Exercise and type 1 diabetes: overcoming the barriers

How do you help your patients with type 1 diabetes overcome barriers to physical exercise?

Mark Greener here explores the latest advice, including that of a recent consensus statement, and highlights areas where more input is needed.

Everyone knows that regular exercise is good for their health and wellbeing. In people with type 1 diabetes (T1D), for example, regular physical activity increases cardiorespiratory fitness, decreases insulin requirements, enhances endothelial function and vascular health, lowers serum cholesterol and improves body composition. So, in turn, regular exercise reduces the risk of complications, increases life expectancy and improves quality of life.1

‘Good clinical management for people with type 1 diabetes should incorporate regular physical activity,’ says Richard Bracken, Associate Professor in Exercise, Physiology and Biochemistry at the Applied Sport, Technology, Exercise and Medicine Research Centre at Swansea University. ‘Sedentary individuals with type 1 diabetes are more likely to die earlier of cardiovascular problems than those who are physically active.’

Despite these benefits, a European study that enrolled 18 028 people with T1D found that 66.0% and 60.5% of women and men respectively were inactive. The proportion of people with T1D who exercised more than twice a week fell from 25.8% of people aged 18 to <30 years to 13.3% and 10.0% of those aged 30 to <45 and 45 to <80 years respectively.2

As these low rates demonstrate, getting people off the sofa is notoriously difficult. Even people without diabetes claim that time and work pressures, poor access to facilities, body image and other barriers make regular exercise difficult. As discussed later, people with T1D face several additional barriers.1,3,4

Against this background, a recent consensus statement5 explores the benefits of exercise and offers suggestions about how health care professionals (HCPs) can help people with T1D get active. ‘The consensus statement is a fantastic starting point and details the current evidence and available recommendations on nutrition and managing changes in glycaemia with exercise,’ says Kathryn Kirchner, Clinical Advisor at Diabetes UK.

The benefits of exercise

‘Reductions in cardiovascular risk is the main benefit of exercise for adults with type 1 diabetes,’ says Ms Kirchner. So, NICE suggests advising adults with T1D that ‘physical activity can reduce their enhanced cardiovascular risk in the medium and longer term’.5 In children with T1D, for example, regular exercise improves the cardiovascular disease risk profile and reduces HbA1c by about 0.3%.3 More widely, some studies, especially those assessing higher intensity or greater frequency of exercise or both, show reductions of 0.4% to 1.2% in HbA1c among T1D patients who had fair to poor control at baseline (HbA1c 8.6–15.1%; 70–141.5mmol/mol).1

In children and young people with T1D, regular exercise improves body composition, cardiorespiratory fitness, endothelial function as well as blood concentrations of triglycerides and total cholesterol. The consensus statement notes that ‘these cardiometabolic improvements are all important, given that cardiovascular disease is the leading cause of morbidity and mortality in young people with type 1 diabetes’.3

Furthermore, in adults with T1D, regular exercise seems to:

• Reduce the risk of retinopathy, microalbuminuria, ketoacidosis and severe hypoglycaemia with coma,
• Increase the likelihood of achieving HbA1c, blood pressure and body mass index targets,
• Reduce total daily insulin needs.

In everyone, not just those with T1D, regular exercise reduces the risk of coronary artery disease, myocardial ischaemia and stroke.3

Overcoming barriers

To obtain these benefits, the consensus statement suggests that adults with T1D should accumulate 150 minutes of physical exercise a week, with no more than two consecutive days without exercise and resistance training two or three times a week.3 Children and young people should get at least 60 minutes of exercise a day.3

The consensus statement suggests including aerobic and anaerobic activities as well as high-intensity interval training, which has ‘established benefits’ in pre-diabetes or type 2 diabetes. Including bouts of high-intensity exercise – such as sprints on a treadmill or bike – during moderate-intensity workout may reduce the risk of hypoglycaemia during and immediately after exercise. The effect on nocturnal hypoglycaemia needs further study, however.3 ‘Most of the exercise-related health benefits can be attributed to aerobic-type training and/or a combination of aerobic and resistance exercise training,’ Dr Bracken comments. ‘However, few studies have investigated the impact of chronic resistance exercise training only on the health of people with type 1 diabetes.’

