Acculturation and Prevalence of Diabetes among Japanese-American Men in Hawaii

Boji Huang,1 Beatriz L. Rodriguez,1 Cecil M. Burchfiel,2 Po-Huang Chyou,3 J. David Curb,1 and Katsuhiko Yano1

The association between acculturation to a Western lifestyle and prevalence of diabetes was examined among 8,006 Japanese-American men in Hawaii with varying degrees of exposure to traditional Japanese social and cultural lifestyles in 1965–1968. A reduced prevalence of diabetes was observed among the men who had retained a more Japanese lifestyle. These men also reported higher levels of physical activity and consumed more carbohydrates and less fat and animal protein in their diet. An inverse association between diabetes and being born in Japan was observed independent of age, body mass index, physical activity, and percentages of calories from fat or carbohydrates (odds ratios = 0.67 and 0.66, 95% confidence intervals 0.49–0.93 and 0.48–0.91, respectively). The number of total years lived in Japan was inversely associated with prevalent diabetes after controlling for age, body mass index, and physical activity (odds ratio = 0.81, 95% confidence interval 0.68–0.96). Current Oriental diet (compared with Western diet) was inversely associated with prevalent diabetes after controlling for age, body mass index, and physical activity (odds ratio = 0.71, 95% confidence interval 0.50–0.98). These findings suggest that living a Japanese lifestyle is associated with a reduced prevalence of diabetes.

MATERIALS AND METHODS

Baseline examination

The Honolulu Heart Program is a prospective study of 8,006 men of Japanese ancestry born in 1900–1919 and living on Oahu in 1965. The Program was originally organized as part of a comparative study including Japanese men living in Japan, Hawaii, and California to examine the East-to-West gradient of increasing mortality from coronary heart disease. The baseline examination was completed in 1965–1968. Standard interviews were used to obtain demographic, lifestyle, sociocultural, and medical information (3, 4). Body mass index was calculated as the weight (kg)/height (m)2. A physical activity index was derived by adding together the product of the number of hours spent in five activity levels and a weighting factor based on the estimated oxygen consumption required for each activity (5–7). The weighting factors were 1.0, 1.1, 1.5, 2.4, and 5.0, respectively, for the five levels of physical activities. The five levels included basal (e.g., sleeping or reclining), sedentary (sitting or standing), slight (casual walking), moderate (carpentry or gardening), and heavy (lifting or shoveling) activities (5). Evaluation of the diet for each Japanese-American man from Hawaii was done by a dietitian using the 24-hour recall method (8). Alcohol intake
was determined by recording the usual monthly intake of beer, wine, or liquor and converted to milliliters of ethanol consumed per day. Nonfasting glucose was measured using the Autoanalyzer model N-2B (Technicon Instruments Corporation, Tarrytown, New York) method modified by Hoffman's potassium ferriyanide method (9) from serum specimens collected 1 hour after a 50-g glucose load (8, 10, 11).

**Study population**

Among the 8,006 Japanese-American men in Hawaii at the baseline examination, 7,959 were included in the current study. Glucose measures were not obtained for 47 men who were therefore excluded.

**Definition of diabetes**

Since the current standard glucose tolerance criteria utilized by the World Health Organization (12) for defining diabetes were not available, an alternative definition of diabetes was used for this study. Probable prevalent diabetes was defined as the self-reported use of medication for diabetes or the self-reported history of diabetes and nonfasting serum glucose level of 225 mg/100 ml or higher 1 hour after a 50-g oral glucose load. This serum glucose level corresponded to the 90th percentile for the cohort.

**Measures of acculturation**

Three measures, place of birth (Japan vs. Hawaii), number of total years lived in Japan, and self-reported current diet type (Oriental or mixed vs. Western), were used to estimate acculturation. Information on acculturation was ascertained from a questionnaire at baseline examination. The number of total years lived in Japan was estimated by taking into account the years of education spent in Japan for those who traveled to Japan and the age of migration to the United States if the men were born in Japan. The current diet type was determined by the response to the question, "Do you consider your present diet to be mostly Oriental, Western, or mixed?" Since a clear association of the three measures with the incidence of coronary heart disease was observed in the Japanese-American men previously (13), further exploration of the association with prevalent diabetes was performed in the current study.

