Quantifying the Excess Risk of Type 2 Diabetes by Body Habitus Measurements Among Australian Aborigines Living in Remote Areas

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OBJECTIVE — To quantify the risk for type 2 diabetes by body habitus measurements among remote-living Australian Aborigines relative to that measured in the general Australian population (as characterized by the Australian Diabetes, Obesity and Lifestyle [AusDiab] study).

RESEARCH DESIGN AND METHODS — Anthropometric measurements and diabetes status were assessed by standard procedures among Aborigines (n = 1,456) and Australians aged ≥25 years (n = 11,247). Age-adjusted odds ratios (ORs) for diabetes among Aborigines relative to AusDiab participants were calculated by commonly used categories of body size measurements.

RESULTS — The OR (95% CI) values for diabetes among normal, overweight, and obese (by waist) Aboriginal women relative to AusDiab women were 2.6 (0.6–11.5), 13.1 (6.7–25.7), and 6.1 (4.6–8.0), respectively, and for Aboriginal men relative to AusDiab men, they were 7.6 (4.6–12.5), 7.6 (4.3–13.4), and 5.2 (3.4–8.0), respectively. Rates of diabetes were also excessive in Aborigines for each standard category of BMI.

CONCLUSIONS — Higher rates of diabetes, even at normal and lower body habitus measurements, among Aborigines suggest that strategies for prevention should expand beyond exclusive focus on diet and weight management.

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Australian Aborigines have different body habitus than non-Aborigines, including a low ratio of sitting height to total height and a higher percentage of body fat (1,2). Early studies showed an average BMI of <20 kg/m^2, which contrasts with the present situation, where overweight and obesity are common.

Overweight and obesity correlate with, and predict, chronic diseases, which are now rife in most Aboriginal communities (3). Waist circumference is said to be the best anthropometric predictor of type 2 diabetes in Aborigines (4). However, there are no comparisons of the risk for chronic diseases among Aborigines associated with specific body size measurements relative to other groups.

We quantified the risk of diabetes in remote-living Aborigines relative to that in participants of the Australian Diabetes, Obesity and Lifestyle (AusDiab) study by comparing categories of body size measurements.

RESEARCH DESIGN AND METHODS

— People from four remote Aboriginal communities from the Top End of Australia's Northern Territory participated in a screening program that included measurement of height, weight, waist and hip circumferences, and tests for type 2 diabetes. The AusDiab study is a stratified cluster sample survey of 11,247 consenting Australian adults aged ≥25 years; its design and methodology are described elsewhere (5).

Body size was measured by standard procedures, with few differences (6). In the AusDiab study, waist and hip circumferences were measured twice, and if they varied more than 2 cm, a third measurement was taken and the mean of the two closest measurements derived. Undiagnosed diabetes was identified by an oral glucose tolerance test performed in all AusDiab participants; in contrast, it was identified by fasting and/or random glucose levels in the Aboriginal population, with suspicious levels confirmed by further testing. Overweight by waist circumference was defined as 94 to <102 cm for men and 80 to <88 cm for women, and obese was defined as waist circumference ≥102 cm for men and ≥88 cm for women. A BMI of 25 to <30 kg/m^2 was considered overweight, and ≥30 kg/m^2 was considered obese. The cutoffs used above were the same for both groups.

Age-adjusted rates for diabetes among Aborigines relative to AusDiab participants were calculated by logistic regression of categories of anthropometric measurements. The frequency of diabetes was predicted by anthropometric measurements with fractional polynomial logistic regression models, with goodness-of-fit assessed by Hosmer and Lemeshow's test. Stata for Windows (version 9.2) was used for statistical analyses.

RESULTS

— Included in the analysis are 1,456 adult Aborigines aged 25–74 years (53% female) and 10,434 adults in the same age-group from the AusDiab study (55% female, 0.8% Aborigine).

Aboriginal women were younger compared with their AusDiab counterparts and were significantly lighter but had higher waist circumferences and waist-to-hip ratios. Aboriginal men were younger and shorter with lower body weight, BMI, and waist and hip circumferences and higher waist-to-hip ratios than their AusDiab counterparts.

The crude prevalences of diabetes

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Abbreviations: AusDiab, Australian Diabetes, Obesity and Lifestyle Study.

