Glucose Intolerance in Colombia

A population-based survey in an urban community

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OBJECTIVE— To determine the prevalence of diabetes and its relationship to age and obesity in an urban community in Colombia.

RESEARCH DESIGN AND METHODS— A cluster sample of 670 adults ≥30 yr of age was selected from the city of Santafè de Bogotá. Classification of diabetes and IGT was according to WHO criteria.

RESULTS— Response to the survey, conducted in 1988–1989, was 71% for men and 84% for women. Prevalence of diabetes was 7% in both sexes. Prevalence of IGT was 5% in men and 7% in women. Age-standardized prevalence of diabetes in the 30- to 64-yr age range was comparable with that reported in urban Brazilians and rural Hispanics in the U.S.. Prevalence was higher than in the white population of the U.S. but lower than in several urban U.S. Hispanic communities. Some 40% of men and 30% of women with diabetes were unaware of their condition before the survey, but all those <50 yr of age were diagnosed previously. Glucose intolerance was associated with high BMI in men and with advancing age in both sexes.

CONCLUSIONS— Glucose intolerance is common in this community and will likely increase in frequency in Colombians with further urbanization and population aging.

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NIDDM, NON-INSULIN DEPENDENT DIABETES MELLITUS; IGT, IMPAIRED GLUCOSE TOLERANCE; WHO, WORLD HEALTH ORGANIZATION; BMI, BODY MASS INDEX; BG, BLOOD GLUCOSE CONCENTRATION; FBG, FASTING BLOOD GLUCOSE; OGTT, ORAL GLUCOSE TOLERANCE TEST; CI, CONFIDENCE INTERVAL; NHANES, NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY; HANES, HEALTH AND NUTRITION EXAMINATION SURVEY.

Prevalence of NIDDM varies widely between different populations, with the highest rates observed in the ethnic minorities of developed countries and among populations of developing countries that have recently undergone rapid changes in life-style (1–3). Because many Latin American communities possess these latter characteristics, an increase in the prevalence of diabetes may be anticipated, with NIDDM becoming a major health problem in the region.

Recent census data from Colombia (4) indicate that the age distribution is changing, and that diabetes is now among the first 10 causes of death (5). We report the results of a diabetes survey, conducted during 1988–1989, in medium-low income, urban residents of the capital city of Colombia, Santafè de Bogotá.

RESEARCH DESIGN AND METHODS

— Colombia is located in the northwest corner of South America, and has an area of 1,141,748 km^2. Its population has experienced much genetic admixture, which started with Spaniards mixing with the indigenous Indians (Mestizos) and later continued with the influx of black slaves from Africa. Most of the 30 million inhabitants reside in the Andean mountain range traversing the country in a northeast-southwesterly direction. Almost 6 million people live in the capital city, Santafè de Bogotá, which is located on a plateau at an altitude of 2600 m.

Considering the high rate of urban drift in Colombia, a relatively stable, urban community of medium-low socioeconomic status (representing the majority of the population), in which most people had been resident for ≥10 yr, was considered most informative. To receive the best cooperation, a well-organized community was preferred. The barrio of San Isidro in Santafè de Bogotá met all these conditions, and a cluster sample of 39 blocks that surround its church were chosen for study. A census

performed before the survey indicated 670 adult residents ≥30 yr of age.

For the first stage of the survey, the community was informed and motivated through leaflets and Sunday mass preaching. All subjects were asked to attend the survey site on a subsequent weekend (to avoid workdays) in an overnight fasting state. After registration, they received a 75-g oral glucose load (Dexpac, Miles, Ames, Cali, Colombia), and their weight and height were recorded. They were asked to remain on or near the site, and 2 h later, they underwent BG examination. Known diabetic patients were interviewed by a physician and, according to their medical history and their FBG value, they were either classified as such or sent to take the OGTT.

In the second stage of the survey, nonresponders were contacted directly and given an appointment for the same examination procedure. A weighted sample was chosen to obtain a final age distribution that would correspond closely to that of the census.

OGTTs were administered according to the WHO recommendations for epidemiological studies (6). A 2-h BG was measured by capillary puncture (finger tip) by using a glucose-oxidase test strip (glucostix, Miles, Ames, Cali, Colombia) and a Glucometer II test machine (Miles, Ames, Elkhart, IN). The professional volunteers who conducted the tests were trained previously and certified at the Colombian Diabetes Association's laboratory. During the survey, a member of the group tested each unit repeatedly with a standard solution to ensure quality control.

