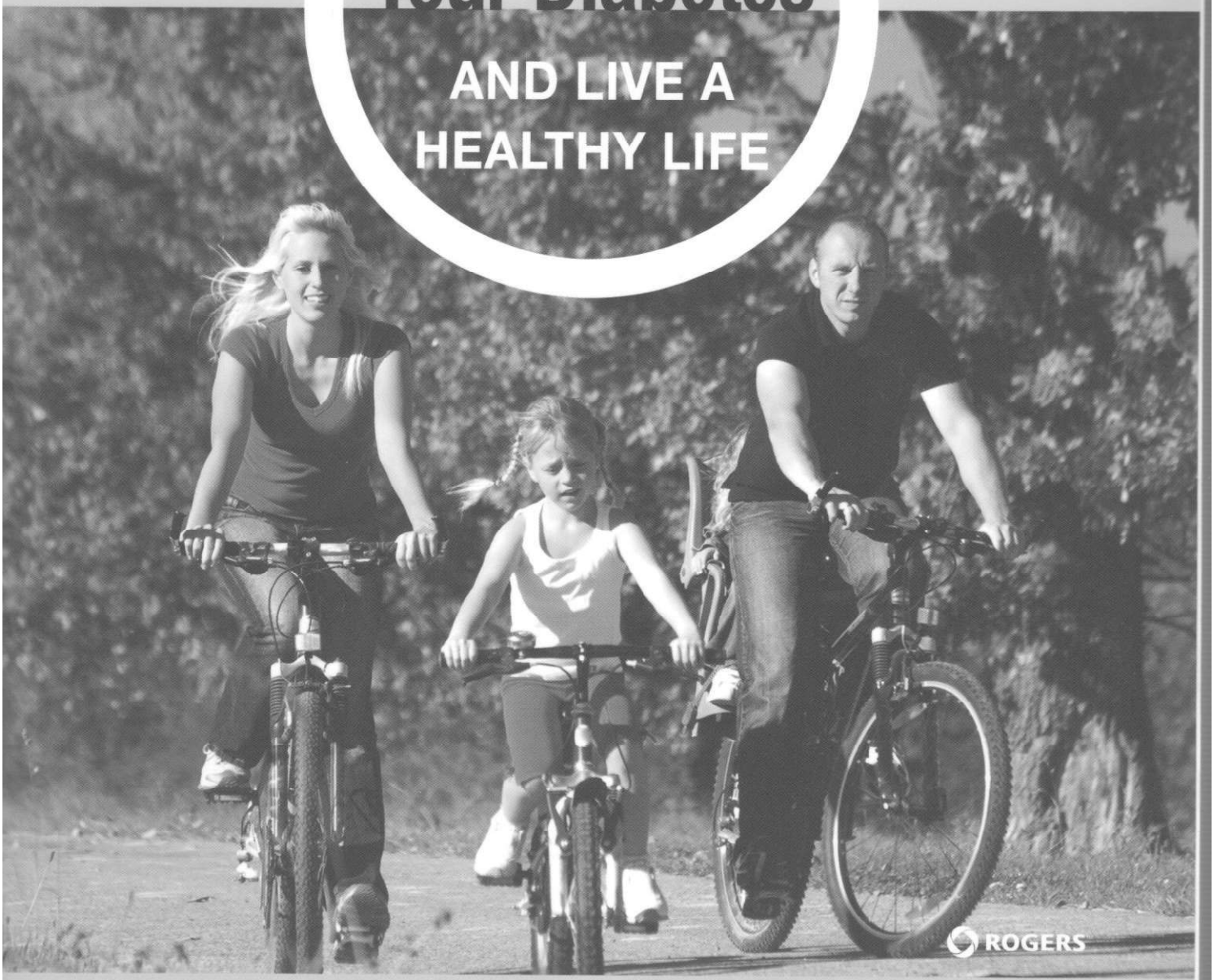
RECOMMENDED BY THE CANADIAN DIABETES ASSOCIATION

DIABETES DAY-CARE UNIT
CHUM – HÔTEL-DIEU, MONTRÉAL

Understand Your Diabetes

AND LIVE A HEALTHY LIFE

IN COLLABORATION WITH
DR. ROBERT G. JOSSE,
PROFESSOR OF MEDICINE,
UNIVERSITY OF TORONTO



NEW EDITION 2009

Physical activity

1. What is physical activity?

Physical activity is defined as any bodily movement produced by the muscles and requiring an expenditure of energy.

