolerance test will be performed earlier in pregnancy and repeated again at 24 and 28 weeks if the first test was normal.

Detection of GDM is important so that appropriate treatment can be given to reduce the risks to the pregnancy.



How is GDM diagnosed?

An oral glucose tolerance test (OGTT) to diagnose GDM requires:

1. Fasting overnight (not eating or drinking anything apart from water)
2. Blood test in the morning, followed by a 75 g glucose drink
3. Repeat blood glucose tests at 1 hour and 2 hours after the glucose drink

Are there any risks or side effects from the OGTT?

The standard glucose drink is sweet and may cause some to feel nauseated. In rare cases, it may trigger vomiting. If this happens, we will need to reschedule the test to be done on another day if you are agreeable.



Why should I do the OGTT?

We strongly encourage all pregnant women to undergo the test as GDM is a common condition in pregnancy, and there are potential risks to the pregnancy if not detected and treated promptly.

What happens if the test shows that I have GDM?

When you have GDM, you will be under the care of a specialist healthcare team comprising of obstetricians, endocrinologists, specialised nurses, and dietitians.

A blood test (HbA1c) that assesses the average blood glucose level over a 3-month period will be performed. You will be given an appointment to attend a day assessment session at SingHealth hospitals to learn to use a glucometer to monitor your sugar levels at different time points within the day (pre-meals, 2 hours after meals and at bedtime), as it is important to ensure satisfactory glucose control during your pregnancy.

You will also be referred to a dietitian for dietary advice.

How is GDM treated?

Gestational diabetes mellitus usually improves with lifestyle measures such as:

1. **Healthy eating** (Refer to pg 87 for *GDM diet and nutrition*)
2. **Exercise**

Despite best efforts at lifestyle modification, some women need to take tablets or insulin injections to control their glucose levels. If insulin therapy is required, the technique for self-injection will be taught.

You may also be referred to a doctor who specialises in diabetes for further monitoring during your pregnancy.

During antenatal visits

We will check your blood pressure and urine at every visit as you have an increased risk of developing pre-eclampsia (high blood pressure condition that develops only during pregnancy).

Ultrasound scans will be performed to monitor your baby's growth closely. Regular blood tests will also be performed to monitor your blood glucose control.

Individualised advice about the timing and type of delivery will also be given to you by the specialist team at an appropriate time. These depend on various factors such as the blood glucose control, size of the baby, blood pressure measurements and previous surgeries, etc.

During labour

It is essential for blood glucose levels to be controlled at a satisfactory level. Blood glucose levels will be measured every hour and some women may require an insulin drip for optimal glucose control.

After delivery

Breastfeeding is encouraged after delivery.





Can diet help treat GDM?

Changing your diet is usually the first method of treatment for gestational diabetes.

Your caloric requirements and needs during pregnancy will be tailored specifically for you and will depend on several factors such as:

- Stage of pregnancy
- Pre-pregnancy weight and BMI
- Rate of weight gain during pregnancy
- Activity levels
- Blood glucose levels

A healthy balanced diet is recommended to help you achieve optimal glucose control while ensuring that there is adequate nutrition to support you and your baby's growth.

Important nutrients for a healthy pregnancy

Some nutrients become particularly important at this stage, namely:



1. Folic acid

Folic acid is found in green leafy vegetables, yeast and meat extracts, citrus fruits and juices (e.g. oranges), beans and fortified foods like cereals.



3. Calcium

During pregnancy, you should take 1,000 mg of calcium a day:

- For the development of your baby's teeth and bones
- To maintain your own calcium stores



2. Iron

Iron is found in liver, meat, fish, beancurd, wholegrain cereals, green leafy vegetables and eggs.

There are 2 types of iron – haem iron and non-haem iron.

Haem iron comes from animals and is found in:

- Red meat
- Poultry (chicken, duck, etc)
- Fish and seafood
- Liver

Please limit liver consumption to no more than 50 g per week in the first trimester as excessive intake of vitamin A in the first trimester can lead to birth defects.