As mentioned above, numerous barriers can discourage people with T1D from taking regular exercise. In addition to those cited by people generally, patients with T1D face several additional hurdles including1,3,4

• Fears of hypoglycaemia during and after (e.g. nocturnal) exercise.
• Concerns about losing glycaemic control.
• Inadequate knowledge around managing diabetes when they exercise.
• A lack of evidence about the optimal frequency, duration and intensity of exercise that improves glycaemic control.

‘Unfortunately, many patients fail to reach minimum physical activity standards due to fears of poor blood
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Glucose control around activities and a failure to appreciate how different forms of exercise have different metabolic impacts, Dr Bracken remarks. 'This results in poor patient confidence to manage blood glucose appropriately during and after exercise, and dissuades longer-term involvement in physical activity.'

For instance, the increase in glucose uptake and insulin sensitivity associated with exercise can emerge rapidly and persist for 48 hours. Indeed, exercise can increase glucose intake into muscles by up to 50-fold, independently of insulin signalling. Not surprisingly, people with T1D worry that exercise may increase the risk of hypoglycaemia, especially at night.

One study, for example, studied 50 people with T1D, aged between 11 and 17 years, on two days. On one of the days, patients exercised on a treadmill in the afternoon. Plasma glucose levels fell in almost all the children and adolescents, and 22% developed hypoglycaemia. Nocturnal hypoglycaemia was significantly more common on the night after exercise and occurred only on the exercise night in 26%, only on the sedentary night in 6% and on both nights in 22%.

Against this background, NICE suggests offering adults with TID information about:

- Appropriate intensity and frequency of physical activity.
- Self-monitoring of changed insulin, nutritional needs or both.
- Activity’s effect on blood glucose levels, which will probably fall, when insulin levels are adequate.
- The effect of exercise on blood glucose levels when hyperglycaemic and hypoinsulinaemic; exercise could worsen hyperglycaemia and induce ketonaemia.
- Appropriate adjustments of insulin dosage, nutritional intake or both before and after exercise, and for the next 24 hours.
- Interactions between exercise and alcohol.
- Further contacts and sources of information.

‘Learning how to adjust diet and insulin to meet demands during endurance or strength activities can help form an individualised “acute exercise management strategy” that helps patients overcome barriers to being regularly active,’ Dr Bracken remarks. ‘If patients have been appropriately assessed and have minimal complications, they should be encouraged to start a regular physical activity programme and embark on the development of a safe regimen themselves.’

In addition, HCPs should consider the patient’s goals – the insulin regimen and nutritional advice may differ depending on whether the person with TID wants to lose weight or maximise sport performance, for example. ‘As with diet or any other therapy, exercise prescription should be highly individualised for the person with type 1 diabetes,’ says Ms Kirchner, who is also a Registered Dietitian in the UK and was previously an Accredited Exercise Physiologist in Australia. ‘Someone simply wanting to improve their health will need a vastly different approach to an athlete competing at a high level. It is important to consider a range of physical, psychosocial and environmental factors when recommending exercise. For example, other medical conditions, including existing diabetes complications, patient goals, and level of fitness, financial constraints and personal preferences are all important, in addition to what the evidence shows to be most beneficial.’

Against this background, the consensus guidelines suggest management strategies based on blood glucose concentrations before exercise as well as reviewing factors that HCPs should consider before adjusting insulin in people with TID who exercise. Further studies, however, need to determine the most effective adjustments to the dose of basal insulin to prevent exercise-induced hypoglycaemia and the best way to manage glycaemia after exercise.

‘Starting small, and building up is key,’ Ms Kirchner remarks. ‘Over time, people can create a picture of how their glucose levels might respond in certain situations. Record keeping may assist with identifying potential patterns that can guide the management of glycaemia with exercise. Large variability between, and within, people still exists, which means that careful monitoring will always be important when exercising with type 1 diabetes. Overall, people with type 1 diabetes should be encouraged and supported holistically with information from their health care professionals to do a little bit of any exercise that they enjoy and can manage on a regular basis.’

