Evidence Summary

Physical activity

Diabetes Service, Country Health SA

March 2018

Government of South Australia

SA Health

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Physical activity

Modification of adverse lifestyle factors is an important aspect of the management of all types of diabetes. In particular, appropriate management of cardiovascular risk factors such as smoking, poor dietary intake and physical inactivity is important for the prevention of macrovascular disease.

Microvascular complications may also be affected by adverse lifestyle factors. Helping patients to modify certain behaviours should take into account the patient's willingness to change their perception of their diabetes, and other factors which may be indirectly related to their diabetes.

Contents

Physical activity

Physical activity is defined as any skeletal muscle movement which expends energy beyond resting level and encompasses exercise and incidental activity. There are many different ways to be physically active every day, including:

- structured activities (eg strength training, tai chi, walking groups, hydrotherapy classes and yoga)
- leisure pursuits (eg sex, golf, lawn bowls, bocce and various types of dancing)
- incidental activity, which includes activities which are part of everyday life (eg housework, walking to the local shop instead of driving, gardening and vacuuming);
- supervised physical activity (eg supervised by a coach, team manager, fitness leader, personal trainer, physiotherapist or exercise physiologist).

It is important to remember that physical activity does not have to be organised or competitive to be beneficial.

Evidence

Health enhancing physical activity is physical activity conducted at a sufficient level to bring about measureable health improvements. This normally equates to a moderate intensity level or above and can generally be described as activity that slightly raises heart rate, breathing rate and core temperature but in which the patient is still able to hold a conversation.

Regular physical activity is associated with a reduced risk of development of type 2 diabetes. This risk reduction is consistent over a range of intensity and frequency of activity, with a dose-related effect. Greater frequency of activity offers greater protection from the development of type 2 diabetes and this is valid for both vigorous and moderate intensity activity.[1]

All people, including those at risk of diabetes and those diagnosed with diabetes, should be advised to increase their level of physical activity to achieve current physical activity recommendations and be supported to maintain this level across the lifespan.[2]

Metabolism

Exercise has both short-term and long-term effects on metabolism.

Short-term effect

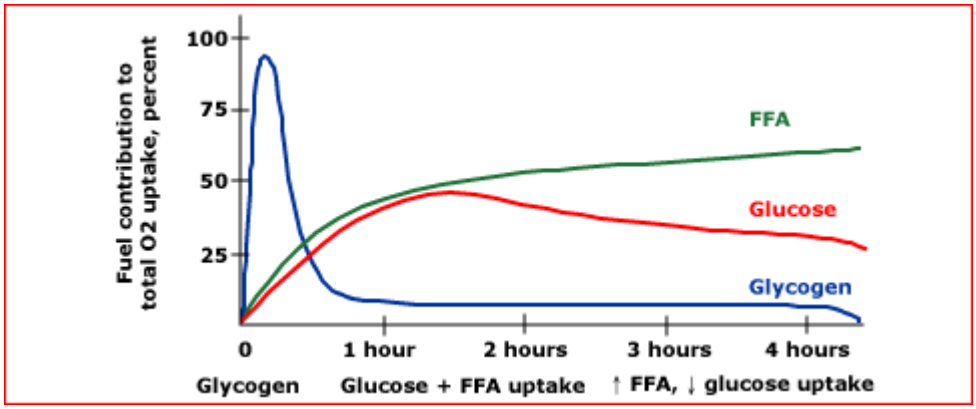
When a person without diabetes is physically active, the muscles initially use glucose and later convert muscle glycogen to glucose to provide energy.

In addition to utilising muscle glycogen, exercising muscle also takes up glucose from the circulation, a process that requires the availability of insulin. As the blood glucose level begins to fall, the secretion of insulin decreases while that of glucagon rises. The result is increased hepatic glucose production due to glycogenolysis and gluconeogenesis.

If the physical activity continues, counter-regulatory hormones other than glucagon play an increasing role. Epinephrine and norepinephrine stimulate hepatic glucose production and stimulate lipolysis. Triglycerides are broken down into both free fatty acids, which are utilised as fuel by exercising muscles, and glycerol, which can be converted to glucose in the liver.

These changes in hormone release and muscle metabolism become more pronounced with prolonged physical activity. The result is a gradual reduction in muscle glucose uptake combined with stimulation of lipolysis and increased free fatty acid uptake by muscle (figure 1).[3]

Figure 1. Muscle metabolism during prolonged physical activity in person without diabetes.