Non-haem iron is found in plants and iron-fortified foods such as:

- Green leafy vegetables
- Beancurd
- Wholegrain cereals

Vitamin C helps your body absorb non-haem iron better.

Benefits of iron intake during pregnancy

Iron helps:

- Prevent anaemia, a condition of insufficient red blood cells in the blood
- Your baby build up his iron stores, to last for the first 6 months of his life



It is essential that you meet your requirements of these nutrients at every stage of your pregnancy.

In addition, from the second trimester, you will also be required to consume:

- Additional calories
- Additional protein to support the baby's growth in the second and third trimester

This however needs to be individualised and apportioned with caution based on:

- a. The rate of weight gain
- b. Blood glucose profile
- c. Eating pattern



Carbohydrate intake

It is recommended that you learn to:

- Estimate the quantity of carbohydrate per serving and per meal/snack
- Learn to select the type of carbohydrate that will contribute to optimal post-meal glucose control

Speak to your doctor about a referral to a dietitian for an individualised education and counselling session.



What happens after delivery if I have GDM?

After you deliver your baby, your insulin requirement decreases significantly with rapid improvement of blood glucose levels.

Most patients who require tablets or insulin injections during pregnancy are able to stop their medications. However, some women may have persistent diabetes after pregnancy.

Therefore, a repeat oral glucose tolerance test (OGTT) is needed for all women with gestational diabetes mellitus, about 6-12 weeks after delivery. This is to ensure that the GDM has resolved.

If the OGTT is still abnormal at this time, you will either be referred to a doctor who specialises in diabetes or to the polyclinic for follow-up, depending on the severity of the results.

Why is it important to attend your follow-up session after delivery?

If diabetes is not detected early or well-controlled, it can lead to serious and permanent complications of the kidneys, eyes, blood vessels and nerves, and may lead to a heart attack or stroke later in life.

Following up with your doctor after delivery can help in early detection of diabetes. Risks of future complicated pregnancy can be reduced with timely intervention and treatment.

Am I at risk of GDM or diabetes in future?

Although most women with GDM recover after the pregnancy, these women still have:

- A higher chance of having gestational diabetes mellitus in subsequent pregnancies
- 6-7 times higher chance of developing diabetes in future

Therefore, even if your repeat OGTT is normal after delivery, you are still encouraged to go for diabetes screening every year.

Tips to lower risk of diabetes after pregnancy

Sensible eating and regular exercise, both of which contribute to reducing body weight and therefore body mass index (BMI), can help reduce the risk of diabetes in future by about 50%.

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)} \times \text{Height (m)}}$$

A high BMI is associated with a higher risk of developing diabetes.

In general, weight loss should be slow, steady and sustained. The recommended weight loss is 0.5 to 1 kg per week.

A reduction of 7% of body weight in 6 months is a safe and effective weight loss goal.



1. Dietary recommendations

My Healthy Plate (Health Promotion Board, Singapore) can be used to guide eating patterns.



PLUS:



Choose water



Use healthier oils



Be active

'My Healthy Plate' is a friendly visual tool on healthy eating habits designed for Singaporeans by the Health Promotion Board (HPB).



a. Choose wholegrain carbohydrates e.g. brown rice, wholemeal bread, oats, chapatti, wholewheat pasta/noodles, high-fibre biscuits and cereals. These are also rich in vitamins and important trace elements and contain fibre which slows digestion.



b. Fill half the plate with green vegetables.



c. Aim for 2 servings of vegetables and 2 servings of fruit. If you are lactating, aim for 3 servings of vegetables and 2 servings of fruit.



d. Use healthier oils, e.g. canola, olive and peanut, which contain monosaturated fats.



e. Choose fish and beans instead of red and processed meats as sources of protein. Oily fishes contain omega-3 fatty acids which are good for the brain and heart. Aim for 2 portions of fish per week.



f. Water is best. Unsweetened tea and coffee can be taken in moderation. If you have canned drinks, go for diet or 'zero' options.