2. Why is regular exercise so important?

Regular exercise is beneficial for everyone, whether or not they have diabetes. There are certain risks associated with inactivity.

Regular physical activity leads to the following benefits:

1) better health, improved physical fitness, increased self-esteem;
2) better posture and balance;
3) strengthening of the muscles and bones;
4) energy recovery;
5) weight control;
6) lower blood lipid levels;
7) relaxation and stress control;
8) increased autonomy in later years;

The risks associated with inactivity are the following:

1) early death;
2) heart disease;
3) obesity;
4) high blood pressure;
5) diabetes;
6) osteoporosis;
7) stroke;
8) depression;
9) colon cancer.

3. What are the benefits of a regular exercise program for people with glucose intolerance (pre-diabetic state) or people with diabetes?

People with glucose intolerance and people with diabetes derive the same benefits from exercise as people with normal glucose tolerance. However, people who are glucose intolerant and engage in moderate regular physical activity decrease their risk of developing diabetes. People with type 2 diabetes who engage in regular physical activity decrease their resistance to insulin and are better able to control their diabetes.

Regular exercise is as beneficial for people with type 1 diabetes as it is for people who do not have diabetes. It is vital, however, for people with diabetes to control their illness and adjust insulin doses and diet according to their physical activity.

4. How should a successful exercise program be approached?

1) First, choose a sport or activity that you like. Dancing, mild gymnastics, swimming, working out, and speed-walking are all examples of simple and pleasant physical activities. The important thing is to choose something that appeals to you. This will increase the likelihood that you will do it on a daily basis.
2) Include the activity in your daily schedule. The more physical activity a person engages in every day, the greater his or her sense of well-being. Daily life offers a number of opportunities for exercise:
    - walking or biking to work;
    - taking the stairs instead of the elevator;
    - doing manual tasks such as sweeping, cleaning windows, gardening, etc.

According to recent recommendations, all adults between 18 and 65 years old should have at least **150 minutes of moderate physical activity per week, or 30 minutes, five times a week.**

5. What is considered a good physical fitness program to help control diabetes?

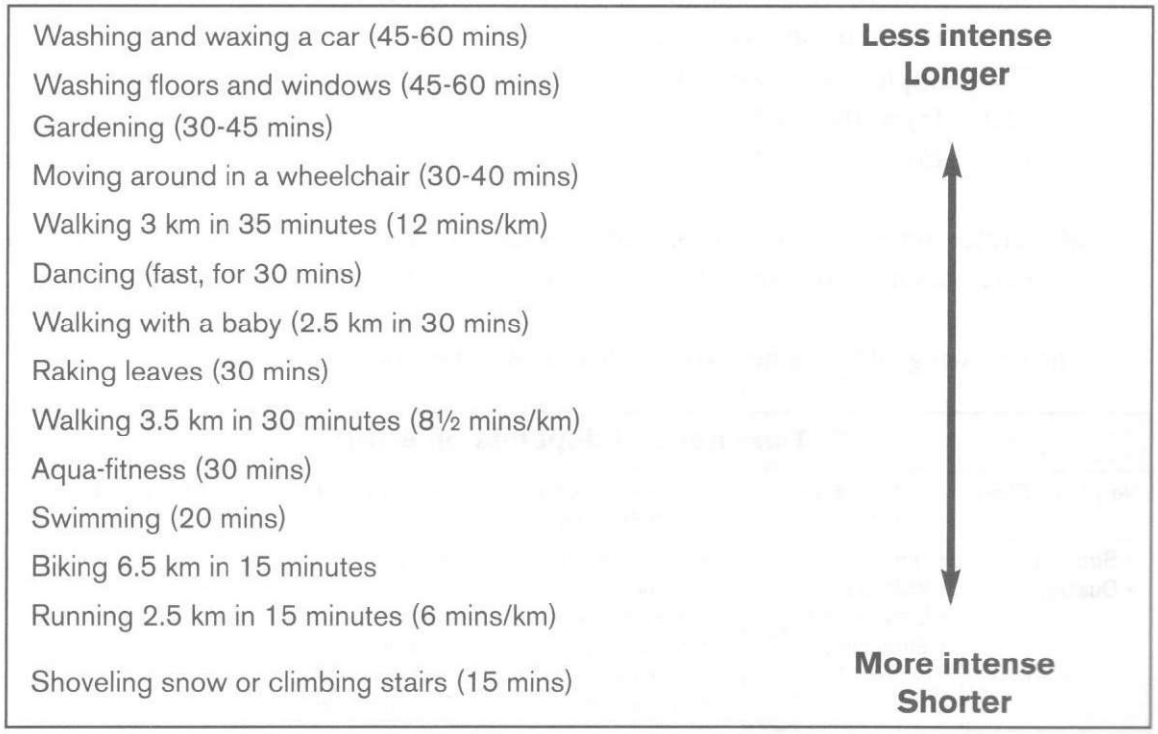
1) The exercises selected require **moderately intense levels of effort.**
2) The person exercises most days of the week, **at least five days a week.**
3) The person exercises an average of **at least 30 minutes a day.** The physical activity can be performed for shorter periods of at least 10 minutes per session.