Source: UpToDate 2017

When a person with type 2 diabetes is physically active, insulin sensitivity is improved. The physiologic responses to physical activity are modified in a person with type 1 diabetes, depending upon the serum insulin concentration at the time of the activity and upon the site and timing of recent insulin injections.

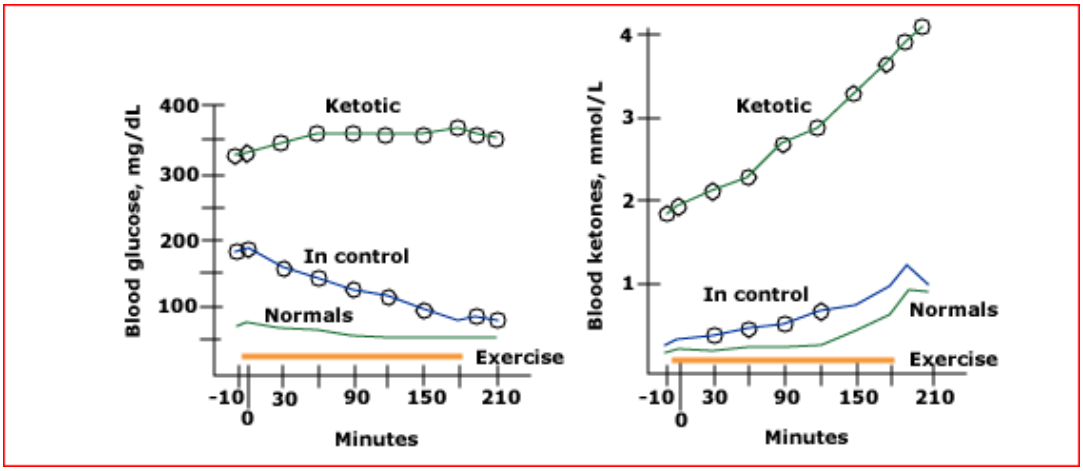
People with type 1 diabetes with adequate insulin levels will usually have a fall in blood glucose levels. There are several factors that contribute to this response:

- exogenous insulin cannot be shut off, thereby maintaining muscle glucose uptake and inhibiting hepatic glucose output
- the increased temperature and blood flow associated with physical activity may speed insulin absorption from subcutaneous depots, resulting in higher serum insulin levels. This effect is most prominent if the injection was recent, was given into an arm or leg that is being exercised, or was inadvertently given intramuscularly.

However, in people with type 1 diabetes with inadequate insulin levels, physical activity can cause a paradoxical elevation in blood glucose levels and the development of ketosis due to:

- the lack of insulin
- impairment of glucose uptake by muscles
- prevention of an increase in hepatic glucose and output mediated by counter-regulatory hormones, particularly epinephrine, cortisol, and growth hormone. These hormonal changes also lead sequentially to increased lipolysis and enhanced conversion of the free fatty acids to ketones (figure 2).[3]

Figure 2: Comparison of the effects of exercise in normal subjects and patients with type 1 diabetes who are in control or poorly controlled (ketotic).



Source: UpToDate 2017

Long-term effect

In the long-term, moderate regular aerobic exercise has several effects on muscle function that leads to more efficient use of energy. These changes include:

- increase in the quantity of mitochondrial enzymes and the number of "slow-twitch" muscle fibres
- development of new muscle capillaries
- increase in translocation of insulin-responsive glucose transporters (GLUT4) promoting glucose uptake from intracellular stores to the cell surface.

The long-term effects of physical activity are different in people with type 1 and type 2 diabetes.[3]

Type 2 diabetes

Often at baseline, people with type 2 diabetes have an impaired capacity to be physically active. This is primarily due to age and increased body mass index, but, may also be affected by cardiac disease. Other factors that may contribute include reduced skeletal muscle oxidation and insulin.

For people with type 2 diabetes, physical activity helps to:

- improve the body's response to insulin which can lower blood glucose levels
- lower blood pressure and cholesterol levels, reducing the risk of cardiovascular disease such as heart attack and stroke
- control weight (eg reduces waist circumference and body mass index)
- reduce the risk of developing diabetes complications.

Other benefits include:

- stronger bones
- improved mood
- increased energy levels
- reduced stress and tension
- improved sleep.

