



# Physical Activity

The ADA Standards of Medical Care - 2015 includes exercise as an important part of the diabetes management plan. Regular exercise has been shown to improve blood glucose control, reduce cardiovascular risk factors, contribute to weight loss, and improve well-being.



Exercise, or physical activity, includes anything that gets people moving, such as walking, dancing, or working in the yard. Regular physical activity is important for everyone, but it is especially important for patients with diabetes and those at risk for diabetes.

Standards of Medical Care in Diabetes-2015. *Standards of Medical Care in Diabetes-2015*. 2015. Available at: [http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement\\_1.dcl/january\\_supplement\\_combined\\_final.6-99.pdf](http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement_1.dcl/january_supplement_combined_final.6-99.pdf). Accessed January 5, 2015.

did you know?

Following regular exercise training, cells can better respond to insulin and effectively take glucose out of the blood and into the cell.

Exercise and Type 2 Diabetes. *ACE Fitness*. Available at: <http://www.acefitness.org/fitness-fact-article/2608/exercise-and-type-2-diabetes/>. Accessed October 24, 2014.

Colberg, SR, Sigal, RJ, Fernhall, B, et al. Exercise and Type 2 Diabetes: The American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes Care*. 2010;33(12):e147-e167. doi:10.2337/dc10-9990.

## Benefits of Physical Activity

- Improved glucose control
- Reduced CV risk factors
- Reduced weight
- Lowered BMI, BP, and LDL
- Decreased risk of falls and fractures
- Improved sense of well-being
- Reduced symptoms of depression

Structured exercise for 8 consecutive weeks has been shown to lower HbA1C on average by 0.66%

Boule, NG. Effects of Exercise on Glycemic Control and Body Mass in Type 2 Diabetes Mellitus: A Meta-analysis of Controlled Clinical Trials. *JAMA: The Journal of the American Medical Association*. 2001;286(10):1218-1227. doi:10.1001/jama.286.10.1218.

American Association of Clinical Endocrinologists/AACE Diabetes Resource Center. *Treatment of T2DM*. Available at: <http://outpatient.aace.com/type-2-diabetes/treatment>. Accessed September 10, 2014.

Standards of Medical Care in Diabetes-2015. *Standards of Medical Care in Diabetes-2015*. 2015. Available at: [http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement\\_1.dcl/january\\_supplement\\_combined\\_final.6-99.pdf](http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement_1.dcl/january_supplement_combined_final.6-99.pdf). Accessed January 5, 2015



## Guidelines For Physical Activity

Many studies have shown that regular physical activity improves glucose control in persons with type 2 diabetes. Physical activity is also a factor in weight loss and is particularly important in the weight maintenance phase.

Colberg, SR, Sigal, RJ, Fernhall, B, et al. Exercise and Type 2 Diabetes: The American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes Care*. 2010;33(12):e147-e167. doi:10.2337/dcl0-9990.

### ADA 2015 Guidelines for Physical Activity



#### Adults

≥ 150 min/wk moderate intensity aerobic activity or ≥ 75 min/wk of vigorous aerobic activity spread over ≥ 3 days/wk with no more than 2 consecutive days w/o exercise. Individuals should limit and/or break up idle or inactive time, specifically any inactivity of more than 90 minutes.



#### Children <18

≥ 60 minutes physical activity/day

Standards of Medical Care in Diabetes-2015. *Standards of Medical Care in Diabetes-2015*. 2015. Available at: [http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement\\_1.dcl/january\\_supplement\\_combined\\_final.6-99.pdf](http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement_1.dcl/january_supplement_combined_final.6-99.pdf). Accessed January 5, 2015.

### AACE Additional Guidelines for Physical Activity

In addition to the guidelines recommended by the ADA, the AACE stresses the importance of daily, unstructured physical activity such as walking.

- Patients can wear a pedometer to track steps throughout the day.
- AACE recommends at least 10,000 steps per day.