**Data analysis**

Univariate logistic regression models were used to identify possible significant risk factors for diabetes in addition to the three acculturation measures. Age, body mass index, physical activity index, daily cigarette smoking, monthly alcohol consumption, serum total cholesterol, total caloric intake, percentages of vegetable and animal protein intake, percentages of simple and complex carbohydrate intake, and percentages of calories from carbohydrates, protein, and fat, as well as education, were initially considered as possible risk factors and then included in models. A method of stepwise logistic regression analysis (14) was used to determine which of the significant risk factors identified in the univariate analysis should be adjusted for when odds ratios of association between the three acculturation measures and diabetes were calculated.

Age-adjusted means and standard errors of the above significant risk factors determined in stepwise models were calculated across levels of acculturation using general linear models for covariance analysis (15). Means across the three acculturation measures were compared using the $F$ test (16). Comparisonwise error rates were calculated to adjust for multiple comparison (17).

Odds ratios and the 95 percent confidence intervals for the associations between the three acculturation measures and prevalent diabetes were calculated by including the relevant covariates one by one into the multiple logistic regression models to adjust for potentially confounding effects.

**RESULTS**

The age-adjusted prevalence of diabetes is presented by the three acculturation measures in table 1. The Japanese-American men born in Japan had a lower prevalence of diabetes compared with those born in...
Huang et al.

The Japanese-American men who lived in Japan for 10 years or longer had the lowest prevalence of diabetes. The men who lived there for 1–9 years had a higher prevalence compared with the men who lived in Japan for 10 years or longer and a lower prevalence compared with the men who had never lived or lived in Japan for less than 1 year. The Japanese-American men who consumed an Oriental diet had a lower prevalence of diabetes compared with the men who consumed a mixed diet. The prevalence was highest for the men who consumed primarily a Western diet.

The age-adjusted means and standard errors of the seven significant risk factors with potentially confounding effects are displayed by three acculturation measures in tables 2, 3, and 4. The Japanese-American men who were born in Japan were more physically active and had a lower percentage of animal protein intake and a lower percentage of caloric intake from fat but a higher percentage from carbohydrates compared with those who were born in Hawaii. In addition, the former were less obese and had a lower total caloric intake compared with the latter, although the difference was not significant (table 2).

The number of years lived in Japan was inversely related to body mass index, total caloric intake, and percentage of animal protein intake, as well as percentages of caloric intake from fat, but positively related to the percentage from carbohydrates. The Japanese-American men who lived in Japan for 10 or more years were more physically active compared with those who lived in Japan for less than 10 years or who had never lived or lived in Japan for less than 1 year. The Japanese-American men who lived in Japan for less than 10 years were slightly less physically active compared with those who had never lived or lived in Japan for less than 1 year, but the difference was not significant (table 3).

The Japanese-American men who had an Oriental diet were less obese and more physically active and had a lower percentage of animal protein intake and percentages of caloric intake from fat and protein but a higher percentage from carbohydrates compared with those who had a mixed or Western diet. On the contrary, the men who had a Western diet were the least physically active and had the highest percentage of animal protein intake and percentages of caloric intake from fat and protein but the lowest percentage from carbohydrates. However, the difference in body mass index for the men who had either a mixed or Western diet was insignificant (table 4).

Unadjusted odds ratios and odds ratios adjusted for the relevant covariates are presented in table 5. The percentages of calories from fat, carbohydrates, and protein were not controlled for simultaneously to avoid possible collinearity. The unadjusted odds ratio of the association between diabetes and birthplace was not significant, but the associations were consistently significant after adjustment for relevant covariates (table 5). The inverse associations between being born in Japan versus in Hawaii and diabetes were independent of age, body mass index, physical activity index, total caloric intake, and the percentages of calories from fat, carbohydrates, or protein, as well as the percentage of animal protein from total protein intake.

The unadjusted odds ratio for the association between the number of total years lived in Japan and diabetes was not significant, but the association was significant after adjustment for age. The odds ratio was 0.75 in a unit of 10 years lived in Japan. The association was independent of age, body mass index, and physical activity index and was no longer significant after controlling for the percentage of calories from fat. However, adjustment for total caloric intake or the percentage of calories from carbohydrates or protein, as well as the percentage of animal protein from total protein intake, did not modify the association.