People with type 2 diabetes should be encouraged to participate in physical activity to improve glycaemic control and cardiovascular risk factors.[1, 2]

Type 1 diabetes

There is less evidence that regular physical activity is associated with improved glycaemic control in people with type 1 diabetes. In a meta-analysis of studies assessing the overall effects of physical activity on chronic glycaemic control, aerobic activity was associated with improved glycaemic control, whereas resistance training, combined aerobic and resistance training, and high intensity exercise did not significantly improve long term glycaemic control.[4]

Expert consensus suggests that there may be substantial beneficial effects of physical activity on general wellbeing, hypertension, and other cardiovascular risk factors, independent of glycaemic control.[5]

People with type 1 diabetes have a greater capacity to be physically active and can tolerate even vigorous exercise, including participation in competitive triathlons and marathons. Studies reviewed recommended that this form of physical activity optimally be performed at the same time of day in relation to meals and insulin injections as when that is done, the change in blood glucose levels was usually remarkably predictable and reproducible.

People with type 1 diabetes should be encouraged to participate in physical activity to improve cardiovascular risk factors.[6]

Australian Guidelines for Physical Activity

The Australian Health Survey 2011-12 indicated that:

> only one in three children (5-12 years) undertook the recommended 60 minutes of physical activity every day

> one in ten young people (13-17 years) undertook the recommended 60 minutes of physical activity every day

> 60% of Australian adults did less than the previously recommended 30 minutes of physical activity per day.[7]

Doing any physical activity is better than doing none. The amount, type and intensity of physical activity needed daily, depends on a number of factors, including age and physical development.

The Australian Government has developed the Physical Activity and Sedentary Behaviour Guidelines to facilitate positive health outcomes for Australians of all ages and include:

> Physical Activity Recommendations for Children 0-5 years

> Physical Activity and Sedentary Behaviour Guidelines for Children (5-12 years)

> Physical Activity and Sedentary Behaviour Guidelines for Young People (13-17 years)

> Physical Activity and Sedentary Behaviour Guidelines for Adults (18-64 years)

> Choose Health: Be Active for Older Australians (65years+).

To view each specific guideline, visit the Australia's Physical Activity and Sedentary Behaviour Guidelines website.

Adults (aged 18-64 years)

The recommendations for people with or without diabetes include the following key points:

> be active on most, preferably all, days every week

> add up to 150 to 300 minutes (2½ to 5 hours) of moderate intensity physical activity or 75 to 150 minutes (1¼ to 2½ hours) of vigorous intensity physical activity, or a combination of both moderate and vigorous activities, each week

> use muscle strengthening activities on at least 2 days each week.[8]

Moderate intensity physical activity elicits a noticeable increase in depth and rate of breathing (eg the breathing and heart rate speeds up, light sweating develops).

Vigorous intensity physical activity are activities that require more effort and results in harder and faster breathing or 'huff and puff' (eg jogging, aerobics classes or strenuous gardening).

Strength training physical activity includes body weight exercises (eg wall push-ups or sitting and standing from a chair, machine based exercises or free weight exercises).

Older Adults (65 years+)

The recommendations are for older people to do some form of physical activity, no matter what their age, weight, health problems or abilities and include the following key points:

> be active every day in as many ways as possible that incorporate fitness, strength, balance and flexibility

> accumulate at least 30 minutes of moderate intensity physical activity on most, preferably, all days

> those who have stopped physical activity, or who are starting a new physical activity, should start at a level that is easily manageable and gradually build up the recommended amount, type and frequency of activity

> continue to enjoy a lifetime of vigorous physical activity and continue in a manner suited to their capability into later life, provided recommended safety procedures and guidelines are adhered to.[9]

Advice about physical activity should be individually tailored and diabetes specific and should include implications for glucose management and foot care.

Risk

Overall the benefits of physical activity outweigh the risks. A person's individual risk will depend on their individual situation, (eg how active they are already, their weight and the food they eat, type of medication, duration of diabetes, presence of complications or comorbidities).

It is well established that sudden physical activity in sedentary subjects can precipitate myocardial infarction.[10]

There is no known association between physical activity and the development or exacerbation of diabetic complications, however physical activity during insulin deficiency can cause hyperglycaemia.

Research demonstrates that high intensity physical activity may transiently increase albumin excretion rate (AER) in people with or without diabetes. No evidence of more rapid progression of nephropathy or retinopathy was identified in subjects with diabetes who exercise more.[11, 12]

Improvements in nerve function, reductions in neuropathic pain, reductions in other types of sensory dysfunction (eg numbness) and improvements in both static and dynamic functional mobility in those with peripheral neuropathy is also noted.[13]

Patients with existing complications of diabetes should seek medical review before embarking on physical activity programmes.

A gradual introduction and initial low intensity of physical activity with slow progressions in volume and intensity should be a recommendation for sedentary people with diabetes.