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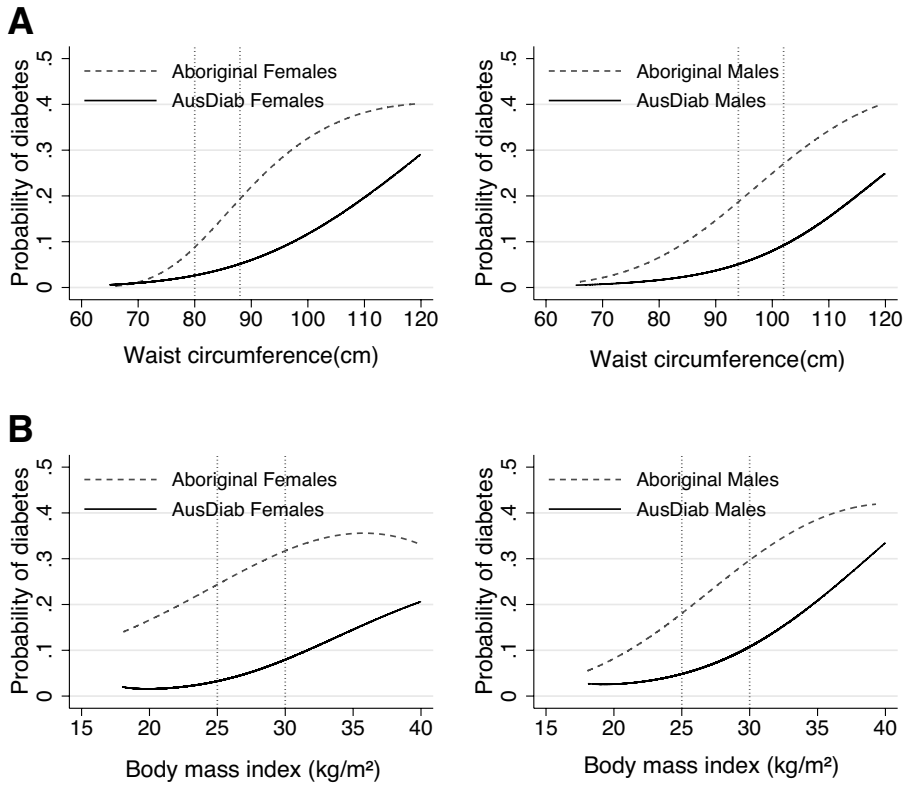

Figure 1—*Probability of diabetes by waist cirumference* (A) *and BMI* (B) *in Aboriginal and AusDiab participants by sex.*

were 25 and 17% for Aboriginal women and men, respectively, and 6 and 8% for AusDiab women and men, respectively. After adjusting for age, Aboriginal women and men had OR (95% CI) values for diabetes of 10.3 (8.2–13.0) and 5.1 (3.9–6.6), respectively, relative to their AusDiab counterparts.

Relative to their AusDiab counterparts, the OR (95% CI) values for diabetes among normal, overweight, and obese (by waist) Aboriginal women were 2.6 (0.6–11.5), 13.1 (6.7–25.7), and 6.1(4.6–8.0), respectively, and for Aboriginal men were 7.6 (4.6–12.5), 7.6 (4.3–13.4), and 5.2 (3.4–8.0), respectively. For Aboriginal women who were normal, overweight, and obese by BMI, values were 17.1 (11.1–26.4), 15.5 (9.6–25.1), and 6.6 (4.4–10.0), respectively, and for Aboriginal men were 7.9 (4.8–13.0), 7.9 (4.8–12.8), and 6.3 (3.6–10.9), respectively.

Figure 1 shows the predicted probabilities of diabetes by Aboriginal status and sex for waist circumference and BMI, with post-estimation diagnostics showing a good fit of data. Even at lower levels of body size measurements, Aboriginal women and men had higher predicted probabilities of diabetes than their AusDiab counterparts. For example, for Aboriginal women to have the same risk for diabetes as AusDiab women with waist circumference of 80 and 88 cm (defining overweight and obesity), their waist circumference would need to be 73 and 76.5 cm, respectively. Aboriginal BMIs that predict a risk for diabetes, equivalent to those of their AusDiab counterparts, were either biologically not feasible or almost impossible to attain as population means.

CONCLUSIONS — In both populations, larger body size was strongly correlated with the presence of diabetes. Aboriginal adults had much higher rates of diabetes than their AusDiab counterparts.

We have previously shown that Aboriginal body habitus profiles differ from AusDiab profiles (6). In addition, the current study demonstrates that the risk for diabetes in both sexes relative to the AusDiab participants is excessive at all levels of body size, including levels that are normal or low. Thus, factors other than body size make important contributions to diabetes risk in Aborigines.

In view of the virtual absence of type 2 diabetes a few decades ago, we assume that most of these additional risk factors derive from rapid social and environmental change. Disadvantage is pervasive in the present environments, with overcrowding in substandard housing, poor-quality Western food, little exercise, excessive smoking, and alcohol abuse, together with low birth weight, repeated and persistent infections, high levels of inflammation, and serious psychosocial stress. Most of these factors have been shown to influence the risk of diabetes among other population groups. A multideterminant model of diabetes, similar to polyfactorial models described for ischemic heart disease (7), most likely applies.

Modification of lifestyle has shown promise in preventing type 2 diabetes and is cost-effective in high-risk populations (8). Our findings suggest that strategies for prevention and modification of type 2 diabetes in Aboriginal populations should expand beyond the dominant focus on diet, exercise, and weight containment to more comprehensively address the risk factors for diabetes.

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