

# Dietary Patterns among Men of Japanese Ancestry in Hawaii<sup>1</sup>

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## Summary

The dietary patterns of 6663 men of Japanese ancestry, living in Hawaii and participating in the Honolulu Heart and Japan-Hawaii Cancer Studies, were analyzed according to country of birth and boyhood education. Approximately 80% of the men were born and educated in Hawaii (Nisei); the others were either born in Japan (Issei) or traveled to Japan for 5 or more years of boyhood education (Kibei). Twenty-four-hr diet recalls, obtained at the first cycle of examinations (1965 to 1968), revealed that the Nisei consumed significantly greater intakes of total and animal protein, total and saturated fat, and cholesterol than the Issei and Kibei. Values for weight, height, skinfold thickness, and serum cholesterol were in the same direction, and the differences were statistically significant.

Food frequency questionnaires at the 1st and 3rd examinations covered a 6-year interval. At both time periods, the Issei and Kibei ate Japanese foods more frequently and in greater quantities than the Nisei. In general, the Nisei consumed more Western foods. Both food frequency questionnaires included 6 identical items: coffee, milk, green tea, rice, tofu (soybean curd), and tsukudani (preserved seaweed paste). The frequent and infrequent consumers were similarly characterized over the 6-year period.

The findings suggest that the country of birth and education has lasting effects on adult eating patterns. The observed heterogeneity for specific food items and nutrients between the Nisei and Issei-Kibei men augers well for attempts to relate such items to chronic diseases such as cancer.

## Introduction

Like other migrant populations, persons of Japanese ancestry living in Hawaii have retained some traditional food habits and accepted others from their host country. Tillotson *et al.* compared the diets of Japanese men, 45 to 69 years of age, living in Japan and in Hawaii (10). They found that the Hawaii Japanese consumed about twice as much fat and substantially less carbohydrate than the indigenous Japanese. Furthermore, 35% of the carbohydrate consumed by the Hawaii Japanese was in the form of sugar compared to 20% in Japan: Saturated fat comprised 65 to 70% of the

total fat in Hawaii versus 40% in Japan. However, the total fat intake in Hawaii Japanese (33%) was still below the 42% reported for the average American (2).

Only limited information on the use of specific food items was included in Tillotson's paper. The Hawaii Japanese ate substantially more bread, butter, margarine, and cheese than men living in Japan, and slightly more meat products. Consumption of fish, tofu<sup>3</sup> (soybean curd), and rice was considerably less frequent in Hawaii than in Japan, although rice was still eaten two or more times daily by one-half of the Hawaii Japanese men. Both the nutrient and food item data suggested that the Hawaii Japanese men were largely, but not completely, Westernized with respect to their eating habits.

These findings support the concept that migrant populations usually change their diet and other traditional habits toward the prevailing customs of the host country. Such changes are of interest since it is now clear that they accompany, and probably cause, changes in the incidence of specific types of cancer and other chronic diseases. It is important to determine whether these changes occur in a uniform or heterogeneous fashion in a given migrant population, because variation provides an opportunity to link specific dietary or cultural changes to specific diseases. We have looked for heterogeneity in the Hawaii Japanese by comparing the consumption of specific food items and nutrients among men who might be expected to have retained their Japanese habits with those who might not. For the 1st group, we identified men who were born or educated in Japan; for the 2nd group, we used men born and educated in Hawaii.

## Materials and Methods

Approximately 8000 men of Japanese ancestry, born between 1900 and 1919, were examined from 1965 to 1968 during the 1st cycle of the Honolulu Heart Study. The identification and recruitment of this cohort has been described previously (12). More than 6600 men returned for their 3rd round of examinations, which was carried out under the combined auspices of the Honolulu Heart Study

<sup>3</sup> Description of Japanese food items: tofu, soybean curd; tsukudani, preserved seaweed paste; soba, buckwheat noodles; udon or saimin, noodles with broth; miso soup, soup with soybean paste; kamabuko, steamed fish cake; sashimi, fillet of selected raw fish; hakusaizuke, pickled Chinese cabbage; takuwan, Japanese pickled turnips; and ume, Japanese pickled plums.

