

NUTRITION FOR DIABETICS IN SPORT

Type 1 Diabetes

Type 1 diabetes is a condition in which the body is unable to produce insulin. Without insulin, the body's ability to use glucose as a fuel source is impaired. Does this mean that people with Type 1 diabetes have to give up dreams of a successful sports career? Swimmer Gary Hall Jnr. is just one of the elite athletes with Type 1 diabetes who has competed at the highest level of demanding sports. Clearly, with good management, it is possible to participate in sporting activities, even at an elite level, with this condition.

This fact sheet examines sports nutrition issues for people with Type 1 diabetes. The needs of each individual with diabetes varies - the information in this fact sheet should not replace the advice of your diabetes specialist.

How does Type 1 diabetes affect metabolism?

Insulin is a hormone produced in the pancreas. It has a number of important functions in the body, including a regulatory effect on carbohydrate metabolism. Insulin stimulates glucose to be taken up by body cells and used for fuel. It inhibits the release of glucose from glycogen in the liver and stimulates the synthesis of muscle glycogen after exercise. In the absence of diabetes, insulin is released according to the body's needs and the concentration of glucose in the blood is kept within a tight range. People with Type 1 diabetes do not produce insulin. The body is therefore unable to use glucose properly as a fuel source and starts to rely on fat and protein as fuel. This causes blood glucose levels to rise excessively and toxic byproducts from fat breakdown (ketones) to build up in the blood. If untreated, this can be fatal.

How is Type 1 diabetes treated?

Type 1 diabetes requires regular insulin injections. The amount and timing of insulin administration needs to be matched to factors such as food intake, individual metabolism and activity level. Blood glucose levels must be monitored regularly to ensure an appropriate amount of insulin is given. Poor use of insulin will result in abnormal blood glucose levels:

Hypoglycaemia - low blood glucose

Occurs when too much insulin is present causing too much glucose to be taken up by the body's cells and too little glucose to be released from the liver. Symptoms include sweating, rapid heart rate, drowsiness, shaking, confusion, poor coordination and nausea. If untreated, hypoglycaemic coma occurs. This is a potentially fatal condition that requires rapid medical assistance.

Hyperglycaemia - high blood glucose

Occurs when too little insulin is present. Too much glucose is released from the liver and cells cannot take up glucose adequately. Symptoms include restlessness, poor concentration, fatigue, thirst, muscle cramps, drowsiness and nausea. In the long term,

regular periods of hyperglycaemia increase the risk of complications related to diabetes including cardiovascular, kidney and eye problems.

How does exercise affect diabetes management?

Factors such as muscle contraction, increased blood flow and increased body temperature cause the body to be more responsive or 'sensitive' to insulin during and soon after exercise. In addition, when muscles contract, they can take up glucose from the bloodstream independently of insulin. Therefore, in people who do not have diabetes, insulin release decreases during exercise. People with Type 1 diabetes usually need to adjust their insulin dose to account for a reduced requirement for insulin during exercise. Management of diabetes varies for each individual. Regular monitoring of blood glucose concentrations and trial and error (under the supervision of your diabetes specialist) is needed to understand and manage each individual's response to exercise. However, in general, the following factors need to be considered:

- Intensity and duration of exercise
Pre-exercise insulin dose generally needs to be reduced when exercise extends beyond 30 minutes. The level of reduction varies for each individual but, in general, the longer the period of exercise, the greater the reduction required. Adjustments to insulin should be made with the guidance of your diabetes specialist, especially in the early stages of management.
- Degree of metabolic control before exercise
It is easier to manage and predict the body's response to exercise when metabolic control is good. It is dangerous to commence exercise when blood glucose levels are high and ketones are present in the urine.
- Type and dose of insulin injected before exercise
It is common practice to use a mixture of short and long lasting insulin to manage diabetes. It is necessary to predict the peak period of insulin activity to avoid excessive levels of insulin in the blood at the same time as exercising.
- Site of insulin injection
Insulin absorption is increased in exercising muscles. The abdomen is usually the preferred site for insulin injection prior to exercise.
- Timing of previous meal
Insulin requirements are influenced by the amount and type of food consumed.

How does Type 1 diabetes affect dietary requirements?

