## OBSERVATIONS

# Impairment of Glucose Tolerance Over 10 Years in Middle-Aged Normal Glucose Tolerant Indians

We followed 191 normal glucose tolerant (NGT; 1985 World Health Organization criteria) nondiabetic subjects (115 men) as control subjects in the Wellcome Diabetes Study (1). Their mean age was 41 years (SD 11.2), BMI 23.6 kg/m$^2$ (34% >25 kg/m$^2$), and 31% had a first-degree relative with diabetes.

During the next 10 years 8 (7 men) died, 40 were lost to follow up, 14 men and 8 women became impaired glucose tolerant (IGT), and 2 men and 4 women developed diabetes. Men whose glucose tolerance deteriorated were heavier at entry (71.8 vs. 62.3 kg, $P < 0.001$), more obese (BMI 25.3 vs. 22.6 kg/m$^2$, $P < 0.01$), and more centrally obese (waist circumferences 85.9 vs. 78.9 cm, $P < 0.01$) than those who remained NGT, all adjusted for age. They also had higher 2-h glycemia (oral glucose tolerance test, 6.6 vs. 5.9 mmol/l, $P < 0.05$), fasting triglyceridemia (1.6 vs. 1.1 mmol/l, $P < 0.01$), and fasting and 2-h insulinemia (95.1 vs. 47.9 and 929 vs. 515 pmol/l, $P < 0.05$ for both), which was reflected in insulin resistance (homeostasis model assessment [HOMA] 2.7 vs. 1.4, $P < 0.05$) (2). Among women, triglyceridemia (1.5 vs. 0.9 mmol/l, $P < 0.01$) and higher systolic blood pressure (137 vs. 122 mmHg, $P < 0.05$) were predictive.

On multivariate analysis, after forcing in age, sex, and family history of diabetes, glucose tolerance deterioration (both sexes) was predicted by initial HOMA (odds ratio 1:38, 95% CI 1.01–1.85), 2-h plasma glucose (1.04, 1.00–1.08), fasting plasma triglyceride concentration (1.01, 1.00–1.02), and weight gain (1.2, 1.02–1.32).

These results, from a first prospective study of such duration among Indians in India, confirm studies from elsewhere in associating deterioration of glucose tolerance in the NGT with obesity, weight gain, insulin resistance, higher circulating triglycerides, and 2-h glucose concentrations. Clearly, there is an excess of insulin resistance over B-cell deficiency markers. Finally, we wish to emphasize the relative thinness at which these effects were seen. The relative risk of deterioration of glucose tolerance during 10 years among the whole group was 2.4 (1.1–5.3) with BMI above and below 23 kg/m$^2$. This may reflect both the higher body fat percentage for a given BMI among Indians and their marked central adiposity (3). This has already prompted a reduction in the target BMI for obesity-related action among Asian Indians to 23 kg/m$^2$ (4).

Therefore, among Indians reduction in adiposity must be a prime target for diabetes prevention. This will have to start at levels that are accepted in the west without demur. This is necessary at all ages, but will be made difficult by our recent observation that central obesity and hyperinsulinemia are present in Indians at birth (5).

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