A1C and Diabetes Diagnosis Among Filipino Americans, Japanese Americans, and Native Hawaiians

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OBJECTIVE — To examine the sensitivity and specificity of A1C ≥6.5% to diagnose diabetes among Filipino Americans, Japanese Americans, and Native Hawaiians.

RESEARCH DESIGN AND METHODS — This was a cross-sectional study among middle-aged adults without prior diagnosis of type 2 diabetes who completed a 2-h 75-g oral glucose tolerance test (OGTT) and A1C measures.

RESULTS — The 933 participants had a mean age of 54.2 years, and 73% were women. A total of 425 (45.5%) subjects had impaired fasting glucose or impaired glucose tolerance, 145 (15.5%) had type 2 diabetes (by OGTT), and 83 (8.9%) had A1C ≥6.5%. The sensitivity and specificity of A1C ≥6.5% to define diabetes (by OGTT) was 40.0 and 96.8% and 68.9 and 95.3%, respectively (by fasting plasma glucose only). However, (64.8%) of Filipino and Japanese subjects with diabetes had isolated postchallenge hyperglycemia; AIC ≥6.5% sensitivity and specificity was 19.1 and 92.1%, respectively, to define isolated postchallenge hyperglycemia in the total sample.

CONCLUSIONS — A1C ≥6.5% had low sensitivity and may delay diagnosis of type 2 diabetes without OGTT. This limitation is exacerbated by isolated postchallenge hyperglycemia in Asian Americans.

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An international expert committee recently recommended the use of A1C values ≥6.5% to diagnose type 2 diabetes, and an A1C between 6.1 and 6.49% was considered pre-diabetic (1). Data from the National Health and Nutrition Examination Survey showed low sensitivity (44%) but high specificity (99%) (2). We recently showed similar sensitivity (44%) but lower specificity (79%) in older Caucasians from the Rancho Bernardo Study (3). Ethnic minorities have significantly higher A1C levels, even after adjusting for factors that affect glycemia (4,5). The utility of A1C cut point of 6.5% has not been evaluated among Pacific Islanders and Asian Americans who have an elevated prevalence of type 2 diabetes compared with Caucasians (6,7). The objectives of this study were to determine the sensitivity and specificity of A1C compared with the *1*) fasting plasma glucose (FPG) test and the *2*) oral glucose tolerance test (OGTT) to define type 2 diabetes among Filipino Americans, Japanese Americans, and Native Hawaiians.

RESEARCH DESIGN AND METHODS

— Between 1995 and 1999, 453 Filipino-American women were enrolled in the University of California San Diego Filipino Women's Health Study as an ethnic comparison group to the Rancho Bernardo Study (6). Participants included community volunteers who were recruited at churches, stores, and festivals and through local Filipino media and organizations (6). Recruitment materials emphasized general health and included tests for osteoporosis and other conditions to reduce self-selection bias for participants with known diabetes. A total of 382 women with no prior diagnosis of type 2 diabetes completed a 2-h 75-g OGTT, and A1C was measured by high-performance liquid chromatography using an automated analyzer (Glaxo-SmithKline, Van Nuys, CA).

Between 1997 and 2000, a population-based study was conducted among 1,452 residents in a rural community in Hawaii, where participants were identified by an earlier door-to-door census and a cross-reference directory (7). Recruitment used telephone contacts, home visits, flyers at community centers and stores, and presentations to community organizations and churches. A total of 210 Native Hawaiians, 171 Filipino Americans, and 170 Japanese Americans with no prior diagnosis of type 2 diabetes completed an OGTT and A1C measures. Ethnicity was based on self-report and limited to Filipino and Japanese subjects without reported admixture from other ethnic groups and Hawaiians with ≥50% Native Hawaiian ancestry.

Type 2 diabetes was defined by American Diabetes Association criteria as an FPG ≥126 mg/dl, 2-h postchallenge glucose (PPG) ≥200 mg/dl, or A1C ≥6.5% (8). Among those without diabetes, prediabetes was defined as having impaired fasting glucose (IFG) (FPG: 100–125 mg/dl) or impaired glucose tolerance (IGT) (PPG: 140–199 mg/dl) (8).

Diabetes prevalence and mean A1C values were age adjusted by the direct and least-square methods, respectively (SAS version 9.1; SAS, Cary, NC). Receiver-operating characteristic curves (ROCs) were used to calculate the sensitivity and specificity of A1C cut points for type 2 diabetes diagnosis.

