

Encouraging physical activity interventions among people with type 2 diabetes

Alison Kirk, Graham Leese

Article points

1. Research shows that physical activity consultation is a useful intervention for promoting physical activity in people with type 2 diabetes. Pedometers are useful for increasing physical activity in the short term.
2. Exercise interventions for older adults should include behavioural or cognitive-behavioural strategies rather than health education, exercise prescriptions, or instruction alone.
2. Recommendations for weight loss include at least 60 minutes of moderate intensity physical activity at least 5 days a week.

Key words

- Physical activity
- Type 2 diabetes
- Pedometers

Alison Kirk is a Lecturer in Physical Activity for Health, University of Strathclyde, Glasgow. Graham Leese is a Consultant Physician, Department of Diabetes, Ninewells Hospital and Medicine School, Dundee.

Regular exercise provides substantial health benefits to people with type 2 diabetes, including better control of their condition, an improved cardiovascular risk profile, weight loss, and an improved quality of life (Sigal et al, 2006). Although physical activity should be a major strategy for any diabetes care team, there is limited information available on how best to encourage people with type 2 diabetes to take more physical activity. This article provides guidance on ways to promote physical activity in people with type 2 diabetes.

Organisations such as the American College of Sports Medicine and the Centers for Disease Control and Prevention have provided evidence-based recommendations for how much physical activity people should do to maintain health and reduce risk factors for a variety of diseases (Haskell et al, 2007). These guidelines recommend a minimum of 30 minutes of moderate physical activity at least 5 days a week. Although it is important to advise inactive people that they should build up to the recommended level, it should also be emphasised that this is the minimum recommendation and greater benefits are likely to be achieved if they endeavour to do more.

In 2004, the Chief Medical Officer published an evidence review (Department of Health, 2004) of the impact of physical activity and its relationship to health. This review concluded that for many people,

where there is no reduction in energy intake, 45–60 minutes of activity each day may be needed in order to prevent the development of obesity. Furthermore, people who have been obese and who have lost weight may need to do 60–90 minutes of activity a day in order to maintain this weight loss.

These conclusions have important implications for people with type 2 diabetes, since a large number of them will have been, or will currently be, overweight or obese. Most importantly, in order to continue to benefit from an active lifestyle, the exercise must be consistently maintained.

Recommendations for physical activity in people with type 2 diabetes support the above guidelines, although a light to moderate amount of physical activity (40–70% of maximum aerobic capacity) can achieve metabolic improvements. Additional recommendations include (Sigal et al, 2006):

- Participation in physical activity on at least 3 non-consecutive days. Heightened insulin sensitivity lasts for 24–72 hours after an exercise session, depending on the intensity and duration of the activity. Therefore, for optimal glucose-lowering potential, exercise should be performed regularly throughout the week. The American Diabetes Association recommends that people should not go for more than 2 consecutive days without aerobic physical activity (Sigal et al, 2006). The effect of resistance exercise (i.e. lifting weights) on insulin sensitivity may last longer, perhaps because some of its effects are mediated by increases in muscle mass.
- For long-term weight control the most successful programmes involve combinations of diet, exercise, and behaviour modification. Exercise alone, without any dietary restriction and behaviour modification, tends to produce only modest weight loss.
- There should be an emphasis on regular and consistent activity, including aerobic exercise supplemented with resistance exercise. There is increasing evidence of the health benefits of resistance exercise for people with type 2 diabetes (Baldi and Snowling, 2003). In particular, resistance exercise appears to improve insulin sensitivity to a similar level as aerobic exercise. Furthermore, with increased age, there is a tendency for a

progressive decline in muscle mass, leading to decreased functional capacity, decreased resting metabolic rate, increased adiposity and increased insulin resistance – resistance training can have a major positive impact on each of these.

- The beneficial metabolic effects produced by physical activity appear to be at their greatest early in the progression of type 2 diabetes, emphasising the need for early intervention. In the absence of complications, the kind of exercise a person with type 2 diabetes performs is primarily a matter of personal choice. In theory, the presence of diabetic complications may contraindicate certain activities, and, although there is no evidence for this, alternative activities should be encouraged to reduce any risk, in addition to maintaining the person’s interest and motivation. *Table 1* outlines exercise recommendations for people with diabetic complications.