Assessment

Before starting any new physical activity program, the general practitioner, diabetes specialist or endocrinologist will complete a physical assessment and review glycaemic control and any diabetes related complications.

A physical examination and a resting electrocardiogram (ECG) in sedentary adults (age >50 years) with diabetes prior to beginning physical activity may be performed.

In addition, all cardiovascular disease risk factors (dyslipidaemia, hypertension, smoking) should be evaluated and treated. Exercise stress testing for asymptomatic individuals at low risk of coronary artery disease is not necessary.[1, 2, 5, 11]

However, an exercise stress test may be indicated for asymptomatic individuals at high risk for coronary heart disease who have:

> peripheral or carotid atherosclerotic vascular disease

> renal disease

> abnormal resting ECG

> multiple diabetes complications.

There is no randomised trial data to support the routine performance of exercise stress testing in asymptomatic patients with diabetes who are planning to begin an exercise program.[2, 11] The decision to perform stress testing prior to beginning physical activity should be individualised.

While increasing physical activity can improve foot structure and function, a risk assessment and advice on suitable footwear by a podiatrist is recommended.

Precautions

Hypoglycaemia

Hypoglycaemia (low blood glucose levels) can occur during, after the activity and even later that night. The responses to low blood glucose levels such as sweating and palpitations may be confused with the response to the activity. For further information, refer to the Evidence Summary - *'Hypoglycaemia and hyperglycaemia'*.

Severe, nocturnal hypoglycaemia is more likely to occur up to 24 hours after at least moderate physical activity of at least 1 hour in duration.[14] The effect appears to be mainly due to increased insulin sensitivity through induction of glucose transporter type 4 in skeletal muscle. In addition, counter-regulatory hormone and autonomic nervous system responses to hypoglycaemia may be blunted.

The National Evidence-Based Clinical Care Guidelines for Type 1 Diabetes for Children, Adolescents and Adults, recommends the following strategies to help prevent nocturnal hypoglycaemia due to physical activity undertaken within the past 24 hours:

- reduce the long-acting insulin dose overnight after the physical activity undertaken that day; and in some cases up to 50%
- basal insulin rates overnight in continuous subcutaneous insulin infusion ((CSII) or insulin pump) may need to be reduced by 20-30%
- ensure blood glucose level is above 7mmol/L before going to bed
- always consume at least 10-15g carbohydrate before bed after a day of physical activity, preferably as a low glycaemic index food or with a mixed meal (eg glass of milk) to aid a slow but persisting rate of glucose absorption into the blood stream
- in higher risk settings after days of unusually intense or long duration physical activity, consider setting the bedroom alarm clock in the early morning hours to check blood glucose levels at those times, and to supplement with carbohydrate as required
- monitor blood glucose levels continuously, to help in recognising asymptomatic hypoglycaemia (monitoring can include both retrospective and real time systems); real-time monitoring systems often have a hypoglycaemia alarm triggered by a threshold blood glucose level, to help avoid severe hypoglycaemia.[6]

The person with diabetes is to be encouraged to always carry their blood glucose meter and 'hypo' treatment with then when they are physically active.

The general practitioner, diabetes specialist or credentialled diabetes educator can discuss risk, provide strategies for prevention (eg carbohydrate (CHO) requirements, changes to insulin dose/doses), a hypo action plan and hypo kit.

For further information on hypoglycaemia refer to the following factsheets '*Hypoglycaemia in type 1 diabetes'* and '*Hypoglycaemia in type 2 diabetes*'.

Hyperglycaemia

Hyperglycaemia (high blood glucose levels) can result if the person has had:

- too little diabetes medication and/or insulin before being physical activity
- too much CHO
- excessive emotional stress
- high intensity physical activity and/or the physical activity is repeated, or
- physical activity that causes mostly anaerobic metabolism (eg short bursts of activity).

In type 1 diabetes who have mild hyperglycaemia, as long as the person with diabetes feels well, and there are no ketones, it is not necessary to stop their activity.

In type 1 diabetes who have mild hyperglycaemia with ketones, physical activity may result in a paradoxical elevation in blood glucose levels and the development of diabetic ketoacidosis. For further information, refer to the Evidence Summary - *'Hypoglycaemia and hyperglycaemia'.*

The general practitioner, diabetes specialist or credentialled diabetes educator can discuss risk, provide strategies for prevention (eg CHO requirements, changes to insulin dose/doses), a sick day action plan and insulin adjustment (eg correctional insulin) action plan.

