

Body Fat Distribution and the Development of Diabetes

Data from the Diabetes Prevention Program were analyzed to test the relationship between IGT, increased body fat and central adiposity.

BY CONNI BERGMANN KOURY, EDITOR-IN-CHIEF

Increased body fat – along with central adiposity – significantly predicted the development of diabetes in a large, ethnically-diverse clinical trial of patients with impaired glucose tolerance (IGT).¹

At the North American Association for the Study of Obesity (NAASO) 2004 Annual Meeting in Las Vegas, George Bray, MD, presented data from the body composition substudy of the Diabetes Prevention Program (DPP).

LARGE POPULATION

“While it is known that increased body fat and central adiposity predicts the onset of diabetes, their effects in a large population of patients with IGT has not been previously reported,” he said. The NAASO meeting was co-sponsored by the American Diabetes Association. Dr. Bray is Boyd Professor at the Pennington Center,

DIABETES PREVENTION PROGRAM AT A GLANCE

- Compared metformin, a lifestyle intervention and placebo, in high-risk, nondiabetic patients with elevated glucose.
- Trial was placebo-controlled, randomized and blinded, with 3,234 patients enrolled. Mean follow-up was 2.8 years, and the mean age was 51.
- There was a 58% reduction in the development of diabetes for lifestyle patients versus placebo, a 31% reduction for metformin patients versus placebo, and 39% reduction for lifestyle patients versus metformin.

Height, weight, waist circumference, hip circumference, triceps, subscapular, suprailiac, abdominal and calf skin folds were tested at baseline.

Louisiana State University.

To test the relationship between increased body fat with central adiposity and IGT, researchers used data from the DPP, which recruited patients with IGT who had elevated fasting and/or impaired postload plasma glucose concentrations.

The DPP, published in *The New England Journal of Medicine* in 2002, randomized patients to treatment with metformin, lifestyle modification or placebo.² Investigators evaluated the treatment arms with regard to their ability to prevent or delay the onset of diabetes in nondiabetic patients with elevated glucose who were at high risk for diabetes. The lifestyle intervention program reduced diabetes better than metformin.

SUBSTUDY MEASUREMENTS

In the body composition substudy, Dr. Bray and colleagues measured height, weight, waist circumference, hip circumference, triceps, subscapular, suprailiac, abdominal and calf skin folds at baseline in 3,234 patients. Patients were randomized to metformin, a lifestyle modification program or placebo. “The ethnic mix of the patients consisted of 54.7% whites, 19.9% African-Americans, 15.7% Hispanics, 4.4% Asian-Americans and Pacific Islanders and 5.3% American-Indians,” he said.

No differences between anthropometric measurements by treatment group within ethnic group were

WAIST CIRCUMFERENCE AND BMI

Body composition – water, fat, protein, carbohydrate and vitamins and minerals – can be assessed by using waist circumference or BMI, among other methods such as waist-to-hip ratio. Measuring waist circumference and BMI are the two most accurate and recommended methods of assessing body composition.

Waist circumference:

- The distance around you waist (measured right above the naval).

BMI:

- In most people, BMI is correlated with body fat.
- BMI values <18.5 are considered underweight; 18.5 to 24.9 are considered healthy; 25 to ≤30 are considered overweight; and ≥30 is considered obese.
- Obese people are around 30 lbs overweight, and are at a higher risk for CVD.

Source: American Heart Association

BMI RISK LEVEL

Height	Minimal risk	Moderate risk	High risk
4'10"	≤118 lbs	119-142 lbs	≥143 lbs
4'11"	≤123 lbs	124-147 lbs	≥148 lbs
5'0"	≤127 lbs	128-152 lbs	≥153 lbs
5'1"	≤131 lbs	132-157 lbs	≥158 lbs
5'2"	≤135 lbs	136-163 lbs	≥164 lbs
5'3"	≤140 lbs	141-168 lbs	≥169 lbs
5'4"	≤144 lbs	145-173 lbs	≥174 lbs
5'5"	≤149 lbs	150-179 lbs	≥180 lbs
5'6"	≤154 lbs	155-185 lbs	≥186 lbs
5'7"	≤158 lbs	159-190 lbs	≥191 lbs
5'8"	≤163 lbs	164-196 lbs	≥197 lbs
5'9"	≤168 lbs	169-202 lbs	≥203 lbs
5'10"	≤173 lbs	174-208 lbs	≥209 lbs
5'11"	≤178 lbs	179-214 lbs	≥215 lbs
6'0"	≤183 lbs	184-220 lbs	≥221 lbs
6'1"	≤188 lbs	189-226 lbs	≥227 lbs
6'2"	≤193 lbs	194-232 lbs	≥233 lbs
6'3"	≤199 lbs	200-239 lbs	≥240 lbs
6'4"	≤204 lbs	205-245 lbs	≥246 lbs

To calculate BMI, multiply weight in lbs by 703. Divide the total by height in inches, and divide again by height in inches.

Source: American Heart Association

seen at baseline. "The females weighed less and had smaller waist circumferences and ratio of waist-to-hip circumference; but had higher body mass index, (BMI) larger hip circumference and larger skin folds at all measured sites," Dr. Bray noted.

Male and female baseline waist circumference had the highest hazard ratio in both men and women.

The investigators used sex-specific Cox proportional hazard regression models to predict diabetes over an average of 3.2 years. They found that baseline waist circumference had the highest hazard ratio (HR) of the obesity measures per 1 SD difference in both men and women (1.34 [95% CI, 1.18-1.52] and 1.28 [1.17-1.41], respectively). This HR remained after accounting for treatment groups as well as adjusting for age and ethnicity.

PREDICTORS OF DIABETES

"In separate models, higher baseline values for waist-height ratio, BMI, waist-hip ratio, weight, hip circumference and subscapular skin fold measures also significantly

predicted the development of diabetes in both genders," Dr. Bray said. When the researchers analyzed additional skin fold measurements including the suprilliac, triceps plus subscapular and the sum of the skin-fold measurements, they found that these significantly predicted diabetes in females but not in males.

For each measure of body fat, the HR per each 1 SD difference at baseline was lower for females than for males using sex-specific comparisons. "Increased body fat and central adiposity significantly predicted diabetes development in an ethnically diverse, large population, in this clinical trial of patients with IGT," Dr. Bray concluded. ■

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1. Bray G. The relation of baseline body fat and body fat distribution to the development of diabetes in the Diabetes Prevention Program. #39-OR. Presented at the North American Association for the Study of Obesity 2004 Annual Meeting. November 16, 2004. Las Vegas.
 2. Knowler WC, Barrett-Conner E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002;346:393-403.