In general, people with Type 1 diabetes have the same dietary requirements as the general population - a varied diet with plenty of fruit, vegetables, legumes, bread and cereals, moderate amounts of fish, meat, poultry, eggs and dairy products and smaller amounts of foods high in fat, refined sugar and alcohol.

Including foods with a low glycaemic index (GI) is thought to assist with blood glucose control. Glycaemic index is a tool used to rank foods according to their immediate effect on blood glucose concentrations. Carbohydrate-containing foods that are broken down quickly,

releasing glucose rapidly into the blood stream, are known as high GI foods. Conversely, carbohydrate-containing foods that break down slowly, releasing glucose gradually into the blood stream, are known as low GI foods. People with diabetes (and the general population) are encouraged to consume a variety of low GI foods each day. Examples of low GI foods include:

- fresh fruit - apples, unripe bananas, pears, mangoes and grapes
- fruit loaf or fruit muffins
- multigrain bread
- porridge
- untoasted muesli
- crumpets
- pasta
- milk
- low fat fruit yoghurt
- baked beans

For further information on GI, speak to your diabetes specialist or sports dietitian. Blood glucose control is usually better when a consistent eating pattern is adopted with regular meals and snacks. People with Type 1 diabetes are encouraged to adjust their insulin regime according to food intake and activity levels rather than distorting their food intake to suit the insulin dose.

How does Type 1 diabetes affect sport nutrition strategies?

General sports nutrition strategies are similar whether or not you have diabetes. Managing Type 1 diabetes and competing successfully requires a commitment to trialing different food and fluid combinations in and around exercise. It is impossible to provide a single set of guidelines that will suit all people with Type 1 diabetes. This fact sheet outlines some issues to consider. You will need to work with your diabetes specialist and sports dietitian and use trial and error to find the best approach for you.

Eating Before Training and Competition

As for all athletes, a carbohydrate-based pre-exercise meal 1-3 hours before exercise is recommended. This may need to be followed up with a small snack closer to exercise. Theoretically, it may help to include a low GI food in the pre-exercise meal. However, research on non-diabetic athletes has not been able to indicate a clear benefit of having a low GI pre-exercise meal, provided sufficient total carbohydrate is consumed, and research on diabetic athletes has not been conducted.

It is important for people with Type 1 diabetes to ensure blood glucose concentrations are at an appropriate level before commencing exercise - ideally between 4-8 mmol/L. Exercising with high blood glucose concentrations disrupts normal metabolic control and will elevate levels even further. Apart from being dangerous, this will result in poor performance. In general, exercise should be postponed if blood glucose concentrations are above 10-14 mmol/L, especially if ketones are present in the urine. Blood glucose concentrations should be monitored closely before exercise. It may be

necessary to consume extra carbohydrate before commencing exercise if blood glucose is low. Blood glucose control is easier if you have a consistent training routine. It becomes more difficult in competition situations when the start time is unknown (e.g. athletics) or the length of the event varies (e.g. tennis). Being attuned to the symptoms of hypo- and hyperglycaemia and regular monitoring is necessary in these situations.

Eating During Training and Competition

The Eating Before Exercise fact sheet on the AIS Sports Nutrition website provides general information. Eating during exercise depends on the duration and intensity of exercise. In general, additional carbohydrate should be considered as exercise exceeds one hour or more or moderate to high intensity. Research suggests 30-60 g of carbohydrate per hour will aid performance in these situations. Usually it is not necessary to have extra insulin if you eat during exercise. Choices such as sports drinks that provide fluid and carbohydrate are a convenient option for most exercise situations. Other options such as carbohydrate gels, fruit and sports bars may also be tolerated. If additional carbohydrate is required during exercise, it is better to consume small amounts frequently rather than leave it until the last minute. Try any new strategies during training sessions when it is easier to monitor the effects on blood glucose control.