<sup>1</sup> Presented at the Conference on Nutrition in the Causation of Cancer, May 19 to 22, 1975, Key Biscayne, Fla. Research supported by Contract NO1 CP 33216 from the National Cancer Institute, NIH.

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and the Japan-Hawaii Cancer Study approximately 6 years later.

On the basis of their birthplace and residential pattern, we separated this cohort into 3 distinct groups which might be expected to show different degrees of acculturation to the Western pattern of living. The *Issei* are Japanese persons born in Japan who migrated to Hawaii. *Nisei* are those of Japanese ancestry who were not born in Japan; nearly all such men were born in Hawaii. *Kibei* (as defined for this study) are Nisei who traveled to Japan before the age of 11 years and stayed there 5 or more years, usually for their elementary or secondary education. They currently reside in Hawaii.

We utilized dietary data of the 6663 persons who participated in both the 1st and 3rd cycles of these examinations. During the 1st examination, dietitians used standard methods to obtain individual recalls of foods and amounts consumed during the previous 24 hr (10). Food models and serving utensils were available to illustrate portion sizes, and standard food composition tables were used to compute the individual intakes of calories and nutrients. We selected the data on calorie, total and animal protein, total and saturated fat, total carbohydrate, sucrose, starch, and cholesterol intakes for this study (10).

An additional dietary questionnaire was administered at that time to ascertain the usual frequencies of eating 26 selected items. The frequencies were classified as: (a) almost never; (b) less than twice a week; (c) 2 to 4 times a week; (d) almost daily; and (e) more than once a day. Sixteen of these items could be classified as typically Japanese or Western, and these were tabulated for this analysis. For each item, the subjects were classified as frequent or infrequent consumers. The definition of a frequent consumer was based on the distribution of responses to the particular item. For commonly consumed foods, such as bread, butter, and milk, a frequent consumer was defined as one who ingested the item more than once a day. For foods occasionally consumed, such as tofu, miso soup, and nori, the definition was applied to those who ate the item 2 or more times a week.

During the 3rd cycle, trained bilingual interviewers administered a 7-day recall questionnaire to obtain estimated frequency of intake, as well as amount of 33 food items, suggested as possibly carcinogenic or protective of gastrointestinal cancer in published papers (3, 5, 9, 11, 13, 14). Portion sizes were estimated from 5- x 7-inch colored photographs of small, medium, and large servings of each

item. A description of this method and of its validation is described elsewhere (6). For this paper, we computed the individual estimated mean daily intake for 21 of these items which were considered to be predominantly Japanese or Western. Twelve items were common to both cultures and were omitted. The frequency questionnaires of the 1st and 3rd examinations included some identical items, permitting comparisons of eating habits over a 6-year period of residence in Hawaii.

Information on body height, weight, subscapular skin-folds, and serum cholesterol was taken from the 1st examination. Descriptions of the methods used for these measurements have been published previously (8).

## Results

The distribution of Nisei, Issei, and Kibei according to age at time of 1st examination is shown in Table 1. The numbers in the younger age groups were strikingly greater for Nisei than Issei or Kibei, and approximately 80% of the total study participants were Nisei.

The specific food items of the 2 questionnaires were separated according to primary association with a Western or Japanese diet, and age-adjusted comparisons were made between the Nisei and Issei and between the Nisei and Kibei. The Nisei-Issei comparisons excluded persons in the 45 to 49 and 50 to 54 age groups because of the small numbers of Issei under age 55. All 5 age groups were included in the Nisei-Kibei comparisons.

Table 2 shows the percentage of frequent consumers of Western and Japanese items at the 1st examination. In general, a greater proportion of Nisei frequently consumed Western foods than did Issei or Kibei. Conversely, Issei and particularly Kibei ate more Japanese items than the Nisei. The differences for Japanese items were in general more impressive than for Western items, and it was notable that milk and ice cream were equally popular in all 3 groups.

