QUICK REFERENCE GUIDE TO DIABETES FOR HEALTH CARE PROVIDERS

A special project of the Michigan Diabetes Outreach Network

Chapter 4

Physical Activity and Diabetes

Benefits of Regular Physical Activity for Persons with Diabetes or Pre-diabetes

- Reduces the risk of Coronary Artery Disease
  - Decreases plasma cholesterol, triglycerides and LDL-cholesterol
  - Increases HDL-cholesterol, especially when coupled with weight loss
- Assists with blood pressure control
- Improves insulin sensitivity
- Reduces hyperinsulinemia
- Reduces body fat and may assist with weight loss
- Increases muscle mass
- Improves quality of life/self-esteem
- Can reduce stress
- Can help reduce diabetes medications required
- Can prevent type 2 diabetes and pre-diabetes

For those with type 2 diabetes, regular activity may also:

- Reduce A_{1C} levels
- Decrease or eliminate the need for insulin or oral agents
- Improve insulin sensitivity
- Help achieve and maintain desirable body weight
- Improve blood glucose control: 12-72 hours post activity

For those with type 1 diabetes:

- Regular physical activity **has not** been shown to consistently improve blood glucose control (unless coupled with food and insulin adjustments).
- Exercise-induced hypoglycemia is common due to accelerated absorption of insulin and increased insulin sensitivity. One of the most common times for hypoglycemia is 6-12 hours after the activity.

Risks of Physical Activity in Persons with Diabetes

1. **Hypoglycemia** (for those treated with insulin and insulin secretagogues, such as sulfonylureas, meglitinide or nateglinide or combination drugs containing these)

   - **Exercise induced hypoglycemia**
     - Monitor blood glucose levels before and after activity.
       - Delay activity if blood glucose in <70 mg/dl **or** <100 if vigorous, long duration activity is planned.
     - If on insulin:
       - Assure insulin is injected into subcutaneous fat layer
       - Be aware that the risk of hypoglycemia is greatest when insulin is peaking. Try to avoid activity when insulin is peaking, if practical.
       - Lower insulin dose that is peaking during the activity. May start with a 30-50% reduction. Insulin adjustment depends on the length of activity, intensity of activity, personal fitness level and experience.
       - Carbohydrate replacement may be needed if activity is unplanned or during activities of long duration.

   - **Post-exercise, late-onset hypoglycemia** (occurs 4 or more hours after activity and is more common in those with type 1 diabetes)
     - Monitor blood glucose levels frequently during the post-activity period
     - Pre-activity snacks (15-30 minutes prior to the activity) can reduce hypoglycemia when activity is less than 45 minutes in duration.
     - May need carbohydrate replacement during the post-activity period.
     - Activity prior to bedtime may cause nocturnal hypoglycemia.
     - If on insulin, decrease insulin that is peaking during the post-activity period.

Carbohydrate Replacement for Physical Activity

Intensity	Duration	Carbohydrate Needed	Frequency
Mild-moderate	< 30 minutes	None	
Moderate	30 – 60 minutes	15 grams	Each hour
High	> 1 hour	30 – 50 grams	Each hour

2. **Hyperglycemia** (after very strenuous, high-intensity activities)
   - Check ketones when blood glucose is greater than 300 mg/dl (type 1) or 400 mg/dl (type 2) (Joslin).
     - If moderate to large ketones are present, activity may worsen blood glucose levels. Delay activity until ketones are absent.
     - If no ketones are present, activity may help lower blood glucose. Begin activity and check glucose after 15 minutes. If blood glucose is higher, stop the activity.
   - For those with type 1 diabetes, diabetic ketoacidosis (DKA) may result if activity begins when blood glucose is elevated and/or ketones are present. Medical treatment is necessary.

3. **Dehydration**
    - Adequate fluid is needed before, during and after being active. (Fluid should be calorie free and caffeine-free, water is ideal.)

4. **Exacerbation of cardiovascular disease**, such as:
    - Presence of silent heart disease (arrhythmia, cardiac dysfunction)
    - Excessive increases in blood pressure with activity
    - Angina
    - Myocardial infarction
    - Sudden death

5. **Worsening of chronic complications** with inappropriate activities.
    - **Retinopathy:** Avoid strenuous, high intensity activities, heavy weight lifting, scuba diving, activities that require the head to be lower than the waist, jarring activities (jogging or racquetball) and competitive sports. Walking, swimming, stationary cycling and best.
    - **Peripheral Vascular Disease (PVD):** Non-weight bearing activities are best. Walking is helpful for those with intermittent claudication. Severe PVD is an absolute contraindication for a walking program.
    - **Peripheral Neuropathy:** Avoid weight-bearing activities and jogging. Be cautious of over stretching. Well fitting shoes are crucial. Daily range-of-motion activities, cycling and swimming are best.
    - **Autonomic Neuropathy:** Avoid strenuous, high intensity activities and being active in temperature extremes. Recumbent cycling and water aerobics are best.
    - **Nephropathy:** Low-intensity aerobic activities are best (walking, swimming, cycling). Exercise tolerance is generally diminished.
    - **Hypertension:** Avoid heavy lifting, straining and excessive arm movements (especially over the head, which can cause dramatic elevations in blood pressure for some).

Physical Activity Recommendations

Type 2 diabetes: minimum of 150 min/week of moderate intensity aerobic activity (50-70% of max HR) and resistance training (up to 3 times per week) in those without contraindications.

Type 1 diabetes: all levels of activity can be performed by those without complications and are in good glycemic control.

For the older adult: 30-40 minutes 5-6 times a week.

For weight loss: at least 60 minutes most days of the week.

Activity Sessions

Warm-up: Each activity session should begin with a couple of minutes of light activity, followed by stretching.

Activity: Aerobic activity (e.g. walking, swimming or biking). Depending on fitness level, the activity session can last from 5-60 minutes. Most need to start out with a short activity period and add 1-2 minutes every 1-2 weeks. The person should be able to talk during the activity and feel that they are working 'somewhat hard'. Activity sessions may be split into 2 or more sessions per day. For example, a 30 minute daily activity could be broken down into three 10 minute sessions.

Cool-down: Slow down the pace for a couple of minutes. End with more stretching.

Safety Tips

1. To prevent hypoglycemia:
    - Carry a rapidly absorbed carbohydrate source
    - Monitor blood glucose regularly
2. Wear or carry diabetes identification
3. To prevent injury:
    - Use proper equipment and shoes
    - Include a warm-up and cool-down period
    - Avoid activity in extreme temperatures (hot, humid or freezing)
    - Stop activity if pain, light-headedness or shortness of breath occurs.
4. Drink plenty of fluids to avoid dehydration:

A graded stress test may be necessary to evaluate the safety of some activities for persons with diabetes. A graded activity test is recommended if one or more of the following are true:

- Older than 35
- Older than 25 years and
    - has had type 2 diabetes for more than 10 years
    - has had type 1 diabetes for more than 15 years
- Other heart disease risk factors present (smoking, high cholesterol, high blood pressure, etc)
- Presence of microvascular disease (proliferative retinopathy or nephropathy, including microalbuminuria)
- Peripheral vascular disease
- Autonomic neuropathy

References: American Diabetes Association (2008). Clinical Practice Recommendations. *Diabetes Care*, Vol 31 (1).