

## Acanthosis Nigricans and Insulin Resistance

*Described in 1889 by a German dermatologist, acanthosis nigricans (AN) is a physical skin finding that may be a marker for high blood insulin levels, suggesting insulin resistance. In 1976 acanthosis nigricans was linked to hyperinsulinemia, a consequence of insulin resistance that is associated with obesity.<sup>1</sup> This report describes recent developments in understanding this connection and public health interventions recommended to prevent the progression of insulin resistance to Type 2 diabetes.*

**I**nsulin resistance is a reduction in the ability of tissue cells, mainly those in muscle, to use insulin. In this condition, the pancreas works harder to produce more insulin, and hyperinsulinemia develops to maintain blood sugar levels within normal limits. The body cannot use the additional insulin, and the pancreas becomes exhausted. Insulin production then decreases. At this point, a person may be diagnosed with Type 2 diabetes. Some researchers consider acanthosis nigricans (AN) to be a predictive marker for Type 2 diabetes. It appears to have a genetic component.

In persons with AN, the skin in the creases and flexor surfaces is rougher, thicker, and darker than elsewhere. These characteristics are most evident on the back and sides of the neck; in the axilla, knee, and elbow creases; in the groin area; and around the waist.

The conclusions of at least two studies indicate that all children with high body mass index (BMI) scores, regardless of whether AN was present, should be screened for hyperinsulinemia. In a study of 139 children, higher insulin levels and lower insulin sensitivity were found in overweight children with AN.<sup>2</sup> In this study the risk of AN was largely explained by its higher frequency in the obese. Another study, however, showed that AN and obesity were independently and positively associated with hyperinsulinemia.<sup>3</sup> Across multiple studies, the prevalence of acanthosis nigricans is higher among Hispanics, Native Americans, African Americans, and Pacific Islanders. Its appears to be a surrogate for hyperinsulinemia<sup>4</sup> and Type 2 diabetes.

### Diabetes in Texas

For the year 2000, the estimated prevalence of diagnosed diabetes (90% to 95% of which is Type 2) among adults 18 years and older in Texas was 6.2%. The prevalence for those 40 years of age and over was 9.9%; and in select counties, up to one fourth of Hispanic adults over 44 years of age were diagnosed with diabetes.<sup>5</sup> The statewide prevalence by race/ethnic group was as follows: 5.7% in non-Hispanic Whites; 9.0% in non-Hispanic African Americans; 6.4% in Hispanics; and 7.8% among other groups. An additional 450,500 (3.6%) adults over age 20 in Texas were estimated to have undiagnosed diabetes.

If this trend continues, based on projected populations in Texas, approximately 1.6 million adults over the age of 18 years will be diagnosed with diabetes in the year 2025. The numbers by racial/ethnic group may reach 650,000 for non-Hispanic Whites; 260,000 for African Americans; 660,000 for Hispanics; and 80,000 for other groups.

### Acanthosis Nigricans Screening Initiative

Due to concern for diabetes in Texas, the 76<sup>th</sup> Texas Legislature authorized acanthosis nigricans pilot screening in nine counties: Cameron, Hidalgo, Jim Hogg, Webb, Willacy, Starr, Zapata, El Paso, and Hudspeth. The goals of this legislation, House Bill 1860, were to identify children with AN and intervene to reduce their risk of developing diabetes. The project, Acanthosis Nigricans: The Education and Screening (ANTES), is under the auspices of the Texas-Mexico Border Health Coordination Office at The University of Texas-Pan American. Over a 2-year period, 1999–2000,

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data were reported on 102,733 screened children aged 8 to 15. Of these, 14,794 (14.4%) had acanthosis nigricans. The ANTES data showed that the highest prevalence occurred among children 11 years of age (20%). Among other age groups the prevalence rates were 14.7% among 8 to 11 year-olds and 10.3%, among 12 to 15 year-olds.

In 2001, the 77<sup>th</sup> Texas Legislature passed House Bill 2989 to include AN screening with vision, hearing, and/or spinal screening in schools located in 8 Texas Education Service Centers: El Paso, Midland, San Angelo, San Antonio, Laredo, Corpus Christi, Victoria and Austin. An estimated 1,360,000 children attend schools in these areas. UT Pan-American's Texas-Mexico Border Health Coordination Office was designated the central agency to provide materials needed for local screening activities.

### Follow Up

HB 2989 states that screening results reported to parents must include the following:

- "a description of acanthosis nigricans and related conditions,
- a statement concerning the individual's need for further evaluation of conditions related to acanthosis nigricans, and
- instructions for obtaining evaluation and intervention by the school district."