The age-adjusted quantitative intakes obtained in the 3rd examination among the 3 groups are presented in Table 3. With a few exceptions, such as celery, the trends for the 3 groups were similar to findings in Table 2. These data suggested that Issei and Kibei have more traditionally Japanese dietary patterns than the Nisei. The similarities among the Issei and Kibei led us to combine these 2 groups in subsequent analyses.

Table 4 reveals consistent differences in body measure-

Table 1  
Distribution of men by birthplace, residential pattern, and age

Group <sup>a</sup>	No. of persons by age at 1st examination					Total
	45-49 yr	50-54 yr	55-59 yr	60-64 yr	65-69 yr	
Nisei	1500	2055	1039	539	121	5254
Issei	18	33	111	375	179	716
Kibei	127	301	157	87	21	693

<sup>a</sup> Nisei are persons of Japanese lineage not born in Japan and generally born in Hawaii. Issei are persons born in Japan who migrated to Hawaii. Kibei are Nisei who traveled to Japan before the age of 11 and stayed there 5 or more years, usually for their elementary or secondary education.

Table 2  
Percentage of frequent consumers of Western and Japanese food items among Nisei, Issei, and Kibei at 1st examination

Food items	Age-adjusted values <sup>a</sup>			
	% eating food items at age 55-69 yr		% eating food items at age 45-69 yr	
	Nisei	Issei	Nisei	Kibei
<b>Western</b>				
Meat	25.7	20.5	33.3	28.9 <sup>b</sup>
Ham, bacon, sausage	17.5	17.6	22.2	16.3 <sup>b</sup>
Butter, margarine, cheese	8.3	5.6	7.1	4.6
Bread	33.7	27.9	33.4	26.8 <sup>b</sup>
Ice cream	11.0	11.2	9.4	9.4
Coffee	41.4	32.3 <sup>b</sup>	45.9	40.8 <sup>b</sup>
Milk	8.2	8.8	7.0	9.0
<b>Japanese</b>				
Rice	46.7	59.9 <sup>b</sup>	47.4	61.2 <sup>b</sup>
Tofu	22.1	41.4 <sup>b</sup>	17.2	29.3 <sup>b</sup>
Tsukudani	8.1	9.7	6.9	11.4 <sup>b</sup>
Green tea	9.1	15.3 <sup>b</sup>	6.4	13.7 <sup>b</sup>
Soba	38.9	38.3	35.1	39.7
Udon	10.3	12.4	11.5	14.3
Miso soup	14.5	26.9 <sup>b</sup>	13.0	24.1 <sup>b</sup>
Fish	7.3	13.4 <sup>b</sup>	5.4	10.5 <sup>b</sup>
Nori, other seaweeds	18.6	27.5 <sup>b</sup>	18.2	30.1 <sup>b</sup>

<sup>a</sup> Age adjusted in 5-year age groups by the direct method.

<sup>b</sup> Differs significantly from Nisei at 0.01 level.

ments between the Nisei and Issei-Kibei. Values for weight, height, skinfold thickness, and serum cholesterol were significantly greater among the Nisei than the Issei-Kibei men. The 24-hr dietary recall data were generally in the same direction. The greater intakes of total and animal protein, total and saturated fat, sucrose, and cholesterol among Nisei than among Issei or Kibei groups were expected, due to the association of these nutrients with Western foods. Differences were statistically significant at the 0.01 level for all variables except total carbohydrate and cholesterol intakes. Total carbohydrate intakes did not differ between the groups, although the percentage of total calories as carbohydrate was slightly higher in the Issei-Kibei than in the Nisei ( $p < 0.01$ ). Eggs are used frequently in traditionally Japanese diets and may account for the similarity in cholesterol intakes. Charts 1 to 6 illustrate the age-specific differences between the 2 groups for weight, skinfold thickness, serum cholesterol, total calories, saturated fat, and sucrose, respectively. The age-specific differences are consistent in direction for all of these variables.