For further information on hyperglycaemia refer to the following factsheets, *'Hyperglycaemia in type 1 diabetes', 'Hyperglycaemia in type 2 diabetes'* and *'Insulin in type 1 diabetes - Basal bolus'*.

Diabetic retinopathy

In the presence of proliferative or severe non-proliferative diabetic retinopathy, vigorous aerobic or resistance exercise may be contraindicated because of the potential risk of triggering vitreous haemorrhage or retinal detachment.

The person with diabetes may be required to avoid strenuous physical activity until the Ophthalmologist indicates that their condition is stable and it is safe to participate. For further information, refer to the Evidence Summary - *'Long term complications'.*

Peripheral neuropathy

Peripheral neuropathy is a major underlying risk factor in people with diabetes developing a foot ulcer.[13]

The person with diabetes may be required to avoid physical activity until the general practitioner, diabetes specialist or podiatrist indicates that their condition is stable and it is safe to participate. For further information, refer to the Evidence Summary - *'Long term complications'.*

For further information on peripheral neuropathy, risk assessment and foot care, refer to factsheets *'Foot care for low risk feet'* and *'Foot care for at risk feet'*.

Preparation

Individual reasons to be physically active vary and some physical activities are planned where others at unexpected. Similarly, each person's response to physical activity is different.

It is important to assist the person with diabetes to work out the best way of balancing the physical activity with their diet, diabetes medications and/or insulin therapy.

Diabetes Tablets

Patients using glucose lowering tablets, such as sulfonylureas, are at risk of hypoglycaemia during periods of physical activity and in the hours that follow due to the duration of action.[1]

Carbohydrate (CHO) requirement

The intensity and duration of the physical activity will affect the amount of energy needed. The type of exercise, and its timing to main meals/snacks and use of rapid-acting insulin is likely to affect the approach.

The National Evidence-Based Clinical Care Guidelines for Type 1 Diabetes for Children, Adolescents and Adults recommends:

- **adequate energy stores before exercise**. A meal containing CHO, fats and protein consumed 3-4 hours before physical activity will maximise endogenous energy stores
- **supplemental CHO**. Extra CHO may be required if physical activity is unplanned, of a high intensity and long period and if the insulin dosage is not cannot or has not been reduced
- The supplemental CHO should be matched as far as possible with the predicted requirement of CHO (eg during the time of peak insulin action, the typical amount of CHO required is 1.0-1.5 g of CHO per kg of body weight per hour)

> **reduce insulin doses before exercise.** If the planned exercise is to be more than 60 minutes in duration, then a reduction in bolus insulin using insulin changes as described (page 13), combined with progressive supplemental CHO every 30-40 minutes, is indicated.[6]

It is also important to stay well hydrated. The person with diabetes should drink enough water to avoid thirst and will need a bit more than usual while being physically active.

An accredited practicing dietitian and credentialled diabetes educator can discuss and assist the patient with diabetes to work out the best individual dietary plan.

Insulin therapy

Basal bolus insulin (BBI) and insulin pump (continuous subcutaneous insulin infusion (CSII) therapy-based regimens provide the greatest flexibility in insulin adjustment for physical activity and is the most effective means of assisting weight loss (if this is a goal).

The National Evidence-Based Clinical Care Guidelines for Type 1 Diabetes for Children, Adolescents and Adults provide recommendations for insulin dose changes for physical activity (figure 3). These suggested changes to insulin doses are based on the time of day and duration of physical activity and are only recommended in patients with type 1 diabetes who generally have good metabolic control.[6]

Figure 3. Insulin dose changes for physical activity

Physical activity time of day and duration	Basal-bolus insulin dose consideration
Physical activity performed early in the morning, before breakfast:	> ↓ previous evening basal (intermediate or long-acting) insulin dose by 20-50% > ↓ pre-breakfast bolus (rapid-acting) insulin dose after physical activity by 30-50% > ↓ evening dose of basal insulin on the day of the physical activity.
Physical activity performed in the postprandial phase:	> preferably delay exercise until at least 1-2 hours after the meal > ↓ pre-meal bolus insulin dose by 20-75%, related to duration and intensity of physical activity.
Prolonged physical activity	> ↓ pre-meal bolus insulin dose by 30-50% if physical activity lasts up to 4 hours; for all day activity, reduce all meal bolus doses across the day by 30-50% > ↓ previous evening basal insulin by 50%, and the basal insulin dose by 10-20% up to 24 hours after all-day activity (eg bush walking, cycling).
Intermittent high-intensity physical activity (eg team sports)	> ↓ pre-meal bolus insulin by 70-90% if physical activity starts within 1-3 hours of the meal.