Variables associated with physical activity

There is limited research investigating the influence of demographic and socioeconomic variables on physical activity in people with type 2 diabetes. However, Barrett et al (2007) found that men with type 2 diabetes participate in more leisure-time exercise than women. Similarly, those from higher income groups participate in more leisure-time physical activity than low- or middle-income groups.

Page points

1. The American Diabetes Association recommends that people should not go for more than 2 consecutive days without aerobic physical activity.
2. For long-term weight control the most successful programmes involve combinations of diet, exercise, and behaviour modification.
3. There should be an emphasis on regular and consistent activity, including aerobic exercise supplemented with resistance exercise.
4. The beneficial metabolic effects produced by physical activity appear to be at their greatest early in the progression of type 2 diabetes.

Table 1. Physical activity recommendations for people with complications of diabetes (Sigal et al, 2006).

Complication	Physical activity recommendation
Proliferative retinopathy	Walking, swimming or cycling. Avoid strenuous valsalva-type or jarring exercise (such as high-intensity aerobics)
Peripheral arterial disease	Interval training (3 minutes walk, 1 minute rest), swimming, stationary cycling, chair-based exercises
Peripheral neuropathy	Non-weight bearing exercise (swimming, cycling, rowing). Avoid heavy-weight bearing exercise (running, prolonged walking, step exercise)
Autonomic neuropathy	Water-based exercise, semi-recumbent cycling. Avoid exercise causing rapid body position, heart rate or blood pressure changes
Nephropathy	Light to moderate exercise

Page points

1. Women with type 2 diabetes are more likely than men to emphasise the importance of emotional support and group meetings when they are changing their physical activity behaviour.
2. Reported barriers to taking up exercise include physical discomfort, fear of hypoglycaemia, being too overweight and lack of support.
3. Low motivation is another major factor associated with poor participation and drop-out in healthy individuals.
4. Social support (having someone to help you be active, such as to exercise with or provide encouragement or advice) for physical activity behaviour change has been consistently correlated with exercise participation in the general population.

Barrett et al (2007) found that walking is the most popular form of physical activity.

Ferrand et al (2008) reported that women with type 2 diabetes are more likely than men to emphasise the importance of emotional support and group meetings when they are changing their physical activity behaviour. In contrast, men emphasised the importance of knowledge acquisition for disease control. Similarly, female participants stressed the importance of a sense of well-being and positive body image that came from regular physical activity, whereas male participants highlighted the relationship between physical activity and health-promoting behaviours (Ferrand et al, 2008).

Self-efficacy describes a person's confidence in their ability to perform a specific behaviour, and has been identified as an important predictor of whether a person with type 2 diabetes will participate in physical activity (Kingery and Glasgow, 1989). However, people with diabetes rate their exercise self-efficacy lower than other self-care behaviour, such as healthy eating or glucose testing. These findings highlight the importance of strategies designed to enhance self-efficacy in people with type 2 diabetes, such as setting realistic goals and providing examples of how other people with diabetes have modified their physical activity behaviour.

Wilson et al (1986) reported that people with type 2 diabetes are more willing to believe in the effectiveness of medication than physical activity, highlighting the need to explain the importance of exercise in the management of type 2 diabetes. Despite this, the perceived benefits of physical activity among people with type 2 diabetes include improving diabetes control and managing weight (Swift et al, 1995). Reported barriers to taking up exercise include physical discomfort, fear of hypoglycaemia, being too overweight and lack of support (Wilson et al, 1986; Swift et al, 1995). The identification of perceived barriers to exercise and education, such as the above, and how to overcome them could significantly enhance adherence to physical activity.

Low motivation is another major factor

associated with poor participation and drop-out in healthy individuals (Dishman and Ickes, 1981). In a study by Hays and Clark (1999), people with type 2 diabetes who reported fewer motivational barriers to physical activity were more likely to report higher levels of participation, suggesting that effective methods for enhancing motivation should be included in exercise promotion, such as setting time-phased realistic goals, establishing social support, and weighing up the pros and cons of increasing physical activity behaviour.

Goal-setting and self-monitoring of progress are also important sources of self-motivation. Martin et al (1984) found that when individuals set their own flexible goals, they were more likely to adhere to an exercise programme, as well as maintaining it in the long-term, compared with when the goals were set by an instructor.