Classification of abnormal glucose tolerance

The diagnostic criteria recommended by WHO (6) were applied to the 2-h BG values to classify the subjects' glucose tolerance status. Because glucometer measurements are standardized against venous rather than capillary whole blood, the diagnostic values used were as follows:

IGT: ≥6.7 mM (120 mg/dl) and <10 mM (180 mg/dl); and

NIDDM: ≥10 mM (180 mg/dl).

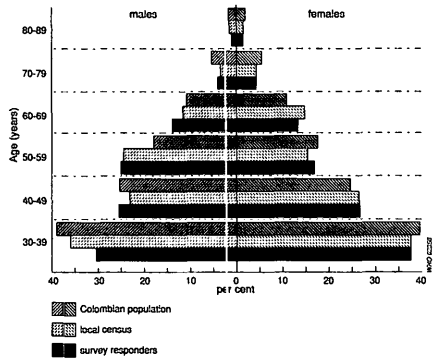

Figure 1—*Age distribution of the survey responders compared with those of the local census and the total population of Colombia.*

Statistical analysis

Data analysis was undertaken with StatWorks statistical software (Cricket Software). BMI was calculated as weight/height^2 (kg/m^2). Tertiles were used to transform continuous data into categorical variables. Unpaired Student's *t* test and linear regression were used to investigate differences/associations and their significance.

RESULTS — During the first stage of the survey (June and July 1988), 383 subjects were examined (57% ascertainment). During the second stage (February and March 1989), 144 initial nonresponders completed the examination. The final response rate was 84% for women and 71% for men. The lower rate for men was mainly attributable to low response (61%) in the youngest age-group (30–39 yr). The final sex and age distribution matched well with the data obtained from the local census and was strikingly similar to that of the total population of Colombia (Fig. 1).

Prevalence of abnormal glucose tolerance

Prevalence of IGT rose with advancing age (Table 1) diabetes was rare (≤2%) in the 30- to 39-yr age range, but rose in prevalence thereafter to reach peaks of 25% for men and 20% for women in the

Table 1—*Prevalence of IGT and diabetes mellitus in Santafè de Bogotá, 1988–89*

Age (yr)	IGT (%)	Diabetes	
		Total (%)	Previously undiagnosed (%)
Men			
30–39	4.8	0.9	0
40–49	1.9	5.9	0
50–59	1.9	15.7	11.5
60–69	3.4	4.5	0
70–79	14.3	20.0	0
≥80	0	25.0	0
All ages (≥30)	4.5	7.3	2.9
Women			
30–39	3.3	2.1	0
40–49	4.7	4.9	0
50–59	9.3	15.6	3.7
60–69	16.7	13.6	4.8
70–79	0	14.3	14.3
≥80	20.0	20.0	20.0
All ages (≥30)	6.6	7.4	2.2

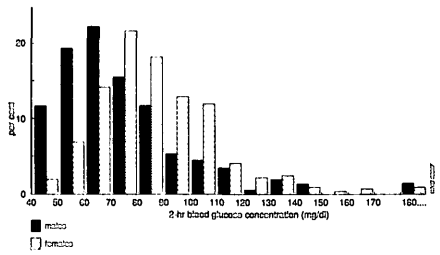

Figure 2—*Frequency distribution of 2-h BG in Colombian men and women aged ≥30 yr.*

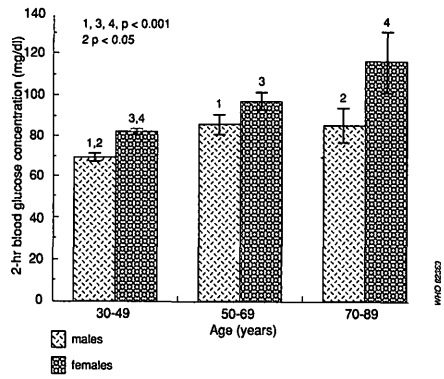

Figure 3—*2-h BG (mean ± SE) in Colombian men and women stratified by age tertiles.*

oldest age-groups. To compare the data, worldwide, age-adjusted prevalence was calculated for the truncated 30- to 64-yr age range, according to recent international recommendations (this issue, WHO Ad Hoc Diabetes Reporting Group, p. 157–78). For IGT, age-adjusted prevalence was 3.1% for men and 7.2% for women (95% CI, 0.7–5.5 and 4.1–10.3, respectively). For diabetes, age-adjusted prevalence was 7.3% for men and 8.7% for women (95% CI, 3.7–10.9 and 5.2–12.3, respectively). Thus, age-adjusted prevalence of abnormal glucose tolerance (diabetes and IGT combined) was 10.4% for men and 15.9% for women.

