

Type 1 diabetes mellitus (T1DM)

What is type 1 diabetes mellitus?

Type 1 diabetes mellitus (T1DM) is a disease in which the cells in the pancreas that produce insulin (the β -cells) are destroyed by the body's own immune system (an autoimmune disease). This process leads to insulin deficiency (1). Insulin is a hormone that lowers blood glucose (sugar). Without insulin, hyperglycaemia (high blood glucose levels) occurs. In contrast to type 2 diabetes mellitus (T2DM), which is mostly associated with unhealthy lifestyles, T1DM often runs in families (inherited genetically). Therefore, most people with T1DM are diagnosed at an early age. However, what triggers the disease process is still largely unknown (1). T1DM is usually treated by dosing with insulin.

How is type 1 diabetes monitored?

Patients with T1DM measure their blood glucose level daily. Usually, patients take a small blood sample themselves by finger prick and then analyse it with colour-coded test strips inserted into a glucometer. Clinicians monitor the long-term status of the disease by measuring a substance in the blood known as glycated haemoglobin (HbA1c; see reference 2 for more information on this test).

For good management of T1DM, fasting blood glucose levels of 4.0–7.0 mmol/L and HbA1c levels of 7% or less are ideal for most people. However, achieving these targets must be balanced against the risk of 'overshooting' the target, which may cause dangerously low blood glucose levels (hypoglycaemia) (2).

Why is it important to control glucose levels?

Developing cardiovascular complications is one of the effects of long-term, poorly controlled T1DM. The effects occur in both small and large blood vessels. Small vessels in the kidneys, the retina of the eye and the nerves are damaged, leading to kidney disease and possible failure (diabetic nephropathy); sight problems and possible blindness (diabetic retinopathy); and changes in pain sensation, loss of muscle control and poor balance. Damage to large blood vessels increases the risk of heart disease.

Other factors that increase the risk of complications are an early onset of T1DM, a family history of diabetes-related complications, smoking, obesity, inactive lifestyle, high blood pressure and high blood cholesterol levels (1).

How does exercise benefit people with type 1 diabetes?

Maintaining good control of blood glucose levels can be more challenging for people with T1DM than for those people with T2DM. However, regular exercise is very

beneficial for both groups. For people with T1DM, regular exercise:

- improves control of blood glucose;
- improves how insulin works in the body (e.g. increased insulin sensitivity and reduced insulin resistance);
- decreases the dose of insulin required;
- improves cardiovascular health and fitness;
- reduces cardiovascular risk factors;
- decreases the risk of diabetes-related complications;
- improves quality of life; and
- reduces the symptoms of depression.

How does exercise produce these benefits?

Exercise cannot reverse the damage to the cells in the pancreas that leads to the decreased production of insulin. However, exercise can improve the way the muscles respond to insulin, which, in turn, helps regulate the blood glucose level for some hours after the exercise. Exercise also increases glucose uptake by the muscles in other ways that do not depend on insulin. In addition, exercise can lower the dose of insulin required by improving the body's response to insulin. Thus, exercise acts as a 'poly-pill' to improve physical, clinical and mental health and fitness.

What type of exercise is best?

People with T1DM who do not have diabetic complications can be involved in most types of exercise and physical activities. They can undertake leisure activities, recreational sports and competitive sports at low, moderate or high intensities.

People with T1DM can perform both resistance exercise (e.g. weight training) and aerobic exercise (e.g. walking, running or cycling). Aerobic exercise, which increases heart and lung fitness, should be performed on most days of the week, at moderate to high intensity, for between 20 and 60 minutes. Alternatively, the total exercise time can be broken into smaller parcels throughout the day. Resistance training should be performed on 2 or 3 days a week. Exercise the major muscle groups with 8–10 different exercises. Repeat each exercise 8–12 times in a set, and perform 2 or 3 sets at moderate to high intensity (50–80% of 1 repetition maximum) (3). You may prefer to have an accredited exercise physiologist work out a program for you.

Whatever you decide, rest assured that your exercise program will be increasing your overall health and quality of life.

Related information and references

Diabetes Australia www.diabetesaustralia.com.au

Exercise & Sports Science Australia www.essa.org.au

1. Daneman D. Type 1 diabetes. *Lancet*, 2006; 367(9513): 847–58.
2. Australian Diabetes Society. (2009). Australian Diabetes Society position statement: individualization of HbA1c targets for adults with diabetes mellitus. <http://www.diabetessociety.com.au/downloads/positionstatements/HbA1ctargets.pdf>
3. American College of Sports Medicine. (2010). Exercise prescription for other clinical populations. In: WR Thompson, NF Gordon & LS Pescatello (eds), *ACSM's guidelines for exercise testing and prescription* (8th ed, pp. 225–71). Philadelphia: Lippincott, Williams & Wilkins.