Reduce consumption of fried food and cakes as these contain trans fats, which are harmful for cardiovascular health.



Limit the amount of processed food.



Reduce intake of sweetened drinks and food such as sweets, desserts and cakes.

2. Exercise recommendations

Regular exercise helps to burn calories, thus helping you to achieve weight loss. Aim for half an hour of moderate-intensity physical activity 5 days a week, if there are no medical restrictions.

If you are used to a sedentary lifestyle, build your exercise level up slowly.

Note: Your normal moving about over the course of a day does not count as exercise!



Suggestions:

- ✓ Take a 20-minute walk after dinner.
- ✓ Use the stairs instead of the lift.
- ✓ Get off the bus one stop earlier and walk the rest of the way to your destination.
- ✓ Go swimming.

In addition to lifestyle measures, it is recommended that you:

- ✓ Seek medical attention early for subsequent pregnancies.
- ✓ Have annual blood glucose tests as surveillance for diabetes.

For enquiries, contact us at:



KK Women's and
Children's Hospital
SingHealth

Obstetrics Day Assessment Centre
Tel: 6394 2097 / 6394 2098



Singapore
General Hospital
SingHealth

Gestational Diabetes Joint Clinic
Tel: 6321 4516



HYPOGLYCAEMIA AND

DRIVING SAFELY

Why do I need to monitor my blood glucose levels?

It is important to be safe when driving, since this affects both yourself and other road users.

Those who are on medications that can lower their blood glucose levels need to be mindful of the safe blood glucose targets for driving and the practical steps to take to maintain safe glucose targets. Hypoglycaemia (low blood glucose) can impair concentration and reaction time; these in turn lead to an increased risk of accidents while driving.

Most people with diabetes who maintain stable blood glucose levels can drive safely. However, it is important for those with diabetes to take certain precautions before they drive.

Am I at risk of hypoglycaemia while driving?

If you are on insulin injections or on oral glucose-lowering tablets like sulphonylureas, your risk of hypoglycaemia can be increased.

This is in particular if you have:

- Performed physical activities e.g. shopping, exercising
- Missed a meal
- Eaten less than you usually do for a meal
- Other conditions like renal impairment which can increase your risk of hypoglycaemia from medications

Other medications that can cause drowsiness may also decrease your alertness on the road and your ability to pick up low blood glucose symptoms and signs.

When should I check my blood glucose levels?

1. Before you drive

Check your blood glucose level before you drive. Aim for a blood glucose level above 5.0 mmol/L before you start driving.

2. Check every 2 hours

If you are on a long car journey, take a break.

3. When you experience symptoms of hypoglycaemia

Test your blood glucose level when you experience symptoms such as:

- Shakiness
- Sweating
- Fast heartbeat
- Headaches
- Dizziness
- Tingling sensation in your fingers, lips or tongue
- Feeling hungry or nauseous
- Feeling nervous or anxious
- Feeling irritable

If not treated, your symptoms can become more severe, and can include:

- Weakness and difficulty walking
- Blurred vision
- Confusion and abnormal behaviour
- Unclear speech
- Loss of consciousness
- Seizures

If you have these symptoms, you or the people around you should call for an ambulance immediately.



What should I do if hypoglycaemia occurs?

1. Locate a safe place to stop and park your car.
2. Remove your ignition key and shift to the passenger seat.
3. Treat low blood glucose (< 4.0 mmol/L) using the 15/15 rule – 15 g of fast-acting carbohydrate like glucose tablets or fruit juices and testing 15 minutes later.
4. When your blood glucose level has reached above 4.0 mmol/L, take 15 g of carbohydrate before you start driving e.g:
 - 3 pieces of biscuits, or
 - 1 slice of bread
5. Start driving only when all your hypoglycaemia symptoms are gone and you are able to perform tasks like mental math – this might take up to 30-45 minutes.