Eating After Training and Competition

General sports nutrition recovery strategies are the same as for non-diabetic athletes. Fuel and fluid used during exercise needs to be replaced. The increased insulin sensitivity caused by exercise lasts for several hours after exercise. Therefore the risk of hypoglycaemia persists for some time. Delayed hypoglycaemia can occur 4-48 hours after exercise. Preventing delayed hypoglycaemia involves making sure you consume sufficient carbohydrate before, during and after exercise. It may also be necessary to reduce the next insulin dose after exercise. It is helpful to monitor your blood glucose levels frequently after exercise. Inconveniently, delayed hypoglycaemia often occurs during the night. If this occurs regularly, it can exacerbate fatigue in athletes. Waking up feeling very tired and groggy in the morning may indicate you have experienced a 'hypo' during the night. This is a sign that you need to increase blood glucose monitoring after similar exercise sessions in the future. Alcohol inhibits the release of glucose from the liver therefore increases the risk of hypoglycaemia. Consuming excessive alcohol also impairs the ability to recognise the symptoms of hypoglycaemia. Sensible use of alcohol should be discussed with your diabetes specialist. All athletes are encouraged to moderate alcohol intake after exercise and ensure recovery needs are taken care of first. Little research is available directly on athletes with diabetes. However, it is possible that people with Type 1 diabetes have a reduced ability to store glycogen after exercise. This may be an issue when strenuous training sessions are held within a short period of time (less than 24 hours apart).

Is carbohydrate loading safe for people with diabetes?

The Carbohydrate Loading fact sheet on the AIS Sports Nutrition website provides general information. Carbohydrate loading is dependent on insulin availability and therefore requires good diabetic control. It is necessary to adjust insulin administration to account for the increased carbohydrate intake and the effects of an exercise taper. Regular blood glucose monitoring is essential when carbohydrate loading. Carbohydrate loading should not be attempted if blood glucose control is poor. Seek advice from your diabetes specialist and sports dietitian if you wish to use this method.

Controlling Blood Glucose Levels During Competition

Excitement and nerves surrounding competition are almost inevitable. A side effect of excitement is the release of hormones such as adrenalin and cortisol. These hormones stimulate the release of glucose from the liver and reduce the effectiveness of insulin. This can result in fluctuating blood glucose levels. Ways to avoid or cope with this include:

- Emulate your race/competition preparation in training (including physical preparation and recovery, and nutrition strategies)
- Try and practice some relaxation techniques (correct breathing techniques, muscle relaxation techniques, music, or talk to a sports psychologist)
- Write your routine down on paper before the event so you don't forget your routine amongst all the excitement.

You may need to consider taking slightly more insulin for competition day or using a more intensive insulin routine (i.e. frequent and small doses of short acting insulin). This should be practiced and planned in conjunction with your diabetes specialist.

Carbohydrate intake on competition day should not be sacrificed to try and reduce blood glucose concentrations. The result could be insufficient energy for competition - there is no benefit to doing this! Forward planning and practice will help avoid this situation.

Blood Glucose Levels and Strength Training

Strength-oriented exercise (e.g. lifting weights or even sports like taekwondo) generally requires short, repetitive and intensive bursts of movement. This type of exercise can provoke a hormone response known as the 'fight or flight' or 'adrenalin' response that can temporarily raise blood glucose levels. Currently, it is not known whether this temporary hyperglycemia from weight training has any long-term effect and management of this response is difficult and still controversial.

Decreasing carbohydrate intake in an attempt to avoid the anticipated hyperglycemia might jeopardise performance during exercise and increase the risk of delayed hypoglycemia after exercise. Increasing your insulin dose after exercise to reduce blood glucose concentrations may increase the risk of delayed hypoglycemia once the 'adrenalin' response has worn off. Regular blood glucose monitoring is important so that you are aware of how your body responds to strength exercise. You should consult your diabetes specialist if you are concerned about your blood glucose response to weight training and seek guidance on the best way for you to respond.

Weight loss and Body Fat Loss with Type 1 Diabetes

Achieving a weight goal, reducing body fat or just maintaining weight should be a planned and realistic process in order to avoid the temptation for fad diets or radical weight loss or gain. This is very important in diabetes as rapid weight loss can lead to severe hypoglycemia, fatigue, and poor exercise performance. These negative consequences of rapid weight loss defeat the purpose of reducing weight or body fat in the first place. As a person with Type 1 diabetes, it is important to consider the impact of what you eat in relation to your blood glucose concentrations as a priority rather than how it immediately affects your weight. Rapid fluctuations in weight affect your health much more significantly than someone without diabetes.

The Weight Loss fact sheet in the AIS Sports Nutrition website provides general information. A sports dietitian can help you to plan your nutrition requirements if weight loss is an issue for your sport.