Univariate and multivariate analyses adjusting for age, body mass index, physical activity index, and the percentage of calories from protein suggested inverse associations between current Oriental or mixed diet (compared with Western diet) and prevalent diabetes. The relation between an Oriental diet and diabetes was no longer significant after adjustment for the percentage of calories from fat or carbohydrates in the multiple logistic regression models. However, adjustment for the percentage of calories from protein or the percentage of animal protein from total protein intake did not influence the significant association. Moreover, the relation between a mixed diet and diabetes

### TABLE 2. Age-adjusted mean levels of risk factors for diabetes by birthplace (Japan or Hawaii), 1965–1968

<table>
<thead>
<tr>
<th>Acculturation characteristics</th>
<th>Body mass index (kg/m²)</th>
<th>Physical activity index</th>
<th>Total caloric intake</th>
<th>% of caloric Intake from Fat</th>
<th>% of caloric Intake from Protein</th>
<th>% of caloric Intake from Carbohydrate</th>
<th>% of animal protein intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan (n = 935)</td>
<td>23.7 ± 0.11†</td>
<td>33.4 ± 0.16</td>
<td>2,229.7 ± 26.32</td>
<td>32.2 ± 0.34</td>
<td>16.7 ± 0.15</td>
<td>47.1 ± 0.40</td>
<td>70.8 ± 0.45</td>
</tr>
<tr>
<td>Hawaii (n = 7,007)</td>
<td>23.9 ± 0.04</td>
<td>32.7 ± 0.05**</td>
<td>2,280.6 ± 8.67</td>
<td>33.4 ± 0.11**</td>
<td>16.7 ± 0.05</td>
<td>46.3 ± 0.13*</td>
<td>73.2 ± 0.15*</td>
</tr>
</tbody>
</table>

* p < 0.05 by F test; ** p < 0.01 by F test.
† Standard error.

was relatively unchanged after adjustment for other risk factors. Associations of other risk factors with prevalent diabetes were examined. Cholesterol, triglycerides, alcohol consumption, cigarette smoking, and education were not significantly associated with prevalent diabetes. There was no evidence that terms involving the number of total years lived in Japan were significant interaction between birthplace or current diet type and risk factors.

Table 3 and 4 show that the majority of the Japanese-American men who had never lived or lived in Japan for less than 1 year had a mixed diet. Nearly 4,000 men, half of the study population, who had never lived or lived in Japan for less than 1 year reported having a mixed diet. The strength of the two measures of acculturation was attempted by including the total years lived in Japan and the current diet type in the same model. As a result, the associations were invariant. The odds ratio for the association of total years lived in Japan with prevalent diabetes is 0.77 (95 percent confidence interval 0.64–0.92) after adjustment for age. The odds ratios for the association of an Oriental diet and a mixed diet (compared with a Western diet) with prevalent diabetes are 0.56 and 0.58 (95 percent confidence intervals 0.40–0.79 and 0.46–0.74), respectively.


---

**TABLE 3.** Age-adjusted mean levels of risk factors for diabetes by total years lived in Japan, 1965–1968

<table>
<thead>
<tr>
<th>Total years lived in Japan</th>
<th>Body mass index (kg/m²)</th>
<th>Physical activity index</th>
<th>Total caloric intake</th>
<th>% of caloric intake from</th>
<th>% of animal protein intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (n = 5,408)</td>
<td>24.0 ± 0.04‡</td>
<td>32.6 ± 0.06</td>
<td>2,292.3 ± 9.81</td>
<td>33.8 ± 0.13</td>
<td>16.7 ± 0.05</td>
</tr>
<tr>
<td>1–9 (n = 1,122)</td>
<td>23.8 ± 0.09</td>
<td>32.5 ± 0.13</td>
<td>2,270.9 ± 21.29</td>
<td>32.5 ± 0.28**</td>
<td>16.5 ± 0.12</td>
</tr>
<tr>
<td>≥10 (n = 1,407)</td>
<td>23.4 ± 0.09***</td>
<td>33.7 ± 0.12**,††</td>
<td>2,208.3 ± 20.01**</td>
<td>31.8 ± 0.25**</td>
<td>16.6 ± 0.11</td>
</tr>
</tbody>
</table>

* Comparison error rate < 0.05; ‡ comparison error rate < 0.01 comparing with 0 years.
† Comparison error rate < 0.05; †† comparison error rate < 0.01 comparing with 1–9 years.
‡ Standard error.

