Prescribing exercise for diabetes

Bronwyn Penny, Exercise Physiologist, Diabetes Australia – NSW, Sydney

Summary

Prescribed effectively, regular exercise is extremely safe, effective and essential in managing diabetes and its complications. It can play a significant role in reducing associated cardiovascular and lifestyle risk factors. The cornerstone of effective exercise prescription lies in the consideration of the various barriers, motivators and medical concerns that face people with diabetes and understanding how exercise may impact both positively and negatively upon these factors.

Key words: cardiovascular disease, stress testing.

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Introduction

Regular physical activity has been shown to significantly improve the health outcomes for people with diabetes. Physically active patients with diabetes have lower rates of all cause mortality and cardiovascular heart disease.[1] Regular exercise assists in maintaining good blood glucose control which in turn helps to decrease the risk of developing diabetes complications such as neuropathy and nephropathy.[2,3,4] It can also enhance quality of life and reduce stress, anxiety and depression.[5]

Prescribing exercise should be considered one of the essential components of diabetes care. Unfortunately, it is still largely underused.[4]

Pre-exercise screening and testing

Certain exercise intensities and modalities may be contraindicated or inappropriate for some people.[3,4,6] Before prescribing an exercise program for a person with diabetes it is imperative that the patient is screened and assessed for cardiovascular disease risk factors or other conditions that may pose significant health risks.[3,6] The patient should be asked about any symptoms of cardiovascular disease including unusual shortness of breath, chest pain with exertion, dizziness, light-headedness, swelling of the ankles and pain in the calves that is not associated with muscle pain. If these symptoms are present, further investigation is needed before the patient can begin an exercise routine.[7] Other cardiovascular risk factors that should be assessed include blood pressure, cholesterol and lipid profiles, resting heart rate, weight, body mass index, waist circumference, family history and previous cardiac history.[6]

The presence of cardiovascular risk factors and other complications does not preclude a person with diabetes from undertaking an exercise program.[6] Screening provides a useful risk stratification tool to guide exercise prescription or identify those who should undergo cardiac stress testing before starting to exercise.[3,6] Currently there are no clear-cut guidelines.

Stress testing allows definitive management of patients with cardiovascular disease before exercise is prescribed. However, there is no evidence that stress testing should be routinely performed before exercise of moderate intensity if cardiovascular disease risk is low. Stress testing may be impractical and expensive.[3] Conversely, ECG stress testing is recommended for sedentary individuals with high cardiovascular disease risk (greater than or equal to 10% risk of cardiovascular disease over 10 years) who wish to participate in aerobic activities that exceed demands of daily living, or patients with several cardiovascular disease risk factors.[3,6]

Other conditions that should be screened for include proliferative and non-proliferative retinopathy, peripheral neuropathy, autonomic neuropathy, nephropathy and microalbuminuria as well as musculoskeletal limitations such as rheumatoid arthritis, severe osteoarthritis, osteoporosis and other joint problems.

High intensity exercise is contraindicated in people with proliferative retinopathy due to the risk of retinal haemorrhage.[3] High intensity exercise, while not contraindicated, is not recommended for people with nephropathy and microalbuminuria. High impact and weight-bearing modalities such as running and jumping are inappropriate and not recommended for people with peripheral neuropathy, arthritis and osteoporosis as they are at greater risk of falls, injuries and foot damage due to poor peripheral sensation.[3]

To develop an individualised program, simple easily performed exercise tests requiring little specialised equipment, such as the six-minute walk test or one-minute sit-to-stand, may provide an insight into the patient's current physical capacity. This will assist the practitioner to successfully develop a program that matches the needs of the patient to the prescribed exercise intervention.[6] Exercise testing is also useful for assessing the efficacy of the exercise program. It is important to consider the appropriateness of any exercise test used as it needs to accommodate the patient's physical abilities and limitations.[7]

Exercise prescription

Various medical and physical concerns will govern the type, intensity and duration of exercise an individual is capable of performing safely.[3,4,6] Several lifestyle and socio-economic issues such as motivation, personal goals and preferences, stage of change and cultural influences will also affect the type

of exercise intervention developed and its implementation.[2,4,5] Finally, availability and access to services and facilities such as exercise professionals, exercise facilities and safe exercising options will vastly influence the design and implementation of an exercise program.[4] It is important that any exercise program be tailored towards the individual.

