Prediabetes in Children and Adolescents: A Guide for Families

What is Prediabetes?

Prediabetes refers to high blood glucose levels but not yet high enough to be diagnosed with Type 2 diabetes. Patients with prediabetes should be monitored closely because it may develop into Type 2 diabetes over time.

Glucose (sugar) is the primary fuel of your body, and it mostly comes from the food you eat. Insulin is a hormone made by your pancreas that controls your body's ability to use and store glucose. After you eat, glucose enters your blood. Insulin allows glucose to leave the blood and enter the cells. This keeps blood glucose levels in normal range. If your body does not make enough insulin or your body's response to insulin is low, blood glucose becomes elevated.

Prediabetes usually occurs in children and adolescents who already have some insulin resistance. Insulin resistance means that your body does not recognize insulin as well as it should. Therefore, your cells cannot take up glucose from the blood very effectively. Patients with insulin resistance make more insulin than usual to overcome this resistance.

What Causes Prediabetes?

What causes prediabetes and insulin resistance is not yet fully understood. It appears that there is a strong association between the following certain factors and prediabetes in children and adolescents:

- Overweight or obesity
- Family history of Type 2 diabetes
- Physical inactivity
- Race and ethnicity: Hispanic/Latino Americans, African Americans, American Indians, Pacific Islanders, and some Asian Americans
- Polycystic ovary syndrome

What Are the Signs and Symptoms of Prediabetes?

One possible sign of prediabetes is skin darkening on certain parts of your body, including your neck, underarms, elbows, knees, knuckles, and skin folds on your abdomen. This skin issue is called *acanthosis nigricans*, which is a sign of insulin resistance. Otherwise, you may not have any other signs or symptoms with prediabetes.

If prediabetes develops into diabetes, the following symptoms may develop:

- Increased thirst
- Increased frequency of urination
- Waking up at night to urinate
- Fatigue
- Increased appetite
- Unexplained weight loss

You should contact your child's doctor if your child experiences these symptoms because these can be warning signs of diabetes.

How is Prediabetes Diagnosed?

Simple blood tests are used to diagnose prediabetes. These include the measurements of:

1. Fasting blood glucose levels
2. Oral glucose tolerance test
3. Hemoglobin A1c levels.

While fasting glucose test and hemoglobin A1c levels are easy to perform, inexpensive and readily available at your child's pediatrician's office, oral glucose tolerance test is done in several steps.

Fasting blood glucose test and oral glucose tolerance test to evaluate for prediabetes or diabetes are done after you have not eaten/drank anything other than water for at least 8 hours. A fasting glucose level between 100-125 mg/dl indicates prediabetes. An *oral glucose tolerance test* can be used to diagnose or confirm prediabetes and diabetes. This test measures your body's response to glucose after a meal. Once you arrive to laboratory, a fasting glucose level will be checked. After the fasting glucose level is drawn, you will be asked to drink a syrupy drink. Two hours after you drink it, glucose level will be measured again. Fasting glucose level between 100-125 mg/dl or a glucose level at 2 hours after the sugary drink between 140-199 mg/dl indicates prediabetes. The following table may help you to understand how the results have been interpreted by your provider.

	Normal	Prediabetes	Diabetes
Fasting glucose	<100	100-125	>126
@2 hours glucose	<140	140-199	>200

Hemoglobin A1c level is another screening test to evaluate average blood sugar levels in the past three months. A normal hemoglobin A1c level is below 5.7%; a level between 5.7 and 6.4% indicates prediabetes; a level 6.5% or above indicates diabetes. This test can be done with a finger prick or from a vein in your arm. For this test, you do not need to fast. The following table may help you to understand how the results are being interpreted by your provider.

	Normal	Prediabetes	Diabetes
Hemoglobin A1c %	<5.7	5.7-6.4	>6.4

While hemoglobin A1c and fasting glucose levels are great screening tools to assess for prediabetes and diabetes, normal levels can be falsely reassuring. Oral glucose tolerance test is the most reliable test available to confirm for early prediabetes and diabetes.

How is Prediabetes Treated?

Lifestyle changes, including a healthy diet and regular exercise, can improve insulin resistance, reverse prediabetes, and prevent developing diabetes. Losing weight and maintaining a healthy weight can also help.

A healthy diet refers to a diet high in vegetables and fruits and low in fat, carbohydrates (meaning sugars or starches), salt and processed food. Avoiding foods with high carbohydrates like processed grains (such as white bread and white rice) or added sugars of all types (any sugary beverages such as juice or soda) is essential. Exercise can also help with weight loss, therefore 60 minutes of moderate to intense physical activity at least five days a week is recommended.