American Association of Clinical Endocrinologists AACE Diabetes Resource Center. *Treatment of T2DM*. Available at: <http://outpatient.aace.com/type-2-diabetes/treatment>. Accessed September 10, 2014.

### did you know?

5 to 10 minutes of running each day can add years to life. Researchers found that 24% of people who ran regularly were 30% less likely to die from any cause over the course of the study and 45 percent less likely to die from heart disease than were those who didn't run.

Lee, D, Pate, RR, Lavie, CJ, Sui, X, Church, TS, Blair, SN. Leisure-Time Running Reduces All-Cause and Cardiovascular Mortality Risk. *Journal of the American College of Cardiology*. 2014;64(5):472-481. Available at: <http://www.sciencedirect.com/science/article/pii/S0735109714027466>. Accessed December 22, 2014.

## Examples of Physical Activity

### Moderate Intensity



- Walking 2 miles in 30 min
- Stair walking for 15 min
- Bicycling 5 miles in 30 min
- Water aerobics for 30 min
- Gardening for 30-45 min
- Vacuuming for 30-45 min

### Vigorous Activity



- Running
- Jump rope
- Cycling class
- Sports Conditioning (e.g. Boot Camp, Zumba, Body Sculpting)
- Step aerobics
- High-Intensity Interval Training (e.g. Kickboxing)

Guide to Physical Activity. *Exercise and Fitness*. Available at: [http://www.nhlbi.nih.gov/health/educational/lose\\_wt/phy\\_act.htm](http://www.nhlbi.nih.gov/health/educational/lose_wt/phy_act.htm). Accessed September 8, 2014.



# Physical Activity

## Exercise and Blood Glucose Control

For patients with diabetes, it's important to check blood glucose levels before exercising to ensure safety.

Blood glucose response to exercise will vary depending on:

- Blood glucose level before starting activity
- Intensity of the activity
- Time length of the activity
- Changes made to insulin doses

Blood Glucose Range	Result	Recommendation
< 100 mg/dL	Blood glucose is too low to exercise safely.*	Eat a small (15g) carbohydrate-containing snack (fruit or crackers) before workout.*
100-300 mg/dL	Safe pre-exercise blood sugar range.	
≥ 300 mg/dL	Safe to exercise without ketosis and feeling well.	Important to stay hydrated.

\*This only applies to individuals taking insulin or the secretagogues more likely to cause hypoglycemia (e.g., sulfonylureas such as glyburide, glipizide, and glimepiride, as well as nateglinide and repaglinide).

Colberg, SR, Sigal, RJ, Fernhall, B, et al. Exercise and Type 2 Diabetes: The American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes Care*. 2010;33(12):e147-e167. doi:10.2337/dc10-9990.

did you know?

New fitness tracking devices provide the ability to track movement (such as steps, miles, calories burned, sleep patterns and heart rate).





## Exercise Intensity Levels

Exercising at the correct intensity can help patients get the most out of physical activity. For most healthy adults, the Department of Health and Human Services (HHS) recommends these exercise guidelines:

- **Aerobic activity.** At least 150 minutes a week of moderate aerobic activity, such as brisk walking, swimming or mowing the lawn, or 75 minutes a week of vigorous aerobic activity such as running or aerobic dancing. A combination of moderate and vigorous activity, preferably spread throughout the course of a week, is a good plan.



**Researchers analyzed 14 exercise studies involving 915 adults with type 2 diabetes. Aerobic exercise (such as walking and bike riding) was better at lowering A1C levels than was resistance training.**

Schwingshackl, L, Missbach, B, Das, S, König, J, Hoffmann, G. Impact of different training modalities on glycaemic control and blood lipids in patients with type 2 diabetes: a systematic review and network meta-analysis. *Diabetologia*. 2014;57(9):1789-1797. doi:10.1007/s00125-014-3303-z.