Knowledge of physical activity has been shown to correlate poorly with physical activity behaviour in the general population (King et al, 1992) and similar findings have been reported in people with diabetes (Guion et al, 2000). Guion et al (2000) assessed the knowledge of physical activity in people with type 2 diabetes, and the results demonstrated that only 38% of respondents were aware of current exercise recommendations. Consistent with previous research, there was a weak relationship between familiarity with exercise recommendations and actual exercise participation. These findings suggest that educating people about the benefit of exercise, although important, is unlikely to lead to long-term changes in behaviour.

Social support (having someone to help you be active, such as to exercise with or provide encouragement or advice) for physical activity behaviour change has been consistently correlated with exercise participation in the general population (Wankel, 1984). However, people with type 2 diabetes report the least amount of social support for exercise, compared with other diabetes self-care behaviour (Swift et al, 1995). Lack of social support is one of the most frequently cited barriers to physical activity participation among people with

type 2 diabetes (Swift et al, 1995), therefore, establishing a network of social support is a key area for exercise promotion.

Promoting physical activity

Several evidence-based guidelines recommend that physical activity and lifestyle interventions should be based on a valid theoretical framework (Scottish Intercollegiate Guidelines Network, 2001; Kahn et al, 2002), and understanding the factors that motivate people to exercise is critical for the development of effective interventions. However, although there are a number of theoretical models, there is no consensus on the best one to use when attempting to achieve changes in exercise behaviour.

A large amount of research in the general population supports the use of the transtheoretical model for physical activity behaviour change (Marshall and Biddle, 2001), and research is emerging supporting the use of this model in people with type 2 diabetes (Mau et al, 2001; Kim et al, 2004; Kirk et al, 2004; Jackson et al, 2007). The transtheoretical model suggests that individuals move through five stages when changing their behaviour: pre-contemplation; contemplation; preparation; action; and maintenance (Table 2). Progression from one stage to another does not always occur chronologically and individuals can progress or relapse at any time. The model proposes that different intervention strategies should be used at different stages to help the individual progress to a higher stage and avoid relapse (Rollnick et al, 1999) – Table 2 outlines

appropriate strategies for each stage. Further research is required on the validity of other theories of behaviour change for application in people with type 2 diabetes, such as the health belief model, theory of reasoned action, protection motivation theory, and the social cognitive model.

Physical activity interventions

A review of physical activity interventions that targeted older adults (King, 2001) identified that effective interventions used behavioural or cognitive-behavioural strategies, rather than health education, exercise prescriptions, or instruction alone. The strategies include goal setting, self-monitoring, feedback, support, stimulus control, and relapse-prevention training (Kirk et al, 2007).

Physical activity consultation is increasingly being used to promote exercise in people with type 2 diabetes. This approach often utilises the transtheoretical model as an underlying theoretical framework, and generally involves a patient-centred discussion with a healthcare professional. Healthcare professionals delivering the physical activity consultation should ideally have experience in using cognitive behavioural strategies. Many diabetes healthcare professionals will have transferable skills, such as using techniques of motivational interviewing with other health behaviours such as diet or smoking. In addition, a knowledge of physical activity in relation to diabetes will be required. The focus of physical activity consultations is on exploring solutions rather than imposing recommendations, and a

Page points

1. Several evidence-based guidelines recommend that physical activity and lifestyle interventions should be based on a valid theoretical framework.
2. A large amount of research in the general population supports the use of the transtheoretical model for physical activity behaviour change.
3. Physical activity consultation is increasingly being used to promote exercise in people with type 2 diabetes.

Table 2. Stage of exercise behaviour change and appropriate strategies (Rollnick et al, 1999).

Stage	Definition	Appropriate strategy
Pre-contemplation	Inactive. Does not intend to become active in the next 6 months.	Provide information and advice on the risks of inactivity and the benefits of becoming active.
Contemplation	Inactive. Thinking about becoming active in the next 6 months.	Decision balance (weigh up the pros and cons of becoming active). Discuss and overcome barriers.
Preparation	Has made some attempts to become active.	Develop realistic activity goals and establish support.
Action	Active, but only for the last 6 months.	Reinforce successful attempts. Re-emphasise the benefits experienced, and overcome barriers.
Maintenance	Active for longer than 6 months.	Relapse prevention. Suggest alternative activities.