For CSII (insulin pump), National Evidence-Based Clinical Care Guidelines for Type 1 Diabetes for Children, Adolescents and Adults suggest:

- the basal rate be decreased by 30-50% for the duration of the activity; and, if activity is planned, reduce the basal rate for 1-2 hours before the activity.
- alternatively, CSII may be suspended for up to 2 hours and consider supplemental bolus insulin either before or 1 hour into the activity.[6]

  In either case, a reduction in the overnight basal rate may also be needed by 20-30% or sometimes more so, after vigorous and prolonged physical activity.

Physical activity with usual insulin dose and no additional CHO significantly increases the risk of hypoglycaemia during and after physical activity. If physical activity can be anticipated, a reduction of the normal insulin dose will significantly reduce the risk of hypoglycaemia and delayed hypoglycaemia.

Insulin absorption

Injection of insulin into exercising areas increases the absorption of insulin and the risk of hypoglycaemia and should therefore be avoided.[15]

High temperatures can also increase insulin absorption and should be taken into consideration when physically active in hot climates. A further reduction in insulin dose may be required.

It is also important to provide individualised advice on avoiding hypoglycaemia when physically active by adjustment of CHO intake, reduction of insulin dose, and choice of injection site where relevant. A medical practitioner, diabetes specialist or credentialled diabetes educator can assist and discuss the patient's insulin therapy and any changes required.

Blood glucose levels and HbA1c

Blood glucose and HbA1c levels above target can reduce the capacity for a person with diabetes to be physical active and can increase the rate of fatigue. Near normal blood glucose levels and a near normal HbA1c can assist the person with diabetes to participate in any type of physical activity and maximise their efforts and their achievements.[6, 15]

Being aware of the persons' recent HbA1c result and encouraging them to test their blood glucose levels before, during and after exercise will identify their overall diabetes control and how the physical activity may have affected their blood glucose levels.

Importantly, these pre and post blood glucose results will confirm that the planning has worked or identify that further changes are needed. Once an initial plan has been developed with the person with diabetes, it useful to carefully monitor and document the blood glucose level during and after periods of physical activity, to help in fine tuning the regimen. This approach allows progressive documentation of reproducibility of the blood glucose response with physical activity.

Contraindications

In 2015, the Australian Diabetes Society (ADS) revised its position statement on scuba diving in persons with diabetes as it had previously been contraindicated in people requiring insulin.[16]

The review recognised that motivated individuals with well controlled diabetes (both insulin requiring and non-insulin requiring), may be able to safely participate in recreational diving. However, diving should not be undertaken by individuals with hypoglycaemia unawareness, recent severe hypoglycaemia, or any complications (apart from background retinopathy).

Alcohol

Particular care should be considered when moderate or large consumption of alcohol is combined with physical activity; for example, at 'big nights out' or dance parties. In these situations, severe hypoglycaemia may also be mistaken for effects of alcohol, or other mood and mind-altering drugs.[17]

Depending on the type and quality of alcohol consumed, it may initially increase blood glucose levels. The danger of over-consumption of alcohol is that it can significantly lower the blood glucose level in the hours that follow.

Alcohol hinders the activity of the liver in producing and releasing glucose into the blood and therefore increases the risk of hypoglycaemia. Moderate or large consumption of alcohol is well known to cause delayed hypoglycaemia after 6-12 hours.[2]

Due care with diabetes self-management will see the outcomes in managing blood glucose levels during social events - including those involving physical activity as positive.

Specific advice to reduce the risk of hypoglycaemia and adverse outcomes of alcohol includes:

> eat CHO beforehand, during the period of drinking alcohol, and afterwards

> consider reducing overnight insulin to avoid overnight hypoglycaemia

> arrange for a responsible person to if possible stay overnight and/or wake the person with diabetes the next morning at an appropriate time, to see that all is well and that the person with diabetes is easily rousable.[6]

Caution

In the event of chest, abdominal, neck or arm pain or tightness, vague discomfort or feeling breathless, faint or lightheaded or have any other usual symptoms, the person with diabetes should be advised to cease physical activity immediately. These symptoms could suggest a cardiac emergency that requires urgent treatment at the nearest hospital emergency department.[2, 10]

If the person with diabetes experiences any other pain, it would be recommended to stop the physical activity and rest until the pain goes away. If the pain does subside, the physical activity may be resumed. It is important that the general practitioner or diabetes specialist is informed.