Thank you for
driving carefully

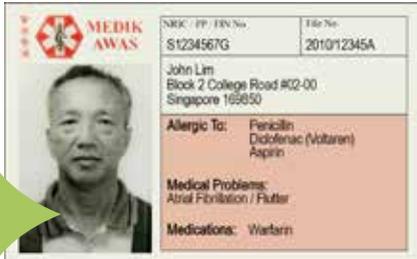
10

Tips for driving safely

- ✓ Always bring along a glucometer to monitor blood glucose readings.
- ✓ Bring along quick- and long-acting carbohydrates to treat hypoglycaemia.
- ✓ Protect your glucometer from extreme temperature by removing it from your car (away from direct sunlight) to ensure accurate blood glucose readings are maintained.
- ✓ Always test your blood glucose levels before driving and every 2 hours into driving.
- ✓ If your blood glucose reading is below 5.0 mmol/L, take 15 g of carbohydrate before you start driving e.g.:
 - 3 pieces of biscuits, or
 - 1 slice of bread
- ✓ Have a Medik Awars card to identify you as a person with diabetes in the event of an emergency. (See page 97)
- ✓ If you have had a hypoglycaemia episode, treat the hypoglycaemia and do not drive until you have fully recovered.
- ✗ Do not drive with blood glucose levels below 5.0 mmol/L.
- ✗ Avoid driving when you are tired or are on medications that may cause drowsiness.
- ✗ Never drink and drive.



What is a Medik Awas card?



According to the Singapore Medical Association (SMA), the Medik Awas card aims to prevent medical mishaps by alerting medical and dental personnel to any specific medical problems of registrants.

Medik Awas cards are useful for those with diabetes since it contains important information like your medical conditions and the medications you are on. This is important as it can alert strangers to the potential cause of your problem should you become unwell and are unable to verbalise why.

How do I apply for a Medik Awas Card?

1. Get your medical or dental practitioner to enroll you in the Medik Awas scheme.
2. Your doctor should fill up the Medik Awas application form at www.sma.org.sg
3. Once completed, you should submit the application to SMA through mail.
4. Mail the completed and signed Medik Awas form, with relevant

fees and a passport-sized photo to:

Medik Awas Department
Singapore Medical Association
No. 2 College Road
Level 2 Alumni Medical Centre
Singapore 169850

What is the cost of a Medik Awas card?

The registration fees for a Medik Awas card (as at 1 January 2012) are as follows:

Registration and Identification Card	\$30
Registration, Identification Card and Amulet	\$40
Renewal/Replacement of Card	\$15

How and when will I receive the Medik Awas card?

A laminated Medik Awas card will be mailed to you within 4-6 weeks through normal mail.

The card will bear the following:

1. Your name
2. Residential address
3. NRIC number
4. The nature of your allergies and/or medical problem
5. Your doctor's name and contact number

For more information, please visit www.sma.org.sg

TRAVELLING

WITH DIABETES

When you have diabetes, and especially when you are on insulin therapy, travelling can be challenging and stressful. Travelling can disrupt your daily routine when there are changes in time zones, food choices as well as your usual physical activity.

Despite the challenges, diabetes should not stop you from travelling. It's best to prepare well and in advance of your trip so that you can keep well during your time away from home.





Pre-departure planning tips

Pre-departure planning is essential to ensure that you are fit and adequately prepared for travelling.

1. Consult the doctor managing your diabetes before you travel

Visit your doctor before you travel to discuss your holiday plans. An early visit to your doctor can help you get the medical advice, medication and travel memos you need for a more pleasant vacation.

Ensure the following:

- Check that your blood glucose levels are under control
- Ensure you have sufficient medications for your trip
- If you are planning special activities, check with your doctor that it is safe to do so, and clarify any questions you may have on how to optimally manage your glucose levels during these activities.