**TABLE 4.** Age-adjusted mean levels of risk factors for diabetes by current diet type, Hawaii, 1965–1968

<table>
<thead>
<tr>
<th>Current diet type</th>
<th>Body mass index (kg/m²)</th>
<th>Physical activity index</th>
<th>Total caloric intake</th>
<th>% of caloric intake from</th>
<th>% of animal protein intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oriental (n = 1,140)</td>
<td>23.5 ± 0.09‡</td>
<td>32.8 ± 0.13</td>
<td>2,328.4 ± 21.19</td>
<td>30.2 ± 0.27</td>
<td>16.1 ± 0.12</td>
</tr>
<tr>
<td>Mixed (n = 5,078)</td>
<td>23.9 ± 0.04**</td>
<td>32.7 ± 0.06**</td>
<td>2,270.2 ± 9.46*</td>
<td>33.2 ± 0.12**</td>
<td>16.7 ± 0.05**</td>
</tr>
<tr>
<td>Western (n = 1,110)</td>
<td>23.9 ± 0.09**</td>
<td>31.9 ± 0.13**</td>
<td>2,253.7 ± 21.44</td>
<td>36.8 ± 0.28**,††</td>
<td>17.2 ± 0.12**,††</td>
</tr>
</tbody>
</table>

* Comparison error rate < 0.05; ‡ comparison error rate < 0.01 comparing with Oriental diet.
† Comparison error rate < 0.05; †† comparison error rate < 0.01 comparing with mixed diet.
‡ Standard error.

**TABLE 5.** Odds ratios for associations between diabetes and risk factors by acculturation, Hawaii, 1965–1968

<table>
<thead>
<tr>
<th>Adjusted variables</th>
<th>Birthplace</th>
<th>Total years lived in Japan</th>
<th>Current diet type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hawaii (OR)†</td>
<td>Japan (OR) 95% CI†</td>
<td>Mixed (OR) 95% CI†</td>
</tr>
<tr>
<td>Unadjusted</td>
<td>1.00</td>
<td>1.03</td>
<td>0.99 – 1.10</td>
</tr>
<tr>
<td>Age</td>
<td>1.00</td>
<td>0.60</td>
<td>0.43 – 0.82</td>
</tr>
<tr>
<td>Age, BMI†</td>
<td>1.00</td>
<td>0.61</td>
<td>0.44 – 0.83</td>
</tr>
<tr>
<td>Age, BMI, PAI‡</td>
<td>1.00</td>
<td>0.64</td>
<td>0.47 – 0.89</td>
</tr>
<tr>
<td>Age, BMI, PAI, TCI†</td>
<td>1.00</td>
<td>0.63</td>
<td>0.45 – 0.86</td>
</tr>
<tr>
<td>Age, BMI, PAI, fat‡</td>
<td>1.00</td>
<td>0.67</td>
<td>0.49 – 0.93</td>
</tr>
<tr>
<td>Age, BMI, PAI, protein§</td>
<td>1.00</td>
<td>0.63</td>
<td>0.46 – 0.87</td>
</tr>
<tr>
<td>Age, BMI, PAI, carbohydrate¶</td>
<td>1.00</td>
<td>0.66</td>
<td>0.46 – 0.91</td>
</tr>
<tr>
<td>Age, BMI, PAI, animal¶</td>
<td>1.00</td>
<td>0.66</td>
<td>0.46 – 0.91</td>
</tr>
</tbody>
</table>

* In the unit of one decade.
† OR, odds ratio; CI, confidence interval; BMI, body mass index; PAI, physical activity index; TCI, total caloric intake.
‡ Fat, percentage of caloric intake from fat.
§ Protein, percentage of caloric intake from protein.
¶ Carbohydrate, percentage of caloric intake from carbohydrate.
† Animal, percentage of animal protein from total protein intake.
DISCUSSION

An increase in the prevalence of diabetes due to acculturation to a Westernized lifestyle has been observed in previous studies (1, 18). The findings of the current cross-sectional study indicate an association between acculturation and diabetes. The Japanese-American men in Hawaii who retained a more Japanese lifestyle had a reduced prevalence of diabetes.

Elevated body mass index is associated with an increased risk for diabetes, although the body mass index was similar for the Japanese-American men born in Japan compared with those born in Hawaii. All multiple regression models in the current study indicated deleterious, highly statistically significant effects of a higher body mass index on diabetes. More diabetes was observed in the more obese men than in the less obese men, although Japanese-American men in Hawaii were in general much less obese, and the 70th percentile of body mass index was 25.8 kg/m² in the men. However, the Pima Indians have a high prevalence and incidence of diabetes with more than two thirds of them having a body mass index greater than 30 kg/m² (19).