The most accessible exercise is **speed-walking**. Walking quickly, but at a pace that allows conversation without breathlessness, is considered to be an activity of moderate intensity.

The energy expended by engaging in regular physical activity helps people maintain a healthy weight.

6. What are some low, moderate, and elevated intensity exercises?

The following chart ranks examples of physical activities according to the length and intensity of effort they generally require.



7. How can the exercise be pleasurable, effective and safe? How can I ensure that I progress at my own speed?

It is strongly recommended that people beginning an exercise program start out slowly and increase their pace little by little. Knowing how to measure out your physical effort is therefore critical and a good way to assess your abilities and progress. There are a number of ways to set your own pace.

1) **The degree of breathlessness:** Find the level where your breathing is deeper than when at rest but you are still able to have a conversation.
2) **Pulse or heart rate (HR):** Exercise is considered moderate when your pulse falls between 50% and 70% of your maximum heart rate. If an exact measurement of your maximum heart rate is not available, it can be estimated by subtracting your age from 220 beats per minute. To determine the moderate zone, this result should be multiplied by 50% or 70%.
   For example, if a person is 45 years old:
   (220 - 45) x 50% = 87.5
   (220 - 45) x 70% = 122.5

Moderate exercise means a heart rate between 88 and 123 beats per minute. This estimate does not, however, take into account drugs that can affect heart rate.

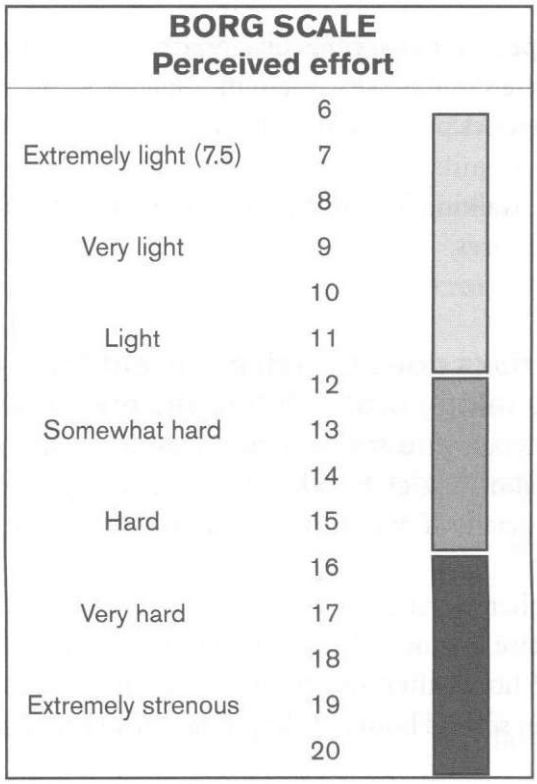
The following table can help you determine whether the intensity is appropriate:

Time needed depends on effort				
Very Light Effort	Light Effort *60 minutes*	Moderate Effort *30-60 minutes*	Vigorous Effort *20-30 minutes*	Maximum Effort
• Strolling • Dusting	• Light walking • Volleyball • Easy gardening • Stretching	• Brisk walking • Biking • Raking leaves • Swimming • Dancing • Water aerobics	• Aerobics • Jogging • Hockey • Basketball • Fast Swimming • Fast aerobics	• Sprinting • Racing
	How does it feel? How warm am I? What is my breathing like?			
• No change from rest state • Normal breathing	• Starting to feel warm • Slight increase in breathing rate	• Warmer • Greater increase in breathing rate	• Quite warm • More out of breath	• Very hot/perspiring heavily • Completely out of breath
	Range needed to stay healthy			