Written exercise instructions may help with adherence to an exercise program. However, of more importance is the level of support the physician gives to the patient regarding the uptake of physical activity. Physician support, patient consultation, specific advice regarding the type, time and intensity of the exercise program and the setting of appropriate and realistic goals appear to be the strongest predictors of adherence along with the patient's readiness to change a perceived limitation. Regular monitoring, assessment and goal setting will greatly assist the patient's ability to achieve long-term behaviour change.[8]

Aerobic activity

Regular aerobic exercise improves blood lipid profiles, blood pressure and resting heart rates, body composition and glycaemic control as well as reducing cholesterol. In addition, it helps patients to lose weight.[3,4]

For health benefits, current guidelines recommend that aerobic activity should be performed for at least 30 minutes at a moderate intensity on most, if not all days of the week with no more than 72 hours between exercise sessions. If weight loss is desired, then 60 minutes of exercise or more is recommended.[3,4,6] It is often difficult for most people to begin at this level, therefore the exercise prescription should initially begin at a level the patient can manage, with the aim of gradually increasing exercise duration and intensity as the patient progresses.[4]

Exercise should be continuous in nature and could include activities such as walking, swimming or cycling.[3,4,6] However, the type of exercise will depend on the patient's safety and physical activity preferences.[6]

Exercise intensity should be at least moderate to vigorous in nature. Moderate intensity exercise is described as a level of activity that elicits a heart rate response of 55–70% maximal heart rate or 12–13 on a 20 point rating of perceived exertion using the Borg scale (see Box 1).[3,6,9] While moderate intensity is preferred, some patients, especially very obese patients, may be unable to cope for sustained periods of exercise. In this scenario, interval type training and alternating periods of high and low exercise intensities may be more useful. With regard to monitoring exercise intensity, while heart rate monitoring has its benefits, rating of perceived exertion requires no additional equipment, is easy to use and teach to patients and correlates strongly with exercising heart rates. The Borg scale is useful in monitoring exercise intensity for those with autonomic neuropathy where heart rate responses may be disproportionate to actual exercise intensities.[6]

Resistance training

Resistance training is another vital component of any exercise program for people with diabetes. This refers to exercise that requires the body's musculoskeletal system to work against an opposing force, such as gravity or weight. Resistance training has positive effects on insulin resistance, glycaemic control, weight loss and management, maintenance of lean body mass, strength, balance and functional capabilities.[2,3]

Very obese individuals, those with balance and mobility issues, foot health problems and peripheral vascular disease often find this form of training easier to cope with and may be more likely to adhere to the program.[2]

Current research and guidelines recommend resistance training be performed at least 2–3 times a week in conjunction with an aerobic training program to obtain the greatest benefits.[2,3,4,6] Heavy resistance training provides the biggest impact on glycaemic control and insulin sensitivity. Previously, only light weight resistance training was recommended because of safety concerns for the patient. The major concern was possible harmful effects from large acute spikes in blood pressure associated with heavy resistance exercise. However, recent evidence suggests the myocardial demands of heavy resistance training are comparable to the cardiovascular demands placed on the body when performing some occasional activities of daily living such as stair climbing.[3] Recent research has also shown the safety and efficacy of heavy resistance strength training even for older adults.[2,3]

Provided there are no contraindications, heavy resistance training targeting all major muscle groups should be included and consist of heavy loads lifted 8–10 times, progressing to 2–3 sets for each exercise. While there are no set guidelines, a 1–2 minute break between sets will give better strength benefits.

Box 1

Borg's ratings of perceived exertion scale [9]

6	
7	very, very light
8	
9	very light
10	
11	fairly light
12	
13	somewhat light
14	
15	hard
16	
17	very hard
18	
19	very, very hard
20	

The load should not be able to be lifted more than 8–10 times each set (that is 8–10 repetitions maximum strength).[2,3] Regardless of exercise intensity, it is imperative that good exercise technique is emphasised throughout the program to reduce the risk of injury and maximise health outcomes.[3,4]

Exercise programs

There are specific exercise programs for people with diabetes (see Box 2). You can also contact Diabetes Australia (phone 1300 136 588) for information on exercise programs in your local area.

Special considerations

The effects of exercise on patients who are insulin dependent, taking oral medications or suffering from one of the many comorbid conditions associated with diabetes also need to be considered when prescribing exercise.

Hypoglycaemia

Exercise has an insulin-type effect which poses potential hazards for those who are insulin dependent or take oral hypoglycaemic medications. Exercise can cause hypoglycaemia if medication dosages or carbohydrate intake are not modified with increases in levels of physical activity.[3,4,6] Blood glucose levels will respond differently depending on the individual, exercise intensity and duration.[6] As a general rule though, extra carbohydrate should be ingested before exercise if the session is to last longer than 30 minutes or if pre-exercise blood glucose levels are less than 5.6 mmol/L.[3,6] As exercise-induced hypoglycaemia may occur many hours post exercise, regular blood glucose monitoring before, during and after exercise is recommended to establish blood glucose responses to exercise.[3,4,6] Alternatively, insulin dosage may be adjusted.[3,6] Referral to a diabetes educator to discuss these strategies is strongly recommended as is the carrying of emergency glucose supplies at all times during and after exercise to treat potential hypoglycaemia.