Page points

1. In an attempt to reduce the time and resources required for interventions, as well as increasing the range delivery methods, a small number of research studies have investigated the effectiveness of providing physical activity interventions by using computer or print-based materials.
2. Pedometers are often used to encourage people to increase the amount of walking they do.
3. A physically active lifestyle plays a vital role in the management of type 2 diabetes.
4. Pedometers can promote short-term increases in exercise levels, and physical activity consultations have been shown to have longer-term success.

typical consultation includes a discussion of the benefits and costs to the individual of becoming more active, an evaluation of their current exercise levels and the identification of any contraindications with their current exercise regimen. The consultation is also a chance to set goals, identify support networks and look at ways to prevent relapse. Kirk et al (2007) provide guidelines on conducting a physical activity consultation, in addition to a review of the evidence for their efficacy. It has been shown that long-term increases (up to 2 years) in activity are possible through physical activity consultations (Di Loreto et al, 2003).

In an attempt to reduce the time and resources required for interventions, as well as increasing the range delivery methods, a small number of research studies have investigated the effectiveness of providing physical activity interventions by using computer or print-based materials. However, findings have been inconsistent, with Kim et al (2006) showing significant increases in physical activity using a 3-month web- and print-based intervention, while McKay et al (2001) reported no significant changes in physical activity after an 8-week web-based intervention.

Pedometers are often used to encourage people to increase the amount of walking they do. A small number of studies have examined their use in people with type 2 diabetes, and the findings indicate an initial increase in short-term (up to 2 months) walking behaviour (Tudor-Locke et al, 2004; Araiza et al, 2006; Richardson et al, 2007), with a return to baseline levels in long-term follow-up (up to 6 months; Tudor-Locke et al, 2004; Engel and Linder 2006; Bjørgaas et al, 2008). These results are similar to studies of the general population (Mutrie et al, 2004) and indicate that, although pedometers can result in an immediate change in walking behaviour, additional strategies are needed to maintain it.

Conclusions

A physically active lifestyle plays a vital role in the management of type 2 diabetes. Specific recommendations for exercise in people with type 2 diabetes have been outlined in

this article, however, few clinical centres have access to exercise physiologists, and it is incumbent on healthcare staff to learn and deliver a more evidence-based and structured approach to increasing exercise levels in people with diabetes.

Pedometers can promote short-term increases in exercise levels, and physical activity consultations have been shown to have longer-term success. However, more research is required to identify effective methods of exercise promotion in people with type 2 diabetes. ■

Araiza P, Hewes H, Gashetewa C et al (2006) Efficacy of a pedometer based physical activity program on parameters of diabetes control in type 2 diabetes. *Metabolism Clinical and Experimental* **55**: 1382–7

Baldi JC, Snowling N (2003) Resistance training improves glycaemic control in obese type 2 diabetic men. *International Journal of Sports Medicine* **24**: 419–23

Barrett JE, Plotnikoff RC, Courneya KS, Raine KD (2007) Physical activity and type 2 diabetes: exploring the role of gender and income. *The Diabetes Educator* **33**: 128–43

Bjørgaas MR, Vik JT, Stølend T et al (2008) Regular use of pedometers does not enhance beneficial outcomes in a physical activity intervention study in type 2 diabetes mellitus. *Metabolism Clinical and Experimental* **57**: 605–11

Department of Health (2004) *At Least Five a Week: Evidence of the impact of physical activity and its relationship to health*. Department of Health, London

Di Loreto C, Fanelli C, Lucidi P et al (2003) Validation of a counseling strategy to promote the adoption and the maintenance of physical activity by type 2 diabetic subjects. *Diabetes Care* **26**: 404–8

Dishman RK, Ickes W (1981) Self-motivation and adherence to therapeutic exercise. *Journal of Behavioural Medicine* **4**: 421–38

Engel L, Lindner H (2006) Impact of using a pedometer on time spent walking in older adults with type 2 diabetes. *The Diabetes Educator* **32**: 98–107

Ferrand C, Perrin C, Nasarre S (2008) Motives for regular physical activity in women and men: a qualitative study in French adults with type 2 diabetes, belonging to a patients' association. *Health and Social Care in the Community* **16**: 511–20

Guion WK, Carter CA, Corwin SJ (2000) Knowledge of exercise in patients with diabetes mellitus. *Medicine and Science in Sports and Exercise* **31**: S361

Haskell WL, Lee IM, Pate RR et al (2007) Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise* **39**: 1423–34

Hays LM, Clark DO (1999) Correlates of physical activity in a sample of older adults with Type 2 diabetes. *Diabetes Care* **22**: 706–12