2. Get these travel documents from your doctor:

- **Doctor's travel memo**
A travel memo is a letter from your doctor that says:
 - You have diabetes, and
 - You must hand-carry medications such as insulin and medical supplies such as syringes, insulin pens, glucometer, and other consumables onboard to manage your diabetes

• Medical memo and prescription

It is also good to have a copy of your prescription in case of unforeseen circumstances overseas. Bring extra supplies of medications and consumables in case your insulin pen is broken or in case the insulin becomes unusable due to extreme temperatures.

3. Check time zone and weather differences, nearest hospital and insurance

- **Changing time zones** can affect the timing for administering insulin, especially basal insulin. Remember to set an alarm so that basal insulin is administered on time. If you are uncertain about insulin timing changes, ask your doctor before you leave.
- **Weather differences** can affect the storage of your insulin and glucometer.
- **Check out the locations of hospitals nearby.**
- Ensure that your **travel or medical insurance** covers diabetes-related emergencies.

Diabetes packing checklist

It is prudent to pack more insulin and oral diabetes medication in case your journey is delayed due to unforeseen circumstances. The same goes for other diabetes supplies such as blood glucose monitors, test strips and lancets.

Do check that all your diabetes medication and consumables are not expired.

Diabetes medication

- | | |
|--|--|
| 1. Insulin | 4. Insulated cooler bag |
| 2. Injection needles/
insulin pen devices | 5. Reusable ice gel pack |
| 3. Alcohol swabs | 6. Oral diabetes medications or
other oral medications (if any) |

Tip: How to pack your oral medication

It may be helpful to pack your oral medication in a compartmentalised pill box so that you can keep track of your dosage and notice easily if you have missed any.

Blood glucose monitoring consumables

- | | |
|----------------|-----------------------------|
| 1. Glucometer | 4. Lancing device |
| 2. Batteries | 5. Lancet |
| 3. Test strips | 6. Recording log sheet/book |

Snacks to cope with hypoglycaemia

Changes in your travel itinerary or transportation delays can affect when you have your next meal, and in turn, your medication. It is important to have carbohydrate foods available at hand to treat hypoglycaemia.

Have a variety of carbohydrate snacks at hand. Suggestions include:

- **Quick-acting carbohydrates:** Fruit juices, sugar-coated jellied sweets and soft drinks (not the diet version). These quick-acting carbohydrates will raise your blood glucose level rapidly.
- **Slow-acting carbohydrates:** Bread, biscuits and crackers. These are especially important if it is going to be a long time before you next consume a meal containing carbohydrates.

Travel documents

1. Travel memo from your doctor
2. Prescription from your doctor
3. Medik AWAS card

How should I pack my insulin?

Travelling with insulin need not be stressful. All you need to do is pack your insulin in an insulated bag to prevent damage due to weather changes or extreme temperatures in the cargo compartment of the plane.

It is important that your diabetes medications and consumables are kept in your hand-carry luggage, and are not checked in.

To store your insulin properly and keep it cool, you need:



1

Insulated cooler bag



2

Reusable ice gel packs



3

Thin hand towel to wrap around the ice gel packs (if the insulated bag has no compartments)



4

Insulin



Follow these steps to help airport security staff process your hand luggage easily:

- ✓ Keep your insulin in their original vials.
- ✓ Pack your medication separately from your toiletries.
- ✓ Have your doctor's letter and prescription on hand.

How do I keep my insulin cool while I travel?



DO NOT CHECK IN YOUR INSULIN.

The insulin will freeze in the luggage hold and alter its effectiveness.

STEP 1

Put your insulin in the inner compartment of your insulated bag (to be hand-carried with you onboard the plane).



STEP 2

Store the refreezable ice gel pack in the pouch compartment. (If there is no compartment to store the ice gel packs, place a hand towel on top of the ice gel pack, and the insulins on top of the towel.)



STEP 3

When you arrive at your destination, unopened insulin pens/cartridges/vials should be kept in the fridge.



DIABETES AND

VACCINATIONS

Why should I be vaccinated if I have diabetes?

People living with diabetes are at high risk for certain infections. They also tend to have more serious or life-threatening forms of these infections.