More physically active populations tend to have a lower prevalence of diabetes. Acculturation to a sedentary lifestyle is associated with an increased prevalence of diabetes among the Australian Aborigines (2). Disparate prevalence of diabetes among Fiji islanders of different races was related to the levels of their physical activity (20). A previous study suggested a lower insulin response to glucose infusion among trained athletes (21). Frisch et al. (22) reported that former female students in the United States who engaged in college athletics and continued to be more active later in life had a lower prevalence of diabetes than did those who did not participate in athletics during college and remained less active in subsequent years.

The findings concerning physical activity in the current study are consistent with the results of the above four studies. The physical activity index was inversely related to the prevalence of diabetes in all the multiple logistic regression models. The mean physical activity index was higher for the Japanese-American men who retained a more Japanese lifestyle, as reflected in all three acculturation measures.

Physical activity was considered as a potentially confounding factor of the association of acculturation with diabetes in the current study. Although physical activity was found to be strongly related to the prevalence of diabetes and the three measures of acculturation, significant association of acculturation with diabetes was independent of physical activity. Associations of the three measures of acculturation with the prevalence of diabetes remain significant with and without adjustment for the physical activity index, and the magnitude of the associations changed scarcely in table 5.

Excessive caloric intake resulting in prolonged obesity can lead to diabetes (23). Increased intake of total calories, fat, and sucrose and decreased intake of total and complex carbohydrates, including fiber, have been reported to play a role in the etiology of diabetes in migrant population studies and secular trend data (24).

It has been reported that Japanese migrants to Hawaii were observed to have approximately twice the prevalence of diabetes as their counterparts of similar age in Hiroshima. The total caloric intake was similar for the two populations, but the Japanese migrants to Hawaii consumed approximately twice as much fat, one third less complex carbohydrates, and almost three times as much simple carbohydrates (25, 26). Furthermore, second-generation Japanese-American men were reported to have diabetes mellitus four times higher than men in Japan. The diet of diabetic men compared with nondiabetic men was similar in kilocalories but was higher in the percentages of calories from fat and protein, especially animal protein (27).

The findings of the current study are analogous to the results of the above three studies that compared indigenous Japanese people and Japanese Americans. The age-adjusted mean percentage of calories from fat and the percentage of animal protein intake were found to be lower for the Japanese-American men in Hawaii who retained a more Japanese lifestyle compared with those who were more acculturated. The reduced fat and animal protein intakes suggest a decreased risk for diabetes.

Relatively low total caloric intake was found among the Japanese-American men born in Japan and those who had lived in Japan for a longer period but not among those who consumed an Oriental diet. This finding is in accordance with the findings of previous studies conducted among Japanese migrants to Hawaii and the Japanese dwelling in Hiroshima (25, 26). The current study suggested that carbohydrates instead of fat were the main caloric source for the Japanese-American men who had a higher total caloric intake and retained a more Japanese lifestyle. The percentage of caloric intake from carbohydrates was consistently higher among the men who were born in Japan, who lived in Japan for a longer period, and who consumed an Oriental diet. On the contrary, the mean caloric intake from fat was lower among those men. Dietary fat is considered more likely to contribute to diabetes. Therefore, a decreased risk for prevalent diabetes among the men who tended to retain a Japanese life-
style may have been partially due to reduced fat intake and increased carbohydrate intake.

The independent inverse association between being born in Japan versus in Hawaii and prevalent diabetes implies early life background factors that may lead to diabetes. The relation of early life background factors to diabetes was examined in a study (28) among Japanese-American men who were born and raised in the United States. A significantly higher risk for diabetes was found with an urban birthplace, parents' education above the primary level, and the mother's being employed. Information on the above early life factors was not available in the current study.

Low birth weight has been reported to be related to a high risk for developing diabetes in adults (29, 30). The high risk may be caused by an inadequate nutrition and oxygen supply before and immediately after birth (29). Japanese-American infants were found to have significantly higher risks of low birth weight in Hawaii during 1979–1990 (31). Although the Japanese-American mothers had adequate prenatal care, a significantly high proportion of these women were married at an older age after having finished their higher education (31). Marriage at an older age could be an explanation for the low birth weight among the Japanese-American infants in 1979–1990. However, because of unavailable data in the Honolulu Heart Program, the current study cannot assess an association of birth weight with diabetes for the Japanese-American men.

