

Prediabetes

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What is it?

Prediabetes, also known as impaired fasting glucose (IFG), or abnormal glucose tolerance, is often the first step to diabetes. Prediabetes is an elevated blood glucose level that is above normal but not yet high enough to be classified as diabetes mellitus. Prediabetes is defined as a hemoglobin A1C level between 5.7% and 6.4% or a fasting glucose level before eating in the morning of 100 to 125. If you are in this range, you are at increased risk of eventually getting diabetes. However, lifestyle changes have been shown to significantly reduce the risk.

What causes it?

The underlying cause of prediabetes and type 2 diabetes mellitus is *insulin resistance*. Insulin can be considered like a key that opens a door lock on the cell wall allowing glucose into the cell to be used for energy. But sometimes the cell door lock gets rusty and is hard to open. The cell becomes "resistant" to opening even with the insulin key. The pancreas then compensates by working overtime to increase insulin. This prediabetes phase lasts for 5-10 years on average before the pancreas becomes exhausted and insulin levels drop which then triggers rising blood glucose and diabetes.

Obesity (Body Mass Index or BMI=30 or above) is the most common precipitating factor of insulin resistance, but other factors have been implicated. Several medications have been known to precipitate insulin resistance, including high-dose diuretics, beta-blockers, oral and inhaled steroids, and niacin.

Who gets it?

According to the Centers for Disease Control and prevention, prediabetes has a high prevalence in the US: 35% of all adults aged 20 years and older and 50% of all adults aged 65 years and older have prediabetes although less than 10% are aware of their condition. In 2012, 86 million Americans were reported to have prediabetes. Most experts agree that the growing number of people with prediabetes is primarily caused by the increasing number of overweight and obese Americans. Without lifestyle changes to improve health,

15-30% of people with prediabetes will develop type 2 diabetes within 5 years.

What are the symptoms?

The vast majority of people with prediabetes have no symptoms. However, there are certain risk factors that strongly correlate with prediabetes including metabolic factors, modifiable lifestyle factors, demographic factors, and pediatric factors. Thus all patients with risk factors for prediabetes should be evaluated for the presence of abnormal blood glucose levels.

Metabolic conditions associated with prediabetes include obesity, metabolic syndrome, polycystic ovarian syndrome, and gestational diabetes. Many of these conditions are known to be modifiable with dietary and lifestyle changes.

Modifiable lifestyle factors include poor diets, lack of exercise, and unhealthy habits like smoking which are major contributors to prediabetes and diabetes. Diets associated with these conditions are characterized by increased intake of processed meats, sweetened beverages, and foods high on the glycemic index and low in fiber and other nutrients. Lack of exercise and smoking compound the effects of poor diet.

Demographic factors like genetics and socioeconomic status are 2 major contributors to the development of prediabetes. Although dietary choices and other lifestyle factors are associated with certain ethnicities, genetics are also a major factor. Lower socioeconomic status contributes on multiple levels – such as lower health literacy, poorer food choices due to cost, and decreased access to quality healthcare and early prevention efforts.

Pediatric factors, especially obesity, increased the risk of prediabetes in children. In obese children aged 4-10, 25% have prediabetes and 4% already have diabetes. Among obese adolescents aged 11-18, 21% have prediabetes.

Because most people have no symptoms, screening people with risk factors should be considered every 3 years. Screening can be done with fasting blood glucose, or a hemoglobin A1C. The US Preventive Services Task Force now recommends screening adults age 40-70 with BMI>25 as a part of routine cardiovascular risk assessment.

Who should be screened for prediabetes

- Anyone over age 45.
- Overweight / BMI >25 (>23 in Asians) any age plus one of the following additional risk factors:
- Physical inactivity
- Parent or sibling with diabetes
- Personal history of diabetes during pregnancy
- Hypertension (>140/90 or being treated)
- Hyperlipidemia (HDL <40 or trig >250)
- High risk ethnicity (African American, Latino, Native, Asian, Pacific Islander)
- Women with polycystic ovary syndrome
- Previous abnormal glucose (A1C 5.7-6.4%)

How do you prevent it?

Studies have shown that people with prediabetes who lose weight and increase their levels of physical activity can prevent or delay type 2 diabetes from evolving, and in some cases return their blood glucose levels to normal. In fact, lifestyle changes are the only treatment shown to be extremely effective for slowing or halting the progression from prediabetes to type 2 diabetes mellitus.

Can it be treated?

Once prediabetes is identified, the main goal of treatment is to prevent progression to diabetes. This is best achieved through lifestyle modifications, including dietary changes (decreased intake of calories, fat, and sugar, as well as increased intake of dietary fiber) and increased physical activity, which are both considered first-line treatments. Because many patients with prediabetes are overweight or obese, weight loss is usually recommended. Together these lifestyle changes can delay onset of diabetes on average by 3.6 years.

In people with prediabetes, lifestyle changes were also associated with improved health-related quality of life including improved general health, physical function, bodily pain, and vitality scores.

- **Weight loss** of at least 7% body weight has been shown to have a large impact on preventing progression to diabetes and on normalizing blood sugar levels.

- **Exercise** an average of at least 2 ½ hours a week has also been effective at reducing the rate of diabetes and in improving blood sugar control with or without significant loss of weight. Walking in particular appears to reduce risk of heart attack in patients with prediabetes.

- **Dietary modification** to restrict the number of carbohydrates consumed daily, particularly those found

in refined grains, starchy vegetables, and sugar-sweetened food and beverages (cookies, cake, candy, and soda) can have tremendous impact. The American Diabetes Association (ADA) recommends starting by restricting carbs to 45-60 grams per meal and emphasizing a diet rich in vegetables and lean protein. The benefits of such a diet stem from the ability to facilitate weight loss and limit carbohydrate intake which improves blood glucose control.

The Mediterranean diet focuses largely on plant based foods (fruits, vegetables, whole grains, legumes, and nuts), and replacing butter with healthy fats like olive oil. The Mediterranean diet can reduce the incidence of prediabetes even in those who are overweight or obese.

- **Herbs and supplements** are increasingly being used by some people with prediabetes. Of these, cinnamon showed a decrease in fasting blood glucose levels. Vitamin D showed mixed results with no difference in average A1C sugar levels. There does not appear to be any evidence supporting the use of chromium or ginkgo biloba in prediabetes.

- **Medication** may be used in some patients. Metformin is generally the only medicine used in prediabetes even though it is not approved by the FDA for this specific use. The ADA recommends using metformin to halt the progression of prediabetes to full diabetes, especially in persons with BMI greater than 35 because it may assist with weight loss.

Are there complications?

If left untreated, patients with prediabetes are at high risk of developing diabetes. Diabetes has ranked in the top 10 causes of death since at least 1980. In addition, it is well known that diabetes is strongly associated with multiple other conditions which contribute to over 200,000 deaths per year in the US.

Life threatening complications of diabetes include heart attack, stroke, kidney disease and some types of cancer including liver, pancreatic, colon, breast, and bladder cancer. Other significant complications can include dementia, decreased testosterone and impotence in men, high cholesterol, fatty liver disease, fractures, hearing impairment, high blood pressure, neuropathy, obstructive sleep apnea, and peripheral vascular disease.

In summary

- 2 lifestyle changes are the most effective treatment for prediabetes – lose 7% of body weight and exercise 2 ½ hours a week.
- For more information contact the CDC at www.cdc.gov/diabetes/basics/prediabetes