

## Do you have insulin resistance or pre-diabetes?

Anyone 45 years or older should consider getting tested for diabetes. If you are overweight and aged 45 or older, it is strongly recommended that you get tested. You should consider getting tested if you are younger than 45, overweight, and have one or more of the following risk factors:

- family history of diabetes
- low HDL cholesterol and high triglycerides
- high blood pressure
- history of gestational diabetes (diabetes during pregnancy) or gave birth to a baby weighing more than 9 pounds
- minority group background (African American, American Indian, Hispanic American/Latino, or Asian American/Pacific Islander)

Diabetes and pre-diabetes can be detected with one of the following tests:

A **fasting glucose** test measures your blood glucose after you have gone overnight without eating. This test is most reliable when done in the morning. Fasting glucose levels of 100 to 125 mg/dL are above normal but not high enough to be called diabetes. This condition is called pre-diabetes or impaired fasting glucose, and it suggests that you have probably had insulin resistance for some time. IFG is considered a pre-diabetic state, meaning that you are more likely to develop diabetes but do not have it yet.

A **glucose tolerance** test measures your blood glucose after an overnight fast and 2 hours after you drink a sweet liquid provided by the doctor or laboratory. If your blood glucose falls between 140 and 199 mg/dL 2 hours after drinking the liquid, your glucose tolerance is above normal but not high enough for diabetes. This condition, also a form of pre-diabetes, is called impaired glucose tolerance and, like IFG, it points toward a history of insulin resistance and a risk for developing diabetes.

These tests give only indirect evidence of insulin resistance. The test that most accurately measures insulin resistance is too complicated and expensive to use as a screening tool in most doctors' offices. The test, called the euglycemic clamp, is a research tool that helps scientists learn more about sugar metabolism problems. Insulin resistance can also be assessed with measurement of fasting insulin. If conventional tests show that you have IFG or IGT, your doctor may suggest changes in diet and exercise to reduce your risk of developing diabetes.

**If your blood glucose is higher than normal but lower than the diabetes range, have your blood glucose checked in 1 to 2 years.      Lab Tests and What They Show**

- **Blood glucose.** High blood glucose may be a sign that your body does not have enough insulin or does not use it well. However, a fasting measurement or oral glucose tolerance test gives more precise information.
- **Insulin.** An insulin measurement helps determine whether a high blood glucose reading is the result of insufficient insulin or poor use of insulin.
- **Fasting glucose.** Your blood glucose level should be lower after several hours without eating. After an overnight fast, the normal level is below 100 mg/dL. If it is in the 100 to 125 mg/dL range, you have impaired fasting glucose or pre-diabetes. A result of 126 or higher, if confirmed on a repeat test, indicates diabetes.

## Can you reverse insulin resistance?

Yes. Physical activity and weight loss make the body respond better to insulin. By losing weight and being more physically active, you may avoid developing type 2 diabetes. In fact, a major study has verified the benefits of healthy lifestyle changes and weight loss. In 2001, the National Institutes of Health completed the Diabetes Prevention Program (DPP), a clinical trial designed to find the most effective ways of preventing type 2 diabetes in overweight people with pre-diabetes. The researchers found that lifestyle changes reduced the risk of diabetes by 58 percent. Also, many people with pre-diabetes returned to normal blood glucose levels.

The main goal in treating insulin resistance and pre-diabetes is to help your body relearn to use insulin normally. You can do several things to help reach this goal.

### Be Active and Eat Well

Physical activity helps your muscle cells use blood glucose because they need it for energy. Exercise makes those cells more sensitive to insulin.

The DPP confirmed that people who follow a low-fat, low-calorie diet and who increase activities such as walking briskly or riding a bike for 30 minutes, five times a week, have a far smaller risk of developing diabetes than people who do not exercise regularly. The DPP also reinforced the importance of a low-calorie, low-fat diet. Following a low-calorie, low-fat diet can provide two benefits. If you are overweight, one benefit is that limiting your calorie and fat intake can help you lose weight. DPP participants who lost weight were far less likely to develop diabetes than others in the study who remained at an unhealthy weight. Increasing your activity and following a low-calorie, low-fat diet can also improve your blood pressure and cholesterol levels and has many other health benefits.



### Diabetes Prevention Program Results

The DPP's striking results tell us that millions of high-risk people can use diet, exercise, and behavior modification to avoid developing type 2 diabetes. The DPP also suggests that metformin is effective in delaying the onset of diabetes.

Participants in the lifestyle intervention group—those receiving intensive counseling on effective diet, exercise, and behavior modification—reduced their risk of developing diabetes by 58 percent. This finding was true across all participating ethnic groups and for both men and women. Lifestyle changes worked particularly well for participants aged 60 and older, reducing their risk by 71 percent. About 5 percent of the lifestyle intervention group developed diabetes each year during the study period, compared with 11 percent in those who did not get the intervention. Researchers think that weight loss—achieved through better eating habits and exercise—reduces the risk of diabetes by improving the ability of the body to use insulin and process glucose.

Participants taking metformin reduced their risk of developing diabetes by 31 percent. Metformin was effective for both men and women, but it was least effective in people aged 45 and older. Metformin was most effective in people 25 to 44 years old and in those with a body mass index of 35 or higher (at least 60 pounds overweight). About 7.8 percent of the metformin group developed diabetes each year during the study, compared with 11 percent of the group receiving the placebo.