- **Strength training.** Strength training exercises are most effective when performed at least twice a week. Examples include free weights, weight machines or activities that use one's own body weight, such as rock climbing or heavy gardening.

Colberg, SR, Sigal, RJ, Fernhall, B, et al. Exercise and Type 2 Diabetes: The American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes Care*. 2010;33(12):e147-e167. doi:10.2337/dc10-9990.

Standards of Medical Care in Diabetes-2015. *Standards of Medical Care in Diabetes-2015*. 2015. Available at: [http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement\\_1.dcl/january\\_supplement\\_combined\\_final.6-99.pdf](http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement_1.dcl/january_supplement_combined_final.6-99.pdf). Accessed January 5, 2015.

**A combination of both types of exercise was best, lowering A1C by 0.17 percentage points more than aerobic exercise alone and 0.62 percentage points more than resistance training alone.**

Colberg, SR, Sigal, RJ, Fernhall, B, et al. Exercise and Type 2 Diabetes: The American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes Care*. 2010;33(12):e147-e167. doi:10.2337/dc10-9990.

did you know?

**Empowering patients to make decisions about their goals, priorities and daily diabetes care activities is an effective method of helping patients take care of themselves.**

Funnell, M. M., and R. M. Anderson. "Empowerment and Self-Management of Diabetes." *Clinical Diabetes* 22.3 (2004): 123-27. Web. 23 Jan. 2015.



# Physical Activity

## Measuring Heart Rate

Exercise intensity must generally be at a **moderate or vigorous** level in order to deliver the most benefit. Measuring heart rate is a technique used to determine the intensity of physical activity.

### ■ Maximum heart rate

To estimate a person's maximum heart rate, subtract their age from 220. For example a 40 year old would subtract 40 from 220, leaving 180. Therefore 180 beats per minute (bpm) is their maximum heart rate during physical activity.

Example: 40 years old

$$\begin{array}{r} 220 \\ -40 \\ \hline \end{array}$$

180 maximum bpm

### ■ Moderate intensity activity

(50-70% of maximum heart rate) For a maximum heart rate of 180 bpm:  $0.5 \times 180 = 90$  bpm and  $0.7 \times 180 = 126$  bpm. Therefore the moderate intensity target range is 90-126 bpm.

### ■ Vigorous intensity activity

(70-85% of maximum heart rate) For a maximum heart rate of 180 bpm:  $0.7 \times 180 = 126$  bpm and  $0.85 \times 180 = 153$  bpm. Therefore the vigorous intensity target range is 126-153 bpm.

## Calculating Heart Rate

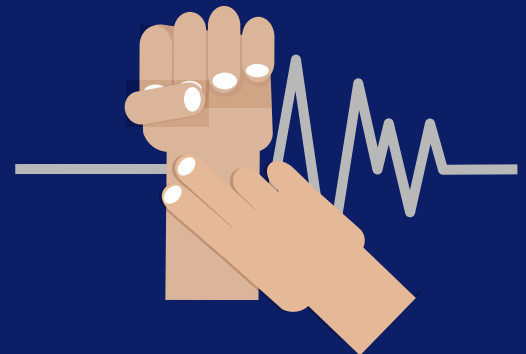
Patients can:

- Buy a personal heart monitor at a drugstore to wear during physical activity



OR

- Manually measure their heart rate by stopping momentarily during activity and taking their pulse by:
  - Placing two finger between the bone and tendon over the wrist on the thumb side
  - Counting the number of beats they feel for 15 seconds
  - Multiplying this number by 4
 The resulting number is their heart rate in bpm.



**When initiating an exercise plan, patients should start off with a goal of around 50% of their maximum heart rate during activity to avoid overexertion.**

did you know?

Fitness. *Exercise intensity: How to measure it*. 2014. Available at: <http://www.mayoclinic.org/healthy-living/fitness/in-depth/exercise-intensity/art-20046887?pg=2>. Accessed October 2, 2014.