The vast majority of people with diabetes, particularly those with a sedentary lifestyle, are encouraged to begin with gentle physical activity and to gradually progress to a more vigorous program as tolerated. Gradually, the person with diabetes will be able to be physically active for longer without pain but treatment may be required.

Prior to physical activity and/or during physical activity, if symptoms of a 'hypo' are experienced, the person with diabetes is advised to check blood glucose levels and treat as per their Hypo Action Plan. Physical activity is to cease and is not recommended to recommence until the symptoms have disappeared and the blood glucose level has returned to normal.

Prior to physical activity, if a blood glucose level is above 15mmol/L (not directly after eating) and ketones are present, then it is generally recommended that any physical activity be postponed. The hyperglycaemia and lack of adequate insulin levels and continued activity can result in the blood glucose levels rises higher, altered metabolism, and increased risk of diabetic ketoacidosis.[6]

Summary

- All people should be advised to modify their level of physical activity to achieve current physical activity recommendations and be supported to maintain this level across the lifespan.
- People with type 2 diabetes should be encouraged to participate in physical activity to improve glycaemic control and cardiovascular risk factors.
- People with type 1 diabetes should be encouraged to participate in physical activity to improve cardiovascular risk factors.
- Physical activity (involving aerobic and/or resistance exercise) should be performed on a regular basis.
- Advice about physical activity should be individually tailored and diabetes specific and should include implications for blood glucose management and foot care.
- Individualised advice on avoiding hypoglycaemia when physically active by adjustment of carbohydrate intake, reduction of diabetes medication and/or insulin dose, and choice of injection site, should be given to patients taking insulin.
- Patients with existing complications of diabetes should seek medical review before embarking on any form of physical activity.
- A gradual introduction and initial low intensity of physical activity with slow progressions in volume and intensity should be recommended for sedentary people with diabetes
- It is important for health professionals to appreciate that altering one's lifestyle on a permanent basis is usually very difficult.
- People need encouragement and support to accept responsibility and recognise the importance and consequences of their own lifestyle behaviour.

Activity for the person in hospital

If medical consent is provided, encourage the person to mobilise around the ward and/or hospital grounds.

If the person has limited mobility (eg bed rest), encourage breathing exercises and foot and ankle exercises twice daily or more frequently as recommended.

- Consult with general practitioner/ medical officer prior to commencing any exercise program.
- Consult with physiotherapist for appropriate exercises.
- Reinforce exercise instructions provided by the physiotherapist evaluate progress.

Suggested exercise for people with limited mobility

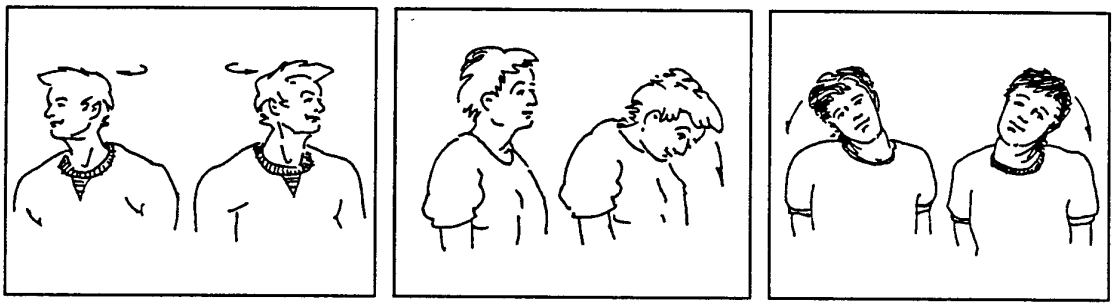
Head exercises

> Gently turn head from one side to the other side. Hold this position for 2-3 seconds and then return head to the front position to look forward again.

> Tilt head forward as far as possible.

> Tilt head as far as possible towards shoulder keeping shoulder still.

It is important the person moves slowly, avoids pain or any other symptoms (eg dizziness, blurred vision). In the presence of any of these symptoms, the exercises should be ceased immediately and a review by the physiotherapist or medical officer is indicated.



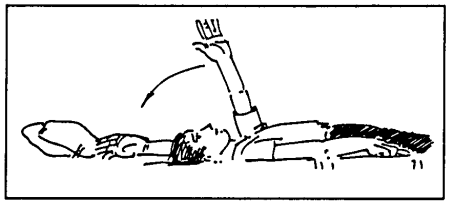
Shoulder exercises

> Lie flat on back, arm at side, palm facing body.

> Keep elbow straight and lift arm until hand points to the ceiling. Continue to move the arm back until it rests on the bed next to the head or to where it feels comfortable.