The 1st and 3rd examination dietary questionnaires included 6 identical food items: coffee, milk, green tea, rice, tofu, and tsukudani. Although the methods of quantitating frequencies differed in the 2 questionnaires, the stability of the individual food patterns can be observed. The mean frequency of intake of each of these items at the 3rd examination is shown according to the frequency reported by the same individuals at the 1st examination. Charts 7 and 8 show that the frequent and infrequent consumers of the 6

food items at the 1st examination tended to be similarly characterized 6 years later.

## Discussion

It is of interest that the country of birth and of education appears to have a lasting effect on adult eating patterns among the Japanese in Hawaii. These effects seem even stronger among the Kibei than among the Issei. This is not surprising, because the Kibei returned to their country of heritage during a formative period of their development and lived under the direct influence of Japanese culture. Furthermore, the parents of Kibeis probably had closer ties with their native country than the parents of Nisei children who did not return to Japan.

The existence of long-term dietary patterns is supported by the reproducibility of dietary frequency data over a 6-year period, utilizing 2 different methods of data collection. If chronic diseases, such as stomach cancer, have their onset in early life (5), characterization of current diet (as an indicator of prior dietary patterns) may provide useful information on etiology. For other chronic diseases, such as colorectal cancer, which appear to be largely determined in later life (4), the usefulness of adult dietary studies is even

Table 3  
Mean daily intakes of Western and Japanese food items among Nisei, Issei, and Kibei at 3rd examination

Food items	Age-adjusted values <sup>a</sup>			
	Amount consumed (g) at age 55-69 yr		Amount consumed (g) at age 45-69 yr	
	Nisei	Issei	Nisei	Kibei
<b>Western</b>				
Beef	191	167 <sup>b</sup>	220	196 <sup>b</sup>
Wieners	28	34	34	33
Spam or luncheonmeat	18	22	24	26
Vienna or pork sausage	20	12 <sup>b</sup>	23	22
Corn on the cob	21	15	22	14 <sup>b</sup>
Celery	30	40	29	40 <sup>b</sup>
Coffee	2336	2172	2723	2633
Milk	650	680	609	679
<b>Japanese</b>				
Rice	1439	1558	1515	1737 <sup>b</sup>
Tofu	148	215 <sup>b</sup>	136	201 <sup>b</sup>
Tsukudani	2	3	2	3
Green tea	820	1370 <sup>b</sup>	763	1040 <sup>b</sup>
Saimin or udon	332	412 <sup>b</sup>	292	352 <sup>b</sup>
Japanese soup	250	420 <sup>b</sup>	247	389 <sup>b</sup>
Kamabuko	15	19	15	21 <sup>b</sup>
Sashimi	57	77 <sup>b</sup>	52	83 <sup>b</sup>
Dried fish, as mackerel	26	27	22	22
Dried cuttlefish	1	3	1	1
Hakusaizuke	42	50	39	55 <sup>b</sup>
Takuwan	12	17	11	15
Ume	6	9	6	10 <sup>b</sup>

<sup>a</sup> Age adjusted in 5-year age groups by the direct method.

<sup>b</sup> Differs significantly from Nisei at 0.01 level.

Table 4  
Mean values of selected body measurements and dietary intakes by age among Nisei and Issei-Kibei men at 1st examination