Target Heart Rate and Estimated Maximum Heart Rate. *Centers for Disease Control and Prevention*. 2011. Available at: <http://www.cdc.gov/physicalactivity/everyone/measuring/hearttrate.html>. Accessed December 23, 2014.



## Measuring Health and Fitness

Weight alone may not be a clear indicator of good health because it does not distinguish between pounds that come from body fat and those that come from lean body mass or muscle. To better measure health and fitness, Body Mass Index (BMI) and body fat percentage are two frequently used calculations.

BMI is a measure of health based on a person's height and weight.

- Metric Formula:  $BMI = \text{weight in kg} \div \text{height in meters}^2$
- Standard Formula:  $BMI = (\text{weight in pounds} \div \text{height in inches}^2) \times 703$

### Body Mass Index (BMI)

### Example:

Height 73" (6'1")

Weight 175 lb

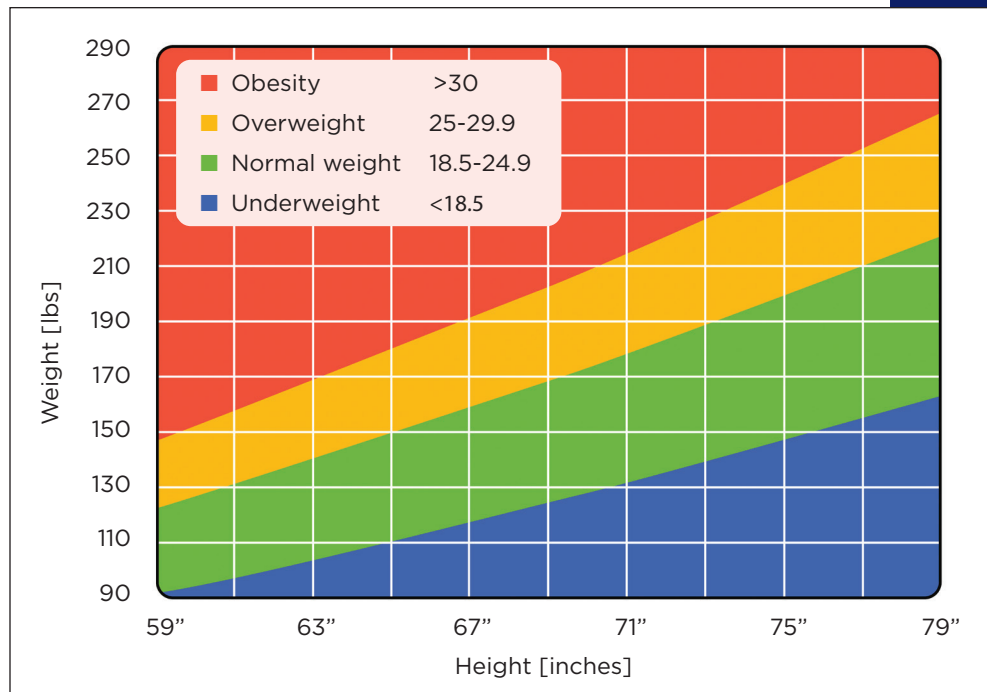
BMI =

$(175 \div 732) \times 703 =$

$(175 \div 5,329) \times 703 =$

$.03284 \times 703 = 23$

**BMI of 23 = Normal Weight**



Adapted from: Body Mass Index Table 1. Body Mass Index Table 1. Available at: [http://www.nhlbi.nih.gov/health/educational/lose\\_wt/bmi/bmi\\_tbl.htm](http://www.nhlbi.nih.gov/health/educational/lose_wt/bmi/bmi_tbl.htm). Accessed October 2, 2014.

did you know?

An overweight or obese BMI increases a patients risk for health problems such as heart disease, high blood pressure, type 2 diabetes, gallstones, breathing problems, and certain cancers.