> The arm, may be bent at the elbow, if the headboard or the bed will not permit the arm to be carried all the way back.

> Return to the starting position, rest, then repeat the exercise.



Elbow exercises

> Bend elbow so that palm reaches towards the shoulder.

> Straighten elbow, turning palm away from shoulder.

> Rest the elbow on a table and turn the palm to face the shoulder, then away from the shoulder.

> This exercise can be extended by adding a light weight (held in the hand) to provide some resistance.

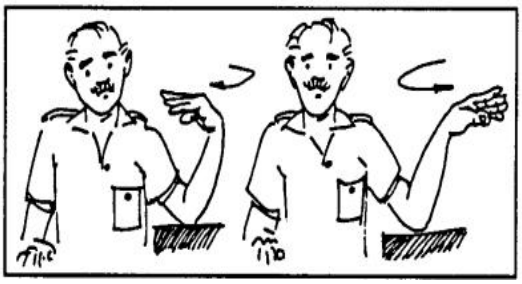
Hand and wrist exercises

> Bend the hand at the wrist, forward and back as far as possible similar to waving goodbye.

> Spread the fingers apart. Start with fingers straight. Close fingers into a fist and straighten again.

> Touch tip of thumb with each finger in turn.

> Grip hand sized piece of sponge or small ball and squeeze. Open, grip and repeat.



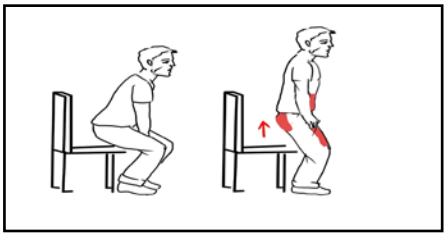
Sit to Stand exercises

> Sit comfortably on a dining type chair. Slowly lean forward and then move from a sitting to a standing position. The arms of the chair can be used for support.

> When in the standing position, fully straighten the legs.

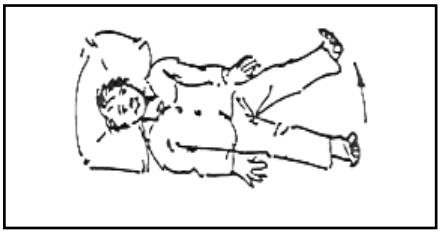
> Stand for the count of 5 and then gently sit back down again. This activity can be repeated 10 times and performed three times daily, or as directed by your health professional.

The movements should avoid pain or any other symptoms (eg dizziness). In the presence of any of these symptoms, the exercises should be ceased immediately and a review by the physiotherapist or medical officer is indicated.



Hip exercises

> Lying flat on back, with legs straight, move foot as far as possible to the side, return leg to original position.



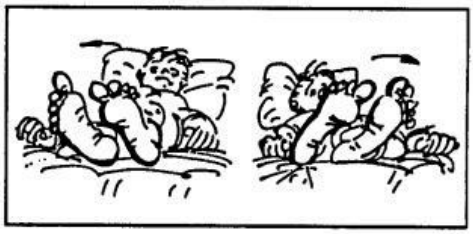
It is important the person moves slowly and avoids pain. In the presence of pain, the exercises should be ceased immediately and a review by the physiotherapist or medical officer is indicated.

Knee exercises

- Sitting onthe edge of bed (or chair), slowly straighten the leg at the knee and then slowly return to original position.
- Sitting upright on a bed with legs straight and back well supported slide foot as far as possible back toward buttocks, bending at the knee. Then slide foot back to original position. Repeat with other leg.

Ankle exercises

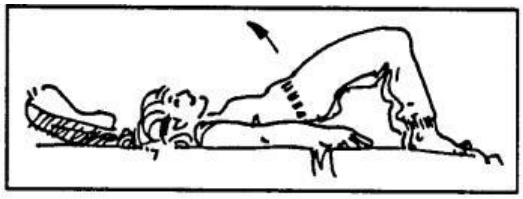
- Slowly bend foot up and down at the ankle.
- Sitting on the edge of bed (or chair), move ankle or foot through circular motion.



It is important the person moves slowly and avoids pain. In the presence of pain, the exercises should be ceased immediately and a review by the physiotherapist or medical officer is indicated.

Back exercises

- Lying with knees bent, lift hips up from the bed.
- Roll both knees from side to side, but keep shoulders flat on the bed.
- Sit on a chair, feet on the floor.
- Turn head and shoulders taking arms first round to the left and then round to the right.



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