Fortunately, there are vaccines which can help to prevent these infections from happening. Many people worldwide experience long-term consequences or die as a result of these infections, which is why vaccinating against them is so important.

Vaccines produce immunity by exposing our immune system to inactivated versions of bacteria or viruses, or parts of these organisms which do not cause disease. This helps our immune systems to be stronger fighters against these infections in future.

What are common infections which may affect people living with diabetes?

1. Influenza

Influenza is a virus which affects the respiratory tract, and is spread by respiratory droplets. It may cause milder illness such as an upper respiratory tract infection (the 'flu'), but may also cause more serious illness such as pneumonia (lung infection).

2. Pneumococcal disease

Pneumococcus is a type of bacteria which is spread by respiratory droplets. It can cause pneumonia, brain and bloodstream infections. It can cause serious illness and lifelong complications.

3. Hepatitis B

Hepatitis B is a virus which infects the liver. It can be passed from mother to child during childbirth, or via contact with contaminated blood or body fluids. It can cause liver inflammation and failure, and liver cancer.

What are routine vaccinations for children and adults living with diabetes?

1. Influenza vaccination

Annual influenza vaccinations are recommended for people with diabetes aged ≥ 6 months. Annual vaccinations are required because immunity declines 1 year after a previous vaccination.

The influenza vaccination is given as a single intramuscular injection. It provides protection against the 3 main strains of influenza which circulate during the flu season.

2. Pneumococcal vaccination

The pneumococcal vaccination is given as a single intramuscular injection. There are 2 types of pneumococcal vaccines available:

- Pneumovax 23 (PPV23)
- Prevenar 13 (PCV13)

These vaccines protect against many strains of pneumococcus which commonly cause disease.

When both vaccines are recommended, Prevenar 13 (PCV13) should be given first, followed by Pneumovax 23 (PPV23) at least a year later. This sequence helps to achieve the strongest immunity.

Always inform your doctor about your previous vaccination history so they can decide on the best vaccination schedule for you.

Pneumococcal vaccination for children with diabetes:

Prevenar 13 (PCV13) is recommended for infants younger than 2 years old as a series of 4 doses, starting at 2 months of age.

Pneumovax 23 (PPV23) is not effective in infants younger than 2 years old, and it is not recommended.



Children with diabetes aged between 2-5 years who have not previously received PCV13 should receive 1 or 2 doses of PCV13.

Children with diabetes aged ≥ 2 years should also receive PPV23.

Pneumococcal vaccination for adults with diabetes:

Pneumovax 23 (PPV23) is recommended for adults with diabetes aged < 65 years.

Adults aged ≥ 65 years should receive both Prevenar 13 (PCV13) and PPV23.

Adults who have previously been vaccinated against pneumococcus before age 65 should still receive PCV13 and a booster PPV23 vaccination after they turn 65.

3. Hepatitis B vaccination

The hepatitis B vaccine is given as 3 intramuscular injections over a period of 6 months (at 0, 1 and 6 months). It is recommended for all children and adolescents with diabetes.

It is also recommended for adults with diabetes who are younger than 60 years old. Hepatitis B vaccination may also be considered in adults above the age of 60, after discussion with a doctor.



Important precautions before vaccination

If you have the following conditions, you may not be able to receive certain vaccines, or, may need to take precautions when getting vaccinated.

Tell your doctor about these conditions when discussing suitable vaccinations:

1. Serious reactions to a previous dose of the vaccine
2. Serious reactions to certain antibiotics
3. Egg or yeast allergy
4. Conditions which predispose to bleeding (e.g. low platelet count, blood thinning medications)
5. Ongoing illness (vaccination may need to be postponed)

(All vaccinations are based on recommendations from the Centers for Disease Control and Prevention, Advisory Committee on Immunization Practices and American Diabetes Association.)

DIABETES AND

RAMADAN

Fasting during the month of Ramadan is one of the pillars of Islam and a duty for every Muslim. At Singapore General Hospital, we aim to support you as much as possible in carrying out your religious duty when you have diabetes.