Families usually contact a primary care provider (PCP) in a private clinic or public health department for follow up of school children with AN. In the past, some practitioners considered AN to be a skin infection, but the underlying problem is usually hyperinsulinemia. During the office visit, the PCP should obtain a family history; observe for abdominal obesity; measure weight, height, and blood pressure; and calculate BMI (see resource below). In addition to checking plasma glucose, the PCP may order serum insulin and lipid studies. Thyroid and other hormone tests may also be ordered to rule out thyroid and polycystic ovarian problems. Fasting plasma glucose that is  $\geq 110$  mg/dL but  $< 126$  mg/dL is termed "impaired" and indicates a risk for Type 2 diabetes. A higher than normal serum insulin level (fasting normal: 6-27 mIU/ml for all ages) in the presence of normal blood glucose suggests insulin resistance, which is also a risk factor for Type 2

diabetes. These individuals also are at increased risk for heart disease, hypertension, high triglycerides, low HDL-C, and central obesity. Consequently, it is advisable to combine the AN evaluation with additional tests as appropriate.

### Management

Its characteristic appearance has sometimes caused practitioners to misdiagnose AN as a skin disease or infection rather than a metabolic disorder. As such it does not call for a topical skin treatment or extra cleaning. Instead, the fundamental cause—insulin resistance—should be treated in most persons through diet and exercise to achieve weight control. Some need medication. AN may lighten over time if the underlying insulin resistance is adequately treated.<sup>6</sup>

**Exercise.** Increasing daily physical activity is a dominant strategy to slow weight gain and help overweight children (and adults) lose weight. Engaging in physical activity more than 4 days a week has been shown to protect against hyperinsulinemia regardless of AN, BMI, family history, gender, and ethnicity.<sup>3</sup> Exercise rapidly lowers blood sugar by enabling insulin to work more effectively in the muscle tissue. The US Surgeon General's Report on Physical Fitness recommends 30 minutes of physical activity per day, but even a low level of activity, such as a 15-minute walk, can improve insulin sensitivity for a day or two.

**Nutrition.** Children who are overweight should be taught to choose healthy foods. Fewer sweets and fried foods should be consumed. Nutrition counseling by a registered or licensed dietitian is an effective way to establish an individualized food plan/diet the family is willing to follow. Frequent follow-up visits are needed to review eating patterns and progress. Gradual weight loss—approximately 1 to 2 pounds per week—is recommended for enduring weight loss. For some children, maintaining weight as their height increases is a reasonable goal. Children need lots of positive reinforcement for any effort they make. Even small improvements in the child's eating habits can reduce insulin resistance.

**Medication.** The decision to prescribe medication for children with insulin resistance depends on the medical findings and should be made only after thoughtful

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examination and discussion with the parents/guardians. Glucose-lowering agents are generally not prescribed for children with insulin resistance. The Food and Drug Administration has approved one agent (metformin HCL) for treatment of Type 2 diabetes in children.

### Related Efforts

Recent studies of adults with impaired fasting glucose levels (a known risk for Type 2 diabetes) showed that these individuals benefited from increased physical activity and modest weight loss.<sup>7</sup> A review of such studies, as well as those evaluating the benefits of mass AN screening among school children, led the Centers for Disease Control and Prevention (CDC) to recommend that state diabetes control programs apply their resources toward primary prevention approaches that stress nutrition and physical activity in schools and communities rather than AN screening.

Senate Bill 19, approved in the 77th Texas Legislature, addresses another systems approach. This legislation

- allows the State Board of Education to require daily physical activity for children in elementary schools;
- requires school district boards of trustees to establish local school health education advisory councils; and
- requires school districts to implement a coordinated preventive health program targeting obesity, cardiovascular disease, and Type 2 diabetes in elementary school students.



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### Tips for Low-Fat Living

The Driscoll Children's Hospital Diabetes Team developed guidelines for these low-fat eating habits that can be incorporated into the family's daily routine:

- Make healthy food choices 80% of the time.
- Drink diet sodas instead of regular sodas.
- Drink plenty of water—limit juice and fruit drinks.
- Use reduced-fat, fat-free, or no-fat salad dressings, mayonnaise, and dips.
- Avoid fried foods—never more than 1 serving/meal.
- Choose lean meat cuts and lunch meats.
- Eat at least 1 fruit (whole, fresh, unsweetened) and 1 vegetable every day. Try to eat a total of 5 servings each day. Canned or frozen are okay.
- Eat slowly—take at least 20 minutes to eat a full meal. Chew, taste, and enjoy all the food you eat.
- Recognize when you are no longer hungry.
- Don't skip meals, especially breakfast. Choose a whole grain cereal or bread and a fruit for a good start.
- Try new foods: baked (not fried) chips, a new fruit, low-fat yogurts of a different flavor.
- Don't super-size fast foods.
- **Exercise!** Try to be active at least 15 minutes every day. Any physical activity improves well-being. Walking, swimming, dancing, running, jumping, biking, playing a sport, working in the yard, or even doing housework burns calories and can be part of a family's healthy habits.

**Source:** Driscoll Children's Hospital handout

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*Newly revised children's growth charts and BMI calculations can be downloaded from the following CDC website: [www.cdc.gov/growthcharts](http://www.cdc.gov/growthcharts).*

*Patient education materials for AN are available at [www.tdh.state.tx.us/diabetes/tdc.htm](http://www.tdh.state.tx.us/diabetes/tdc.htm).*



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