Specific issues

The statement offers some advice about specific issues facing people with T1D. For instance, marathons, treks and other activities requiring prolonged endurance as well as diets very low in carbohydrate can elevate blood ketone concentrations. If people want to participate in these regimes, HCPs should offer advice about monitoring and management. People with longstanding T1D or markedly elevated HbA1c concentrations should avoid vigorous exercise, lifting heavy weights, and competitive endurance events, especially if they have unstable proliferative retinopathy, severe autonomic dysfunction or renal failure. ‘The ability and decision to engage with some forms of exercise over others may be more dependent on the individual and involve underlying fitness and complications, such as proliferative retinopathy, neuropathy, nephropathy, foot ulcers and underlying cardiovascular disease risk,’ adds Dr Bracken.

For example, Dr Bracken suggests that given the elevated cardiovascular disease risk, people with TID may benefit from a graded exercise test to exclude underlying, significant heart disease. ‘Patients with significant proliferative diabetic retinopathy or nephropathy should initially engage in low-impact cardiovascular activities, such as swimming, aqua-aerobics, yoga, Pilates, walking or cycling. They should avoid activities that involve high-intensity elements, such as team sports, encourage competition or include heavy resistance exercise,’ he says. ‘If the patient has peripheral or autonomic neuropathy or has ulcers, health care professionals should check the patient’s feet before activity and recommend non-weight bearing aerobic activities, such as swimming, aqua-aerobics, cycling, chair or arm
exercises and avoid prolonged walking, step aerobics or jogging.’

‘Care is to be taken with yoga and Pilates as any “head down” movements – such as the downward dog and other inversions – should be avoided in proliferative retinopathy,’ Ms Kirchner adds. ‘Care should also be taken with breathing and the potential for breath holding in Pilates during movements of a prolonged nature.’

**Outstanding questions**

Despite the consensus about the benefits, numerous outstanding issues remain. Yardley and colleagues, for instance, call for large, well-designed, randomised trials to determine the effect of including high-intensity exercise into regular workout, focusing especially on glycaemic control generally and at night. 'We need more detailed information on the different approaches to managing glycaemia for a range of different activities to give people more choice and flexibility, which in turn, may assist with their confidence,’ Ms Kirchner notes.

Moreover, the evidence that exercise improves metabolic control in adults with T1D is ‘somewhat scarce’ and the most effective exercise regimen to improve cardio-metabolic control in T1D needs clarification. "The benefits of aerobic, resistance and interval training have been examined, but more research on combination activities and exercises for flexibility are needed,’ Ms Kirchner says.

Dr Bracken would like to see more studies investigating the most effective way to motivate sedentary individuals to start exercise, especially those who worry about any exercise inducing more hypoglycaemia. ‘We need to identify ways to promote adoption and adherence to exercise specific to the type 1 diabetes population to help address low exercise participation rates,’ Ms Kirchner agrees.

‘As Lascar and colleagues concluded, cheaper gym memberships and access to pools, help with time management, advice and encouragement around managing diabetes for exercise, setting and re-setting goals for exercise and starting at an appropriate intensity to reduce muscle soreness will no doubt go some way to promoting ongoing exercise adherence,’ Ms Kirchner comments. ‘On the other hand, approaches that encourage exercise in the general population, such as group activities and motivational interviewing, were not favoured by people with type 1 diabetes.’ Further research is needed to define factors that can improve uptake and persistence in people with type 1 diabetes specifically.

Nevertheless, suddenly overcoming these barriers and engendering a widespread switch to regular activity is probably unrealistic. ‘A reasonable goal would be to aim for improvements upon the current rates of participation over time,’ Ms Kirchner concludes. ‘Diabetes UK sees that aiming for the ideal recommended amounts of exercise in the long-term with a strong emphasis on education, further research and support from health care professionals is a reasonable goal for type 1 diabetes care.’

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**References**

5. NICE. Type 1 diabetes in adults: Diagnosis and management. 26 August 2015. Available at: www.nice.org.uk/guidance/ng17.