The number of total years lived in Japan was inversely associated with prevalent diabetes after adjustment for age, body mass index, and physical activity. The association was no longer significant after the percentage of calories from fat was added to the multiple logistic regression model. However, the total caloric intake and the percentage of calories from carbohydrates did not appear to modify the association. It is reasonable to assume that Japanese-American men in Hawaii who did not live in Japan for many years were predisposed to adopt a Western diet. It may explain in part why the inverse association was initially significant and became insignificant after adjustment for the percentage of calories from fat.

The change in statistical significance of the association between current diet type and diabetes was further examined. The odds ratio for the association between Oriental diet type and diabetes was still statistically significant after adjustment for age, body mass index, physical activity index, and total caloric intake, but significance disappeared after adjustment for the percentage of calories from fat or carbohydrates. The disappearance suggests that the protective effect of an Oriental diet for diabetes might be partially mediated through the percentage of calories from fat or carbohydrates. An inverse association of carbohydrates and a positive association of fat with diabetes were consistent in all of the multiple regression models. In contrast to the association of Oriental diet type with diabetes, the association of mixed diet type remained significant after adjustment for the covariates. The reasons for the inverse association that was independent of the percentages of calories from fat and carbohydrates are unknown.

Because of the lack of availability of the current standard glucose tolerance criteria, a conservative alternative definition of diabetes was used for this study. The Japanese-American men who reported a history of diabetes and had a 1-hour postload serum glucose value of less than 225 mg/100 ml were considered to be nondiabetic. The possible effects of differential misclassification were examined. A less conservative definition, including the self-reported use of medication for diabetes or a self-reported history of diabetes regardless of glucose value, was also used to examine the associations between acculturation and diabetes. The results showed only slightly weaker protective effects of the more Japanese lifestyle reflected in the three acculturation measures with the similar statistical significance displayed in table 5. A few additional definitions of diabetes were considered to examine the associations between acculturation and diabetes, including the self-reported use of medication for diabetes or a self-reported history of diabetes with serum glucose above several specified values (263, 225, 215, 200, and 190 mg/100 ml corresponding to the 95th, 90th, 85th, 80th, and 75th percentiles, respectively). The results were very similar when potentially undiagnosed diabetic men were included and excluded. Since only 32 men reported taking insulin at the baseline examination, the associations between the three measures of acculturation and diabetes changed very little when these 32 men were excluded.

The current diet type was estimated subjectively. To evaluate possible interview bias, we inspected the frequency of Oriental, mixed, and Western diet types across birthplace and total years lived in Japan. We found that the Oriental diet type was observed much more frequently and that the Western diet type was observed less frequently in the Japanese-American men who were born in Japan or who lived in Japan longer compared with those who were born in Hawaii and lived for a shorter period or had never lived or lived in Japan for less than 1 year. In addition, the least consumption of fat and animal protein was observed among the Japanese-American men who had an Oriental diet, and the most consumption was observed among those men who reported a Western diet as shown in table 4.

Oahu is a relatively small island. Japanese Americans lived in communities with others of similar ancestry. It was not difficult to obtain Japanese food for the men who retained a Japanese lifestyle. Generally speaking, a Western diet contains more fat than an Oriental diet. The Japanese-American men frequently consumed rice, tofu, green tea, and fish (32). In comparison with other Americans, the Japanese-American men had a higher percentage of total caloric intake from carbohydrates and polyunsaturated fatty acids but a lower percentage from fat, especially saturated fatty acids (33). The information on diet used in the current study was ascertained in a 24-hour dietary recall interview conducted by a trained dietitian. Reliability was evaluated previously (8). In the current study, the men who retained a Japanese lifestyle were found to have less fat and animal protein intake but more carbohydrate intake than the men who did not (tables 2–4). The diabetic men were consistently observed to have more fat intake than nondiabetic men. Although the significant difference of fat intake across the three acculturation measures was relatively small, the difference between diabetic and nondiabetic men was larger.

In summary, the current cross-sectional study provides evidence of associations between acculturation and diabetes. Japanese-American men in Hawaii who tended to retain a more Japanese lifestyle were less likely to have diabetes. Also, these men were observed to have been more physically active, and their diet consisted of more carbohydrates and less fat as well as reduced animal protein intake. Inverse associations of diabetes with the number of total years lived in Japan and current Oriental diet (compared with Western diet) can be partially explained by the reduced fat intake among these men. The inverse associations between diabetes with the number of total years lived in Japan and current Oriental diet (compared with Western diet) were observed to have more fat intake than nondiabetic men. Although the significant difference of fat intake across the three acculturation measures was relatively small, the difference between diabetic and nondiabetic men was larger.

REFERENCES