Box 2

Exercise programs for people with diabetes

Living longer, living stronger (Victoria, Western Australia)
Strength for life (South Australia)
Council on The Ageing www.cota.org.au
Phone 1800 182 324

Lift for Life
www.liftforlife.com.au
Phone 1300 733 143

Heartmoves
www.heartfoundation.org.au/Professional_Information/Lifestyle_Risk/Physical_Activity/Heartmoves.htm
Phone 1300 362 787

Diabetic retinopathy

The presence of diabetic retinopathy may also impact on exercise prescription. Exercise may have adverse effects on those with proliferative or severe non-proliferative retinopathy. Until the retinopathy has been stabilised, high intensity resistance and aerobic training should be avoided due to the risk of retinal haemorrhaging.[3,4,6] Nevertheless, patients with either of these conditions can still benefit from regular moderate exercise.

Peripheral neuropathy and vascular disease

Both peripheral neuropathy and vascular disease can increase the risk of injury and infection in the feet. Peripheral neuropathy can also affect balance, placing the patient at greater risk of falls. Some types of exercise such as treadmill walking should be avoided. Adequate footwear and regular screening for blisters is a must for these individuals, especially with weight-bearing activities.[3,4,6] Non-weight-bearing exercises such as cycling, and upper limb resistance training may minimise damage or infection.

Conclusion

Exercise can play a major role in prevention and management of diabetes. It can improve glycaemic control, reduce cardiovascular risk and improve quality of life. Both aerobic and resistance training modalities should form the cornerstone of any exercise program. Prescribed correctly and with adequate considerations of the barriers, motivators and medical concerns facing people with diabetes, exercise can be an extremely safe and effective treatment strategy.

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Further reading

Bowen K. Managing foot infections in patients with diabetes. Aust Prescr 2007;30:21-4.

Conflict of interest: none declared

Self-test questions

The following statements are either true or false (answers on page 135)

7. High intensity exercise may cause haemorrhage in patients with diabetic retinopathy.
8. Patients with diabetes who have cardiovascular disease are precluded from undertaking an exercise program.

New drugs

Some of the views expressed in the following notes on newly approved products should be regarded as tentative, as there may have been little experience in Australia of their safety or efficacy. However, the Editorial Executive Committee believes that comments made in good faith at an early stage may still be of value. As a result of fuller experience, initial comments may need to be modified. The Committee is prepared to do this. Before new drugs are prescribed, the Committee believes it is important that full information is obtained either from the manufacturer's approved product information, a drug information centre or some other appropriate source.

Human papillomavirus vaccine

Cervarix (GlaxoSmithKline)

vial or syringe containing 0.5 mL liquid

Approved indication: prevention of human papillomavirus infection and associated genital disease

Australian Medicines Handbook section 20.1

This is the second vaccine to be registered in Australia against human papillomavirus infection. Like the first vaccine (see New drugs, Aust Prescr 2006;29:138–43), this product is not a live vaccine but is made up of virus-like particles derived from the major capsid (L1) protein. It is a bivalent vaccine, designed to protect against human papillomavirus types 16 and 18. These virus types are responsible for around 70% of invasive cervical cancers worldwide and are the most common oncogenic papillomavirus types isolated from Australian women.

The bivalent vaccine has been compared to placebo in a randomised trial of 1113 North American and Brazilian women aged 15–25 years. These women were negative for type 16 or 18 DNA (by the polymerase chain reaction) and seronegative for virus types 16 and 18 at screening. Three doses of the vaccine or placebo were given, at 0, 1 and 6 months. Cervical and cervicovaginal specimens (taken at 3 or 6 month intervals) were analysed for human papillomavirus DNA and abnormal cytology for up to 27 months after the first injection.[1]

After 27 months, there were four cases of persistent infection with type 16 or 18 human papillomavirus in the vaccinated group (560 women) compared to 31 cases in the placebo group (553 women). Two women in the vaccine group had cytological abnormalities associated with virus type 16 or 18 compared to 27 women in the placebo group.[1] These abnormalities included atypical squamous cells of undetermined significance and low- and high-grade squamous intraepithelial lesions.

A follow-up study continued to monitor the women. Some of them were followed in total for approximately 48 months. These women had received all three doses of the vaccine or placebo and their treatment allocation was still double blind. In the follow-up phase, 10 out of 340 women had persistent human papillomavirus type 16 or 18 infection (for 10 months or longer) in the placebo group compared with none of the 357 women in the vaccine group.[2]

During the combined initial and follow-up phases of the trial, there were four cases of abnormal cytology or histology associated with type 16 or 18 virus in the vaccine group and 83 cases in the placebo group. There were no cases of cervical intraepithelial neoplasia in the vaccine group.[2]

There seemed to be some cross-protection of the vaccine against infection with other human papillomavirus types, particularly types 45 and 31. This corresponded to fewer cases of cytological and histological abnormalities in the vaccine group compared to the placebo group.[2]

There were no vaccine-related serious adverse events reported. However, there were more injection-site symptoms (pain, swelling, redness) in the vaccine group compared to the placebo group.[1,2]

The vaccine should be given intramuscularly in the deltoid region at 0, 1 and 6 months. The second dose can be delayed for up to 2.5 months after the first dose if necessary. The need for booster doses is currently unknown.

This bivalent vaccine appears to be effective in providing long-term protection against human papillomavirus types 16