Insulin and Anti-Doping Policies

Insulin promotes protein synthesis and inhibits protein breakdown. It has therefore been misused as an anabolic agent. This is a dangerous and illegal practice. WADA anti-doping policies allow people with diabetes to use insulin and compete in official competitions. However formal approval for therapeutic use must be obtained. [ASADA](#) can advise on the procedure for obtaining therapeutic approval.

Travel

Nutrition for Travelling Athletes outlines general strategies. Athletes with diabetes need to pack ample supplies of insulin and testing equipment. Supplies need to be packaged in a container that protects from heat stress and physical damage. Consider packing half your supplies in your hand luggage and the rest in your checked in luggage.

Responsible Management

Maintaining good diabetic control will maximise the benefits from training. It is important to persevere to understand your own metabolic response and develop a management strategy. Regular consultation with your diabetes specialist is important. Athletes with diabetes need to plan for the management of hypoglycaemia. It is important to train with a partner who is aware of the problems and knows how to treat hypoglycaemia. Coaches of athletes with diabetes need to understand the effects of diabetes on athletic performance and be familiar with their athlete's management plans. They should also be prepared to treat hypoglycaemia.

Thinking about starting a sport?

If you are contemplating getting into sport then you should first seek a medical assessment (complications screening) by your diabetes specialist. A sports physician can also offer an

assessment based on the requirements of your chosen sport/s and help guide the pace at which you get into your sport.

Want to improve your performance in your current sport?

There are many factors related to diabetes that can influence physical performance as well as all the factors unrelated to diabetes that influence performance. You may need to adopt a team approach so you manage your diabetes and your exercise performance simultaneously. Be sure to involve your diabetes specialist, sports physician, sports dietitian and coach to help maximise your sports performance and manage your diabetes.

Monitoring Diet and Training

A training diary is probably the most important and useful tool you can embrace as an athlete. Consider combining your diabetes-monitoring tool with your training diary in order to monitor both diabetes and non-related diabetes factors simultaneously. There are a number of commercial sports training diary programs available through the internet. Alternatively, you could create your own in a spreadsheet using the suggested headings below.

- Date - It's always handy to know when the event took place!
- Training Times - Exercising at different times during the day may affect your body's response during or after exercise.
- Nature of the Exercise - Recording the type, duration and intensity of exercise enables you to more accurately reflect on the nature of the exercise you undertook. Keeping a record will help you or your dietitian/diabetes specialist/coach to work out whether your nutritional strategies are appropriate. It will also enable you to see whether your training is adequate or excessive over time.
- Blood Glucose Levels - Regular blood glucose testing is recommended as part of your usual diabetes management routine. However, when starting out in a sport or beginning a new season, more frequent testing is essential. This may mean testing around meal times (before and after) as well as before, during (if possible) and after exercise. There are no rules as to how best to do this, however regular testing provides a clearer picture of how your body responds to exercise. Ultimately, this will allow you to determine the impact of a variety of factors including pre-exercise nutritional status, insulin regimen, insulin injection site, and nature of the exercise on blood glucose control.
- Insulin Type and Dose - Seek advice from your diabetes specialist about what insulin regimen (e.g. insulin pump or injections) is likely to work for you and how to adjust your insulin according to blood glucose readings and the nature of the exercise you perform. Recording information about how much insulin and what type of insulin you use will provide a basis from which you can progressively alter your regimen according to your exercise demands.
- Food Record - A sports dietitian can help you to assess your food diary and see if there are ways to improve your sports performance by modifying your dietary intake. Visit the [Sports Dietitians Australia](https://www.sportsdietitiansaustralia.com.au) website to find a Sports Dietitian near you.

- Energy Levels - This factor relates to how you felt during training. Did you feel tired, lethargic, or full of energy? This may help explain your exercise performance and assist you in monitoring whether you are recovering adequately between exercise sessions.

Initially, it may seem there is a lot of information to be collected. However, collecting detailed information will allow you to identify problem areas and take steps to rectify them. It is beneficial to record the information even when things are going well so you can reflect back on successful strategies in the not so good times. You can use your own codes and very short descriptions to reduce the amount of time required to fill out your diary. Your diary can be shown to your sports physician, sports dietitian, diabetes specialist or coach. This network of specialists can help you achieve your sporting goals while managing your diabetes. Not only are they objective, they may also have some great ideas and offer support in the good and bad times.

Written by AIS Sports Nutrition, last updated November 2009. © Australian Sports Commission.