Group	Age (yr)	Wt. (kg)	Height (cm)	Left subscapular skinfold (mm)	Serum cholesterol (mg/100 ml)	Calories	Total protein (g)	Animal protein (g)	Total fat (g)	Saturated fat (g)	Total carbohydrate (g)	Sucrose (g)	Starch (g)	Cholesterol (mg)
Nisei	45-49	66.2	164.3	17.5	220.0	2503	103.0	76.9	98.1	36.2	276.4	52.3	168.6	582
	50-54	64.9	164.1	16.9	219.7	2373	98.0	73.0	91.5	33.8	264.4	48.0	162.7	567
	55-59	63.5	163.1	16.6	218.9	2279	95.5	69.9	84.5	31.0	262.6	45.5	164.4	538
	60-64	62.0	162.1	16.3	218.1	2066	85.3	60.7	75.5	27.5	245.9	41.7	156.2	506
	65-69	61.0	160.8	16.0	215.3	1902	81.6	57.9	64.9	23.7	233.8	33.4	151.3	455
Total age-adjusted <sup>a</sup>		64.3	163.6	16.9	219.2	2318	96.0	70.7	88.1	32.4	262.7	46.9	163.0	551
Issei-Kibei	45-49	64.0	162.6	16.9	217.0	2259	91.9	67.5	84.3	31.6	262.8	46.4	166.0	560
	50-54	61.3	161.3	15.4	216.4	2278	93.1	66.7	82.1	30.3	269.1	46.0	170.2	558
	55-59	60.6	160.8	15.4	215.8	2198	88.6	62.5	76.4	28.7	269.8	44.2	174.6	513
	60-64	58.7	159.3	14.7	217.0	2040	85.3	59.4	71.7	26.2	245.5	34.9	162.5	527
	65-69	58.7	159.5	14.2	209.2	1844	74.7	50.3	60.6	22.3	231.3	31.9	157.0	435
Total age-adjusted <sup>a</sup>		61.3 <sup>b</sup>	161.0 <sup>b</sup>	15.6 <sup>b</sup>	216.2 <sup>b</sup>	2201 <sup>b</sup>	89.9 <sup>b</sup>	64.1 <sup>b</sup>	78.9 <sup>b</sup>	29.3 <sup>b</sup>	262.3	43.4 <sup>b</sup>	168.2 <sup>b</sup>	539

<sup>a</sup> Age adjusted in 5-year age groups by direct method.

<sup>b</sup> Differs significantly from Nisei at 0.01 level.

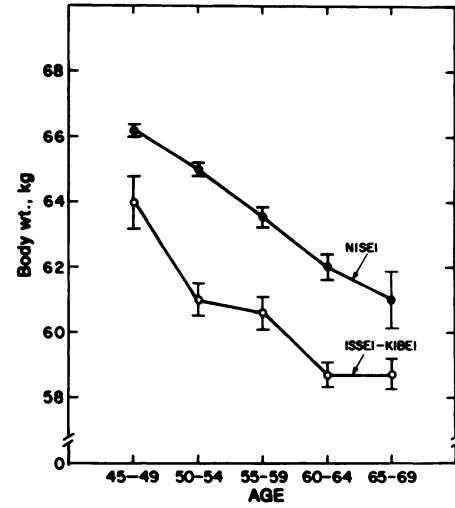


Chart 1. Comparison of body weights of Nisei and Issei-Kibei men by age groups at 1st examination. Values are shown as mean ± S.E.

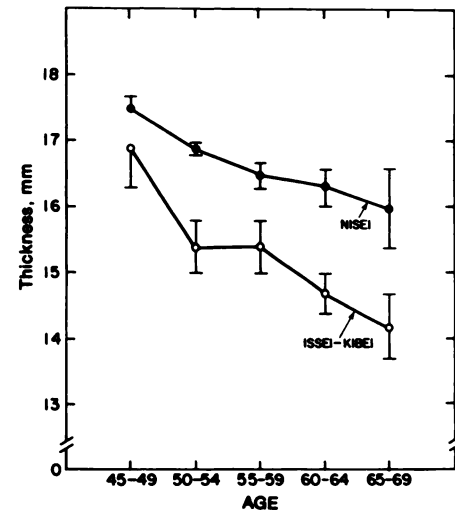


Chart 2. Comparison of subscapular skinfold thicknesses of Nisei and Issei-Kibei men by age groups at 1st examination. Values are shown as mean ± S.E.