Why Is a Healthy Weight Important?. *Maintain a Healthy Weight*. Available at: [http://www.nhlbi.nih.gov/health/educational/lose\\_wt/index.htm](http://www.nhlbi.nih.gov/health/educational/lose_wt/index.htm). Accessed September 16, 2014.



## Body Fat Percentage

BMI is used to determine whether a person is at a healthy weight for their height. But BMI doesn't tell the whole story because it doesn't measure body composition. So one may have a normal BMI while their body fat percentage is high enough to increase health risks.

- Achieving a healthy body fat percentage can be done through healthy eating and the addition of physical activity.
- Body composition is just as important as maintaining a healthy weight.



Zeratsky, K. normal body weight?. *Mayo Clinic*. 2014. Available at: <http://www.mayoclinic.org/diseases-conditions/obesity/expert-answers/normal-weight-obesity/faq-20058313>.

## Weight Management

For patients with diabetes, being overweight or obese increases the risk for comorbidities and potential complications. A combination of physical activity and a healthy diet is the best way to lose weight. Losing just a few pounds can help with diabetes control and can reduce risk for other health problems. Weight loss benefits also include improved glycemic control, BP, and/or lipid levels.

The ADA recommends starting off with a 7% body weight reduction goal

- For a 180 lb person, this equals a weight loss goal of 12.6 lb

Standards of Medical Care in Diabetes-2015. *Standards of Medical Care in Diabetes-2015*. 2015. Available at: [http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement\\_1.dcl/january\\_supplement\\_combined\\_final.6-99.pdf](http://care.diabetesjournals.org/content/suppl/2014/12/23/38.supplement_1.dcl/january_supplement_combined_final.6-99.pdf). Accessed January 5, 2015.

## Interpretation of BMI for adults

For adults 20 years old and older, BMI is interpreted using standard weight status categories that are the same for all ages and for both men and women. For children and teens, on the other hand, the interpretation of BMI is both age- and sex-specific.

For more information about interpretation for children and teens, see the Child and Teen BMI Calculator at <http://nccd.cdc.gov/dnpabmi/Calculator.aspx>

The standard weight status categories associated with BMI ranges for adults are shown in the following table.

BMI	Weight Status
Below 18.5	Underweight
18.5 - 24.9	Normal
25.0 - 29.9	Overweight
30.0 and Above	Obese

For example, here are the weight ranges, the corresponding BMI ranges, and the weight status categories for a sample height.

Height	Weight Range	BMI	Weight Status
5' 9"	124 lbs or less	Below 18.5	Underweight
	125 lbs to 168 lbs	18.5 - 24.9	Normal
	169 lbs to 202 lbs	25.0 - 29.9	Overweight
	203 lbs or more	30.0 or higher	Obese

About BMI for Adults. *Centers for Disease Control and Prevention*. 2014. Available at: [http://www.cdc.gov/healthyweight/assessing/bmi/adult\\_bmi/index.html](http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html). Accessed January 15, 2015.



# Physical Activity

## Impact of Exercise

Regardless of the type of diabetes, regular physical activity is important for overall health and wellness.

With type 1 diabetes, it's very important to balance insulin doses with food and activity.

A type 1 patient should plan ahead and know their body's typical blood glucose response to exercise. This will help keep their blood glucose from going too low or too high.

### Preventing Lows

Blood glucose response to exercise will vary depending on:

- blood glucose level before starting activity
- the intensity of the activity
- the duration of activity
- changes made to insulin doses

Sometimes people experience a drop in blood glucose during or after exercise, so it is very important they monitor their blood glucose, take proper precautions, and be prepared to treat hypoglycemia.

In order to learn how different types of activity affect them, they should frequently check their blood glucose before, during, and after an exercise session.

Increased activity may require a lower insulin dose or eating extra carbohydrates before exercising to keep blood glucose in a safe range. Some activities may cause blood glucose to drop quickly, while others may not.