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Table 1—*Glucose, diabetes, and A1C characteristics among Filipino American, Japanese American, and Native Hawaiian adults without known type 2 diabetes, San Diego and Hawaii, 1995–2000*

	Total	Filipino (San Diego)	Native Hawaiian	Filipino (Hawaii)	Japanese (Hawaii)
n	993	382	210	171	170
Age (years)	54.2	57.5	46.1	53.1	57.9
BMI (kg/m^2)	26.9	25.3	31.6	25.8	25.7
IFG or IGT (%)	45.5	39.6	45.2	48.5	55.9
A1C ≥6.5%	8.9	12.6	5.2	8.8	4.2
Type 2 diabetes (by OGTT) (%)	15.5	22.0	10.0	11.7	11.8
FPG ≥126 mg/dl (%)	6.5	6.5	8.6	4.1	6.5
PPG ≥200 mg/dl* (%)	9.0	15.5	1.4	7.6	5.3
Age-adjusted mean A1C (%)					
Type 2 diabetes (by OGTT)	6.47	6.64	6.27	6.13	6.29
FPG ≥126 mg/dl (%)	7.12	8.07	7.10	6.11	6.55
PPG ≥200 mg/dl* (%)	6.00	6.11	5.71	6.20	5.62

	Sensitivity and specificity of A1C ≥6.5% vs. type 2 diabetes		
	OGTT	FPG ≥126 mg/dl	PPG ≥200 mg/dl*
Sensitivity (%)	40.0	68.9	19.1
Specificity (%)	96.8	95.3	92.1
Positive predictive value (%)	69.9	50.6	19.3
Negative predictive value (%)	89.8	97.8	92.0
Area under ROC curve	0.68	0.82	0.56

*PPG ≥200 mg/dl and FPG <126 mg/dl.

RESULTS — The mean age of the 933 participants was 54.2 years, and 73% were women. Mean BMI ranged from 25.3 kg/m^2 among Filipinas in San Diego to 31.6 kg/m^2 among Hawaiians (Table 1). Mean ± SD FPG was 101.6 ± 18.5 mg/dl and mean PPG was 142.2 ± 60.7 mg/dl. A total of 145 (15.5%) subjects had diabetes defined by an OGTT; of these, 61 (6.5%) had an FPG ≥126 mg/dl, whereas the majority (*n* = 84 [9.0%]) had isolated postchallenge hyperglycemia (PPG ≥200 mg/dl but FPG <126 mg/dl). A total of 83 (8.9%) subjects had A1C ≥6.5%; of these, 25 (2.7%) did not have diabetes defined by OGTT. A total of 425 (45.5%) subjects had pre-diabetes, including 182 (19.5%) with IFG only, 134 (14.4%) with IGT only, and 109 (11.7%) with both IFG and IGT. Age-adjusted diabetes prevalence by OGTT (Filipino: 18.9%, Hawaiian: 12.3%, Filipino-Hawaiian: 12.9%, Japanese: 10.9%) did not differ markedly from unadjusted rates. Age-adjusted mean A1C levels were 6.47% among those with diabetes defined by OGTT, 7.12% in those with diabetes defined by FPG, and 6.00% in subjects with isolated postchallenge hyperglycemia. Mean A1C was 5.16% among those with pre-diabetes.

Using an A1C cut point of ≥6.5% to define diabetes by OGTT, sensitivity was 40.0%, specificity was 96.8%, and the area under the ROC was 0.68. AIC ≥6.5% to define diabetes by FPG ≥126 mg/dl had a sensitivity of 68.9%, specificity of 95.3%, and area under the curve (AUC) of 0.82. Whereas, using AIC ≥6.5% to define isolated postchallenge hyperglycemia had a very low sensitivity of 19.1%, a specificity of 92.1%, and an AUC of 0.56. Using A1C cut points of 6.1–6.49% to define pre-diabetes showed that sensitivity was 14.1%, specificity was 94.5%, and AUC was 0.54. The optimal A1C cut point to define diabetes by OGTT was ≥5.8%, with a sensitivity of 75.9%, specificity of 80.0%, and AUC of 0.78.

CONCLUSIONS — Applying A1C ≥6.5% to diagnose type 2 diabetes in this cohort of Asian Americans and Pacific Islanders had low sensitivity and would have failed to diagnose 60% of those with newly diagnosed diabetes. The low sensitivity is exacerbated by the high prevalence of isolated postprandial hyperglycemia and lower A1C values in such individuals. Similar to other Asians with diabetes, in whom impaired β-cell function is a common defect (9,10), almost two-thirds of Filipino and Japanese subjects with diabetes had isolated postchallenge hyperglycemia. Only one-third (35.2%) of Filipino and Japanese subjects with diabetes would have been diagnosed if screening was limited to FPG measures only; this reinforces the importance of OGTT in Asians. The inclusion of A1C criteria identified a nominal proportion (2.7%) with newly diagnosed diabetes.

Our observed sensitivity of 40% was lower than in our Caucasian cohort in the Rancho Bernardo Study (44%), National Health and Nutrition Examination Survey data (44%), and Chinese (51%) in Shanghai (3,2,11). Prior studies in Asia showed that an A1C cut point of ≥6.1% was optimal among Asian Indians and A1C ≥6.3% was optimal among Chinese for diagnosing type 2 diabetes by either FPG or OGTT (11,12). We found an optimal A1C cut point of ≥5.8% to diagnose diabetes in this cohort of Asian Americans and Hawaiians.

Asian and Pacific Islander populations are not homogenous populations, but our sample size was insufficient to evaluate A1C measures by ethnicity. However, to our knowledge, this is the first report to assess A1C measures collectively in Asian Americans and Hawaiians. Limiting diabetes screening to fasting glucose measures and A1C inadequately identifies Asian Americans with type 2 diabetes. The observed low sensitivity of A1C ≥6.5% to diagnose type 2 diabetes adds to the debate about its screening utility.

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