Handbook for *Canada's Physical Activity Guide to Healthy Active Living*. Ottawa, Ontario, K1A 0S9. Tel.: 1-888-334-9769; Website: http://www.phac-aspc.gc.ca/pau-uap/paguide/index.html

3) **The Borg Perceived Effort Scale:** This scale, which measures an individual's subjective perception of his or her effort, is easy to use. It is an excellent way to assess the intensity of physical activity undertaken by people who are taking drugs that affect their heart rate. An intensity of 12-13 corresponds to a moderate level of effort (see illustration below). Although the measurement is subjective, an estimate of perceived effort can provide a fairly reliable assessment of the person's actual heart rate during the physical activity.

The Borg scale should be referred to while the physical effort is taking place. The scale ranges from 6 to 20, with 6 signifying "no effort at all" and 20 signifying "exhaustion" or "maximal effort". Choose the number the best corresponds to your perception of your effort. It will give a good idea of the intensity of your physical activity and will guide you either to accelerate or slow down your movements to achieve the intensity you want. An accurate estimate depends on your being as honest as possible in your evaluation of your exertion.



8. When is exercise dangerous for people with diabetes?

Exercise can be risky and contraindicated when a person's diabetes is poorly controlled and blood glucose is:

1) lower than 4 mmol/L;
2) above 14.0 mmol/L and there are ketone bodies in the urine or blood;
3) above 17.0 mmol/L, whether or not there are ketone bodies in the urine or blood.

In some cases, people with diabetes can engage in regular physical activity, although they must always make careful choices regarding the type of activity they engage in.

For example:

1) **if the person with diabetes has a heart problem**, he or she should only undertake an exercise program under medical supervision;
2) **if the person with diabetes has eye problems with a risk of hemorrhage**, he or she should take up physical activities such as swimming, walking and riding a stationary bike instead of anaerobic activities such as weightlifting or activities that can involve blows or jolts, such as boxing, racket sports (tennis, badminton) and jogging;
3) **if the diabetic person has serious neuropathy with complete loss of sensation in the feet**, he or she should take up activities such as swimming, biking, rowing, arm exercises or exercises performed while seated.

Generally speaking, walking for short periods remains one of the least risky activities, even in such special cases.

9. What potential risks does exercise present for a person with diabetes who is taking oral antidiabetic medications or insulin?

People with diabetes being treated with insulin or drugs that stimulate the pancreas to produce more insulin (e.g. glyburide, gliclazide, repaglinide) run a higher risk of **hypoglycemia**, especially if the activity is unplanned, prolonged, and of moderate intensity.

It should be remembered that:

1) moderate exercise sustained for several hours can cause delayed hypoglycemia as long as 12 to 16 hours after the activity. For example, cross-country skiing, house-cleaning or even several hours of shopping can all provoke delayed hypoglycemia;

2) the more regular the activity (schedule, duration and intensity), the lower the risk of hypoglycemia.

10. What precautions should be taken when planning to exercise?

1) Blood glucose should be measured **before** any physical activity, regardless of the treatment regimen.
2) The condition of the feet should be checked **before and after** any exercise.
3) Alcohol should not be consumed **before, during or after** exercise.
4) People with diabetes should always wear a diabetic ID bracelet or pendant.
5) People with diabetes should also have quickly metabolized carbohydrate sources on hand.
6) People taking insulin are advised to use an injection site in an area that will be the least involved in the exercise, such as the abdomen.

11. What can people with diabetes who are taking insulin do to prevent hypoglycemia when exercising?

People with diabetes who are taking rapid or short acting insulin before meals should know how to adapt their treatment to prevent hypoglycemia when exercising.

1) When the activity is **planned and takes place 1 to 2 hours after a meal**, the insulin dose before the meal should be reduced, according to the type of exercise, its duration, its intensity, the training involved and above all, the person's **experience**.

The following table provides an example of how to decrease the insulin dose before the meal:

Intensity of effort	Percentage (%) reduction in the rapid or short acting insulin dose, according to duration of exercise	
	30 minutes	60 minutes
Low	25%	50%
Moderate	50%	75%
Elevated	75%	90% to 100%

Let us take, for example, a man with diabetes who injects 10 units of insulin before a meal. He plans on taking an hour-long walk at moderate intensity immediately after the meal. He can reduce the insulin dose by 75% and inject 2.5 (or 3) units before the meal.