Whilst fasting during Ramadan brings many benefits to diabetes patients (for example weight loss), there are also associated risks.

Tips for safe fasting

Before you fast

1. Know that there is no compulsion to fast when you are not healthy

Surah Al Baqarah Verse 184-185 provides a clear guide that fasting during Ramadan is not compulsory if you have chronic diseases, or where fasting endangers or is harmful to your life (e.g. if you're on insulin, have renal failure, or are pregnant).

You can make contributions to the poor or needy in lieu of fasting during Ramadan.

2. Make the decision to fast with the doctor treating your diabetes 2 months before Ramadan

It is important to discuss fasting with your doctor up to 2 months before Ramadan as you will need to know:

- How to fast safely
- Whether adjustments to your diabetes medications may need to be made beforehand

Do not self-adjust or stop medications on your own.

3. Have a trial run of fasting before Ramadan

A 'trial run' of fasting before Ramadan (i.e. *Puasa Sunat*) may be done to identify possible problems during fasting for Ramadan. Please discuss this with your doctor.





During your fast

4. Don't skip *Sahur*

(your pre-dawn meal)

You must not skip your *Sahur* (pre-dawn) meal. Should you miss your *Sahur* meal, you should not fast. Try to eat adequately for *Sahur*.

5. Drink 8 glasses of sugar-free fluids

Try to drink adequate fluids (choose sugar-free fluids) during *Sahur* and *Iftar* (sunset-meal) to replenish fluid loss during the day. Aim for 8 glasses a day.

6. Monitor your blood glucose levels when you are fasting

Self-monitoring of blood glucose during fasting is allowed during Ramadan. In fact, it is necessary for a successful fast.

7. Check for high blood glucose levels, low blood glucose levels or severe dehydration

You must be able to recognise when you have high blood glucose levels, low blood glucose levels or severe dehydration.



8. Signs you should stop fasting

You MUST terminate your fast immediately if you encounter these problems. Skipped fasting days can be replaced in the future.

Blood glucose levels

- Blood glucose < 4.0 mmol/L during fasting
- Blood glucose > 16.0 mmol/L

Signs of hypoglycaemia (low blood glucose)

- Feelings of tremors
- Sweating
- Palpitations
- Hunger
- Dizziness
- Confusion

Symptoms of severe dehydration

- Dizziness (feeling faint)
- Confusion

After your fast

9. Break your fast promptly and eat in moderation

Breaking of fasting (*berbuka*) should not be delayed. Try not to go overboard when you *buka puasa!*

ACKNOWLEDGEMENTS

Editor-in-Chief:

Dr Daphne Su-Lyn Gardner

Consultant

Department of Endocrinology

Singapore General Hospital

Advisors:

Dr Bee Yong Mong

Head, SingHealth Duke-NUS Diabetes Centre

Senior Consultant

Department of Endocrinology

Singapore General Hospital

Dr Goh Su-Yen

Head and Senior Consultant

Department of Endocrinology

Singapore General Hospital

Contributors:

Department of Endocrinology,

Singapore General Hospital:

Dr Goh Su-Yen

Head and Senior Consultant

Division of Obstetrics & Gynaecology,

KK Women's and Children's Hospital:

Prof Tan Kok Hian

Senior Consultant

Dr Bee Yong Mong

Senior Consultant

Dr Ann Wright

Consultant

Dr Teh Ming Ming

Senior Consultant

Dr Qi Maili

Senior Resident

Dr Daphne Su-Lyn Gardner

Consultant

Lim Boon Heng Bryan

Assistant Director

Dr Suresh Rama Chandran

Associate Consultant

Department of Nutrition and Dietetics,

KK Women's and Children's Hospital:

Han Wee Meng

Head and Senior Principal Dietitian

Dr Lim Weiyong

Associate Consultant

Department of Obstetrics & Gynaecology,

Singapore General Hospital:

Assoc Prof Yong Tze Tein

Senior Consultant

Dr Amanda Lam

Associate Consultant

Department of Podiatry,

Singapore General Hospital:

Manfred Mak Yaoquan

Head

Department of Endocrinology,

Tan Tock Seng Hospital:

Dr Michelle Jong

Senior Consultant

Department of Dietetics,

Singapore General Hospital:

Kala Adaikan

Senior Principal Dietitian

**NMRC Integrated Platform for
Research in Advancing Metabolic Health
Outcomes (IPRAMHO)
Study Group**

Surgical Retina Department,
Singapore National Eye Centre:
Assoc Prof Lee Shu Yen
Deputy Head and Senior Consultant

Dr Gavin Tan
Consultant

Divison of Nursing,
Specialty Nursing,
Singapore General Hospital:
Jean Lau Mei Ying
Senior Staff Nurse
Diabetes Nurse Educator

Yu Junjiao
Senior Staff Nurse
Diabetes Nurse Educator

Ou Enjun
Senior Staff Nurse
Certified Diabetes Educator

Ling Shiau Lee
Senior Staff Nurse
Certified Diabetes Educator

Zhang Xiaoping
Senior Staff Nurse
Certified Diabetes Educator

Salmiah Abdullah
Assistant Nurse Clinician
Certified Diabetes Educator

Er Boon Hui
Assistant Nurse Clinician
Certified Diabetes Educator

Chan Yoke Ling
Nurse Clinician
Certified Diabetes Educator

Lim Huee Boon
Nurse Clinician
Certified Diabetes Educator

Aslena Hussain
Nurse Clinician
Certified Diabetes Educator

Divison of Nursing,
Specialty Care Services,
Sengkang General Hospital:
Tan Qinghua
Senior Staff Nurse
Diabetes Nurse Educator

Information contributed by:



**Singapore
General Hospital**
SingHealth

www.sgh.com.sg

Tel: 6321 4377 | Email: appointments@sgh.com.sg



**Sengkang
General Hospital**
SingHealth

www.ah.com.sg

Tel: 6472 2000 | Email: appointment@skh.com.sg



**KK Women's and
Children's Hospital**
SingHealth

www.kkh.com.sg

Tel: 6294 4050 | Email: centralappt@kkh.com.sg



**Singapore National
Eye Centre**
SingHealth

www.snec.com.sg

Tel: 6227 7266 | Email: appointments@snec.com.sg

Concept and production: SingHealth Marketing Communications

Project team:
Syuhaidah Fadzil, Senior Executive
Fadhlina Jasni, Senior Executive

Advisor:
Kathryn Ng, Director

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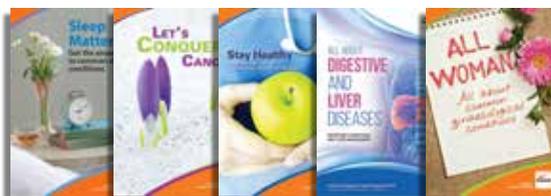
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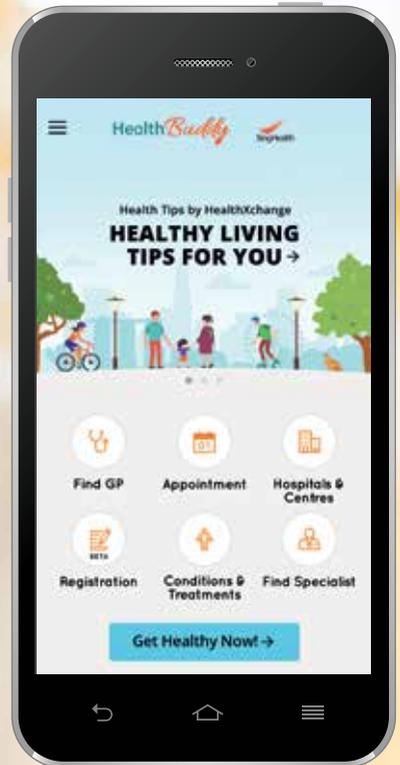


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