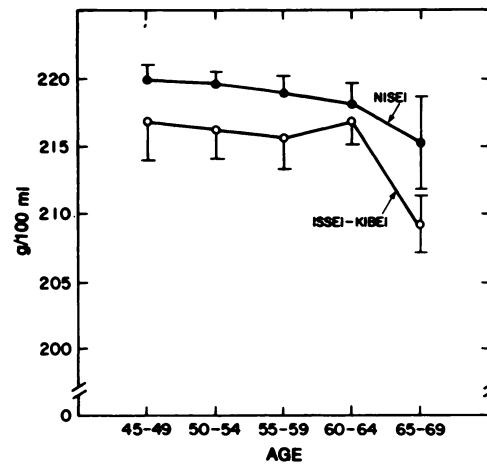


Chart 3. Comparison of serum cholesterol levels of Nisei and Issei-Kibei men by age groups at 1st examination. Values are shown as mean ± S.E.

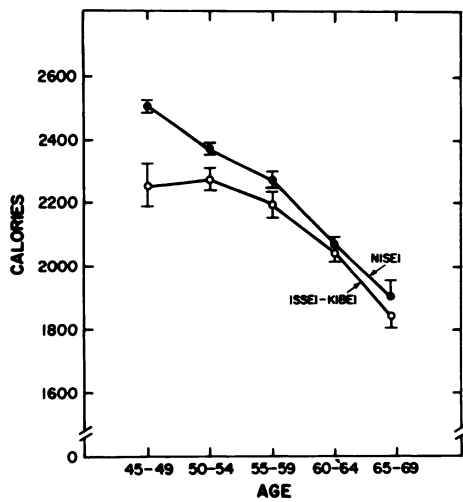


Chart 4. Comparison of total caloric intakes of Nisei and Issei-Kibei men by age groups at 1st examination. Values are shown as mean  $\pm$  S.E.

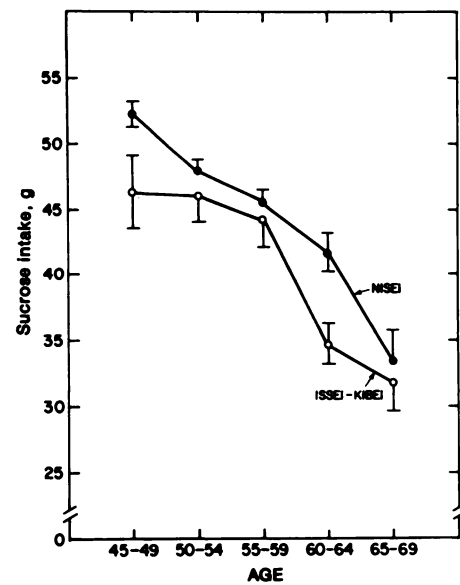


Chart 6. Comparison of dietary sucrose intakes of Nisei and Issei-Kibei men by age groups at 1st examination. Values are shown as mean  $\pm$  S.E.

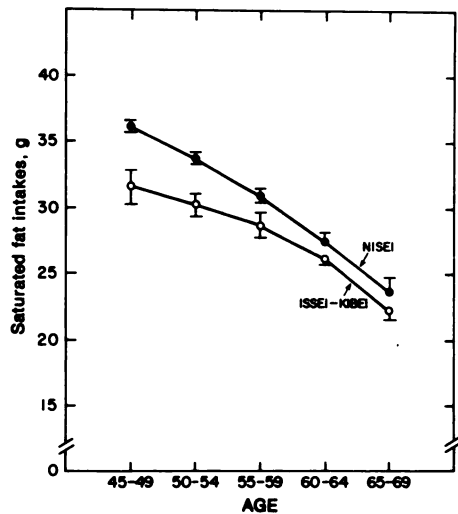


Chart 5. Comparison of saturated fat intakes of Nisei and Issei-Kibei men by age groups at 1st examination. Values are shown as mean  $\pm$  S.E.