Jackson R, Asimakopoulou K, Scammell A (2007) Assessment of the transtheoretical model as used by dietitians in promoting physical activity in people with type 2 diabetes. *Journal of Human Nutrition and Dietetics* **20**: 27–36

Kahn EB, Ramsey LT, Brownson RC et al (2002) The effectiveness of interventions to increase physical activity. A systematic review. *American Journal of Preventative Medicine* **22**: 73–107

Kim CJ, Hwang AR, Yoo JS (2004) The impact of a stage matched intervention to promote exercise behaviour in participants with Type 2 diabetes. *International Journal of Nursing Studies* **41**: 833–41

- Kim CJ, Kang DH (2006) Utility of a web-based intervention for people with Type 2 diabetes. Impact on physical activity levels and glycaemic control. *Computer, Informatics, Nursing* **24**: 337–45
- King AC, Blair SN, Bild DE et al (1992) Determinants of physical activity and interventions in adults. *Medicine and Science in Sports and Exercise* **24**: S221–36
- King A (2001) Interventions to promote physical activity by older adults. *Journal of Gerontology* **56**: 36–46
- Kingery PM, Glasgow RE (1989) Self-efficacy and outcomes expectations in the self-regulation of non-insulin dependent diabetes mellitus. *Health Education* **20**: 13–9
- Kirk A, Mutrie N, MacIntyre P, Fisher M (2004) Promoting and maintaining physical activity in people with type 2 diabetes. *American Journal of Preventive Medicine* **27**: 289–96
- Kirk A, Barnett J, Mutrie N (2007) Physical activity consultation for people with Type 2 diabetes. Evidence and guidelines. *Diabetic Medicine* **24**: 809–16
- Marshall SJ, Biddle SJH (2001) The transtheoretical model of behaviour change: A meta-analysis of applications to physical activity and exercise. *Annals of Behavioural Medicine* **23**: 229–46
- Martin JE, Dubbert P, Katell AP et al (1984) Behavioural control of exercise in sedentary adults. *Journal of Consulting and Clinical Psychology* **52**: 795–811
- Mau MK, Glanz K, Severino R et al (2001) Mediators of lifestyle behaviour change in Native Hawaiians: Initial findings from the Native Hawaiian Diabetes Intervention Program. *Diabetes Care* **24**: 1770–75
- McKay HG, King D, Eakin EG et al (2001) The diabetes network internet based physical activity intervention. A randomized pilot study. *Diabetes Care* **24**: 1328–34
- Mutrie N, Wright A, Wilson R, Guynneon K (2004) Do pedometers motivate people to walk more? *Journal of Sports Science* **22**: 254
- Richardson CR, Mehari KS, McIntyre LG (2007) A randomized trial comparing structured and lifestyle goals in an internet-mediated walking program for people with type 2 diabetes. *International Journal of Behavioral Nutrition and Physical Activity* **4**: 59–70
- Rollnick S, Mason P, Butler C (1999) *Health Behaviour Change: A Guide for Practitioners*. Churchill Livingstone, London
- Scottish Intercollegiate Guidelines Network (2001) *Management of Diabetes: Lifestyle Management*. Scottish Intercollegiate Guidelines Network, Edinburgh
- Sigal RJ, Kenny GP, Wasserman DH et al (2006) Physical activity/exercise and type 2 diabetes: A consensus statement from the American Diabetes Association. *Diabetes Care* **29**: 1433–8
- Swift CS, Armstrong JE, Beerman KA et al (1995) Attitudes and beliefs about exercise among persons with non-insulin-dependent diabetes. *The Diabetes Educator* **21**: 533–40.
- Tudor-Locke C, Bell RC, Myers AM et al (2004) Controlled outcome evaluation of the First Steps Program: a daily physical activity intervention for individual with type II diabetes. *International Journal of Obesity Related Metabolic Disorders* **28**: 113–19
- Wankel LM (1984) Decision-making and social support strategies for increasing exercise involvement. *Journal of Cardiac Rehabilitation* **4**: 124–35
- Wilson W, Ary DV, Bigard A et al (1986) Psychosocial predictors of self-care behaviours (compliance) and glycemic control in non-insulin-dependent diabetes mellitus. *Diabetes Care* **9**: 614–22

“A physically active lifestyle plays a vital role in the management of type 2 diabetes.”