- If blood glucose levels are trending down before a workout, a pre-exercise snack is warranted. Carry a carbohydrate food or drink (like juice or glucose tabs) to quickly raise blood glucose.
- If blood glucose level is less than 100 mg/dl before activity, a small carbohydrate snack (about 15 grams) will increase blood glucose and reduce the risk for hypoglycemia. This is especially important if circulating insulin levels will be higher during the time of exercise and if the exercise lasts longer than 30 minutes.
- If on an insulin pump, patients may be able to avoid adding an extra snack by lowering their basal insulin rate during the activity.

**If the patient with type 1 diabetes has repeated problems with low blood glucose dropping during or after exercise, they should consult with their physician.**

### High Blood Glucose:

Blood glucose can also run high during or after exercise, particularly when doing a high-intensity exercise that increase stress hormone levels.

If they feel well, and do not have ketones in their blood or urine, it should be fine to exercise.

Colberg SR, Sigal RJ, Fernhall B, Regensteiner JG, Blissmer BJ, Rubin RR, Chasan-Taber L, Albright AL, Braun B, American College of Sports Medicine, et al. *Diabetes Care*. 2010 Dec; 33(12):e147-67.

Exercise and Type 1 Diabetes. *American Diabetes Association*. 2014. Available at: <http://www.diabetes.org/food-and-fitness/fitness/exercise-and-type-1-diabetes.html>. Accessed December 23, 2014.

In order to learn how different types of activity affect them, they should frequently check their blood glucose before, during, and after an exercise session.



Before



During



After





# Physical Activity

## Safety Tips

To help prevent injuries, dehydration, and hypoglycemia when exercising, patients with diabetes should:

- Start slowly, especially if they have not been active for a while.
- Talk to their health care team about which activities are safest.
- Warm up for 5 minutes before starting to exercise and cool down for 5 minutes after. Warm up or cool down should be a lower intensity than the rest of the time exercising.
- Avoid doing activity in extremely hot or cold temperatures.
- Drink plenty of water before, during, and after activity.
- Be prepared to test for and treat a low if they feel it coming on, and carry a source of carbohydrate to treat low blood glucose if needed.
- Consider having a sports drink that provides carbohydrates if exercising for an extended period (more than an hour or two).
- Engage in activities that are energizing but not too hard. Patients with diabetes should use the “talk test” - If they become short of breath and can’t talk, they should slow down.
- Take care of their feet by wearing shoes and clean socks that fit well.
- Carefully inspect their feet before and after activity for blisters, redness, or other signs of irritation. Talk to their doctor if experiencing a foot injury or a non-healing blister, cut, or sore.
- Stop doing an activity if they feel any pain or lightheadedness and talk to their doctor about any unusual symptoms that they experience.

Injury-Free Exercise - 11 Quick Safety Tips. *American Diabetes Association*. 2013. Available at: <http://www.diabetes.org/food-and-fitness/fitness/get-started-safely/injury-free-exercise.html>. Accessed December 23, 2014.

## Risk of Injury

- Patients should check with their health care provider before making big changes in their exercise plan. If they have any diabetes complications, there may be certain exercises they should avoid.
  - The age and previous level of physical activity should be considered when developing a program.



- Patients should wear a medical ID tag, especially during exercise, so if a hypoglycemic event or collapse occurs, proper medical help can be given.



- Patients should NOT exercise when urine tests show elevated ketones and blood glucose.



Injury-Free Exercise - 11 Quick Safety Tips. *American Diabetes Association*. 2013. Available at: <http://www.diabetes.org/food-and-fitness/fitness/get-started-safely/injury-free-exercise.html>. Accessed December 23, 2014.

Get Started Safely. *American Diabetes Association*. Available at: <http://www.diabetes.org/food-and-fitness/fitness/get-started-safely/>. Accessed January 14, 2015.

DKA (Ketoacidosis) & Ketones. *American Diabetes Association*. American Diabetes Association, n.d. Web. 21 Jan. 2015. <http://www.diabetes.org/living-with-diabetes/complications/ketoacidosis-dka.html>.