The proportion of diabetic subjects undiagnosed before the survey was higher for men (32%) than for women (25%). All diabetic subjects <50 yr of age were diagnosed previously. Previously undiagnosed diabetic men were all in the 50- to 59-yr age range.

Distribution of 2-h BG

The distribution of 2-h BG in men and women is shown in Fig. 2. The distributions were unimodal with a higher mode for women, in whom the whole distribution was shifted somewhat to the right (mean 88.2 vs. 77.7 mg/dl, $P = 0.001$).

Factors associated with BG and prevalence of diabetes

In this study population, women had higher BMI than men (26.2 ± 4.2 vs. 25.3 ± 3.3 kg/m^2, $P < 0.01$). Men, but not women, with BMI >25 kg/m^2 had higher 2-h BG than those with BMI ≤25 kg/m^2. Also in men, prevalence of both IGT and unknown NIDDM were higher in those with BMI >25 kg/m^2 (4.9 vs. 3.2% for IGT and 4.9 vs. 1.1% for unknown NIDDM). Such differences were not found in women. Age was strongly related to 2-h BG in women, but less so in men (Fig. 3). Women with BMI >25 kg/m^2 were older than those with BMI ≤25 kg/m^2 (48.4 ± 12.9 vs. 44.2 ± 12.5 yr, $P < 0.01$), whereas no such difference was found in men.

CONCLUSIONS— This is the first published report of glucose intolerance in Colombia that uses WHO survey methods and diagnostic criteria.

Age-standardized estimates of diabetes prevalence in the 30- to 64-yr age range have been published recently for a number of American populations (this issue, WHO Ad Hoc Diabetes Reporting Group, p. 157–78), and the Colombian data can be compared directly with these. Age-adjusted prevalence was the same as that reported from the Brazilian city of Sao Paulo and from the rural Hispanic population of San Luis Valley, CO (7 vs. 9% for men and women, respectively, in each case). Prevalence in Colombia was much higher than in the rural Mapuche Indians of Chile (0 vs. 1% for men and women, respectively). When compared with data from the NHANES II and Hispanic HANES surveys in the U.S., prevalence in Colombians was higher than in the white U.S. population (5 vs. 7% for men and women, respectively) but lower than in blacks (9 vs. 12% for men and women, respectively) and most urban U.S. Hispanic communities (14% for Mexican Americans in Southwest US, 18% in men and 13% in women for Puerto Ricans in New York).

The prevalence of previously undiagnosed diabetes, at <50% in both men and women, was not particularly high in this Colombian community (undiagnosed diabetes generally varies from 20 to 80%, with an average of 50%, even in developed countries) (this issue, WHO Ad Hoc Diabetes Reporting Group, p. 157–78). Note also that all 13 diabetic subjects <50 yr old were diagnosed previously.

In men, an association was found between BMI and BG. Also, unknown NIDDM and IGT were more prevalent among men with higher BMI. Prevalence of diabetes increased with age in both sexes. This association has particular public-health relevance in a country like Colombia, which has a young population now, but in which the age pyramid is rapidly changing.

Urbanization has been associated strongly with diabetes prevalence in many developing countries (this issue, WHO Ad Hoc Diabetes Reporting Group, p. 157–78) (9). Comparing the 1973 and 1985 censuses, the urban sector in Colombia has increased from 59 to 67% of the total. This trend toward increasing urbanization will continue most likely, further inflating the national impact of diabetes.

Note that socioeconomic status, climate, and life-style vary widely in different regions of Colombia. Therefore, these results may not be valid for extrapolation countrywide. However, the age-sex distribution of the survey sample was similar to that of the total Colombian population. The study sample also was

representative of 70–80% of the urban population of Colombia with regard to Hispanic ethnicity and medium-low socioeconomic status.

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