75% x 10 units = 7.5 units
10 units – 7.5 units = 2.5 (or 3) units.

2) When the activity is **unplanned and takes place immediately before or after a meal,** or when the activity is **planned but takes place more than two hours after a meal:**
   - **for blood glucose below 5.0 mmol/L**, have a carbohydrate snack (15 g to 30 g) at the beginning of the activity, and approximately every 30 to 45 minutes afterward, while the activity lasts;
   - **for blood glucose above 5.0 mmol/L**, have a snack of about 15 g of carbohydrates every 30 to 45 minutes while the activity lasts.

Blood glucose should always be measured immediately **after exercising** to adjust the amounts of insulin and carbohydrates required.

In all cases, the need for insulin can decrease after exercise. This sometimes requires reducing the insulin dose for the next meal or at bedtime.

12. What can people with diabetes do to prevent hypoglycemia when exercising if they are taking oral antidiabetic drugs that stimulate the secretion of insulin?

For people with diabetes who are taking **drugs that stimulate the pancreas to produce insulin (for example, glyburide, gliclazide, repaglinide)**, the only way to lower the risk of hypoglycemia is to consume more carbohydrates while exercising. Anyone who regularly experiences hypoglycemia after exercising, however, is strongly advised to contact his or her doctor.

The recommendations are:

- **for blood glucose below 5.0 mmol/L**, have a carbohydrate snack (15 g to 30 g) at the beginning of the activity and then approximately every 30 to 45 minutes afterwards, while the activity lasts.

- **for blood glucose above 5.0 mmol/L**, additional carbohydrates are only necessary if the hypoglycemia occurs during the exercise. It is essential to check the blood glucose levels before eating, in order to avoid overeating. If more carbohydrates are needed, have a snack of about 15 g of carbohydrates every 30 to 45 minutes during the activity can provide what is necessary.

The following chart* can serve as a guide for adding carbohydrates during exercise. Additional carbohydrates are especially useful during unplanned exercise and almost always necessary during exercise that lasts a long time or is quite intense, resulting in a significant expenditure of energy.

Type of exercise	Blood glucose (mmol/L)	Additional carbohydrates
Short duration (< 30 min) at light intensity	< 5.0	10 g to 15 g
	> 5.0	not necessary
Moderate duration (30 to 60 min) at moderate intensity	< 5.0	30 g to 45 g
	5.0 - 9.9	15 g every 30 to 45 min of exercise
	10.0 - 13.9	not necessary
Long duration (> 60 min) at elevated intensity	< 5.0	45 g
	5.0 - 9.9	30 g to 45 g
	> 9.9	15 g per hour

*Adapted from Hayes C. *J Am Diet Assoc 97* (suppl 2): S167-S171

13. What precautions are appropriate for people with diabetes who take insulin or oral antidiabetic drugs that stimulate the secretion of insulin?

People with diabetes treated with insulin or oral antidiabetic drugs that stimulate the secretion of insulin must do the following:

1) always measure blood glucose before, during and after a session of exercise, and more often than normal in the 24 hours following prolonged physical activity;
2) always carry foods containing carbohydrates to correct hypoglycemia.

14. Should exercise be done in one long session or several shorter ones?

A 30-minute session of exercise has a hypoglycemic effect, which is often desired, but it also requires adjusting insulin doses or eating more carbohydrates. The same amount of exercise performed in three ten-minute sessions has little hypoglycemic effect and requires little or no insulin adjustment or additional carbohydrates, but it still provides the sought-after benefits.

Risk of hypoglycemia from physical activity according to antidiabetic medication*	
Class of medication	**Risk of hypoglycemia**
Biguanides (e.g., metformin)	No
Alpha-glucosidase inhibitors (e.g., acarbose)	No
DPP-4 inhibitors (e.g., sitagliptin)	No
Thiazolidinedione (e.g., pioglitazone)	No
Sulfonylureas (p. ex., glyburide)	Yes
Non-sulfonylurea secretagogues (e.g., repaglinide)	Yes
Insulin	Yes

* People taking drugs associated with a risk of hypoglycemia must speak with their doctor about dose adjustment or whether to ingest carbohydrates when exercising.