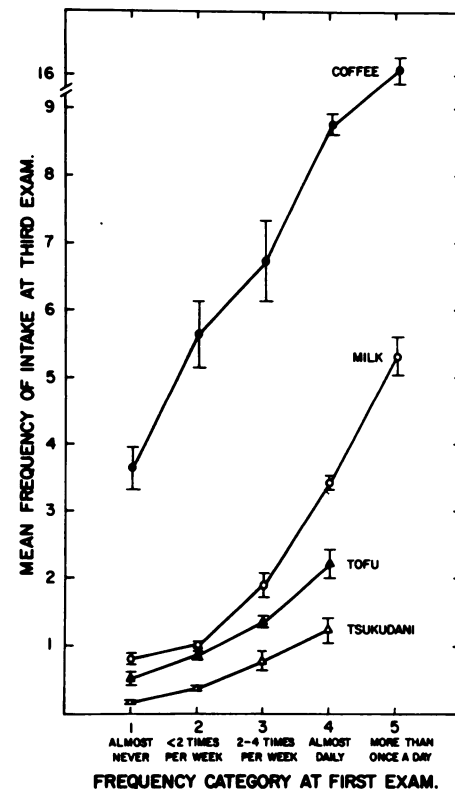


Chart 7. Mean weekly frequencies of intake of coffee, milk, tofu, and tsukudani at 3rd examination of Hawaii Japanese men according to the frequencies reported by the same persons at 1st examination, 6 years previously. Values are shown as mean  $\pm$  S.E.

more apparent.

In general, dietary differences between the Nisei and Issei-Kibei groups were greater for the intakes of particular foods than for nutrients. This may reflect uneven rates of acculturation to different specific food items. Thus, the Nisei eat more meat and beef than the Issei-Kibei, but the overall difference in animal protein and fat intakes is diminished by the absence of a similar difference in milk and ice cream consumption. The heterogeneity found for specific food items supports the usefulness of characterizing diet in this way.

Various studies on diet and cancer have hypothesized that either specific nutrient intakes or food items with carcinogenic potential may be associated with the development of neoplasms (1, 5, 7, 13, 14). Because data are available on both aspects of diet in this prospective study, the question can be investigated in both ways, as sufficient numbers of

cancer cases accumulate. Furthermore, if diet does play a role in oncogenesis, we may eventually observe significant differences in cancer incidence between the Nisei and Issei-Kibei study populations in Hawaii.

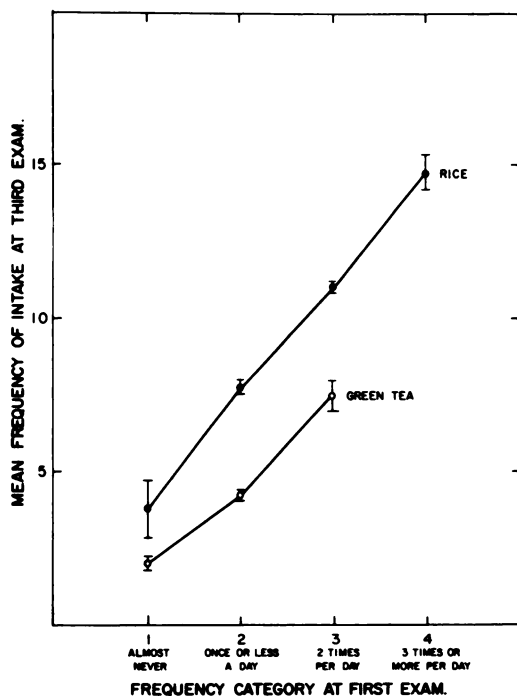


Chart 8. Mean weekly frequencies of intake of rice and green tea at 3rd examination of Hawaii Japanese men according to the frequencies reported by the same persons at 1st examination, 6 years previously. Values are shown as mean  $\pm$  S.E.

**Acknowledgments**

The dietary data at the 1st examination were collected under the supervision of Jeanne Tillotson of the National Heart and Lung Institute.

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