A comparative study of food intake patterns and health indicators between Japanese Americans and Native Japanese —A comparison of incidence of atherosclerosis related indicators between two population Groups—

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Changes of diet and life style can provide substantial effects on health status. The objective of this study was to investigate this kind of effect, and to obtain some suggestions for constructing healthy life style.

We compared the results of detailed questionnaire which was designed to clarify the characteristics of daily life and diet pattern, and measurement of aortic pulse wave velocity between the native Japanese residents continuously living in Japan and Japanese Americans living in Seattle, USA. The former was a population group who had sustained their traditional life style and the latter was a group who had mostly changed their life-styles.

There were many differences between two population groups in their dietary habits. Japanese Americans were fond of foodstuffs rich in fat much more than native Japanese. And this characteristics of Japanese American's dietary habit seemingly increase the prevalence of arteriosclerosis among them. It may suggest that Japanese Americans in Seattle have problems in their daily food intake.

Key words : pulse wave velocity, nutrition, life style, athroscrelosis, Native Japanese, Japanese American

I Introduction

For the past several decades diet patterns and life style of the Japanese people have been gradually changed towards western patterns particularly among the youth. Due to such changes, the

average serum total cholesterol level in the Japanese population has increased 12.2 mg/dl for men and 16.0 mg/dl for 30 years old and over from 1980 to 1990 according to the national surveys (Kosei no shihyou, 1993). It may be predictable that an increase in prevalence of some

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Figure 1 Study Sample

chronic disease occurs in Japan in the future. One way to measure the effects of environmental changes including diet and lifestyle (smoking, drinking, physical activities and others) on disease indicators or disease itself is to compare native Japanese and Japanese Americans who have the same generic background as but different lifestyle from native Japanese in Japan.

In this study, we compared the results of the surveys on eating habit (diet and eating behavior) and lifestyle (smoking, drinking) and the screening results of serum lipid levels and the aortic pulse wave velocity (PWV) between Japanese Americans in Seattle, U.S.A. and native Japanese in Japan.

II Subjects and Methods

The study subjects in Seattle were comprised of 710 male and 736 female Japanese-American residents who participated in cardiovascular disease prevention screening at the Pacific Rim Disease Preventive Center (PDPC) (Figure 1).

Among 1446 participants, 439 males and 391 females participated in the survey on eating habits. The study subjects in Japan consisted of 4,134 native Japanese males and females randomly selected from 31,068 people who underwent the disease prevention screening at the Epidemiological Arteriosclerosis Research Institute (EARI), Japan Labor-Cultural Association. More male-workers underwent the check up than female-workers, reflecting current labor situations in which male workers greatly outnumber female workers in Japan. Among 31,068 native Japanese who were randomly selected, 1,000 males and 841 females participated in the survey on eating habits.

Based on the screening results in both Seattle and Japan, we included examinations of the PWV, serum lipids and lipoproteins, total cholesterol [TC], high density lipoprotein cholesterol [HDL-C], low density lipoprotein cholesterol [LDL-C], triglycerides [TG] and blood pressure in the analysis. To minimize the possible measure-

Figure 2 Method for measuring the aortic pulse wave velocity (PWV)

ment bias, measuring PWV in Seattle was conducted by the medical technicians who were trained at the EARI. All PWV records were sent to the EARI and validated by the same criteria used for native Japanese subjects.

Regarding measurement of serum lipid concentrations, we followed the quality control guideline set by the U.S. Centers for Disease Control and Prevention (CDC): frozen testing serum samples were sent from Seattle to the EARI for quality control testing to confirm that values measured at the EARI were acceptable. Serum lipid samples collected at the PDPC in Seattle were analyzed at the University of Washington Northwest Lipid Research Laboratory, which is the CDC's designated core laboratory.

With regard to PWV, it has long been pointed out that PWV is closely related to modulus of elasticity of the arterial wall (Hallcock, 1934). Ex-

perimental and theoretical grounds for PWV as a noninvasive and quantitative indicator for atherosclerosis were established by Hasegawa (Hasegawa et al., 1970). Furthermore, Otsuka (1973) observed that atherosclerosis is absent for PWV values of less than 8 m/second and present for greater than 9 m/second on the basis of the association between ante mortem PWV values and postmortem pathological observations in aortic arteries among 169 cases. Morishita et al. (1985) followed up patients having onset of cerebrovascular and cardiovascular diseases for one year, and reported significantly high PWV values in those with such diseases than in those without. The PWV measuring method is illustrated in Figure 2. The present study used PWV-200 manufactured by Fukuda Denshi Co., Ltd. Abnormal PWV value was defined as not less than 8.0 m/second for those aged under 60

Table 1 Characteristics of Japanese Americans in Seattle, Washington U.S.A. and native urban Japanese in Japan who participated in screening

	Japanese American				Native Japanese	
	males	N=710	females	N=728	males	N=3,833
	Mean	SD	Mean	SD	Mean	SD
Age	56.4	13.7	55.9	13.6	55.6 *	7.7
BMI (kg/m ²)	25.7	3.2	24.0	3.8	23.8 **	2.7
TC (mg/dl)	224.1	37.8	227.3	41.6	191.1 **	32.4
LDL-C (mg/dl)	139.1	35.3	135.0	38.0	108.6 **	31.1
HDL-C (mg/dl)	51.0	14.0	63.2	16.7	55.4 **	14.3
Triglycerides (mg/dl)	169.8	158.6	143.9	120.5	135.6 *	101.3
TC/HDL ratio	4.7	1.4	3.9	1.3	3.7 **	1.1
Alcohol (g/day)	5.8	11.9	1.3	4.6	27.3 **	22.2
	Number	(%)	Number	(%)	Number	(%)
Drinking Habit						(**)
Non-drinkers	257	36.2	389	53.4	686	17.9
<1 drink/week	157	22.1	212	29.1	378	9.9
1-6 drink/week	157	22.1	98	13.5	621	16.2
1-2 drink/week	89	12.5	24	3.3	516	13.5
3-5 drink/week	44	6.2	4	0.5	1015	26.5
>5 drink/week	6	0.8	1	0.1	617	16.1
Smoking						(**)
Non-smokers	265	37.3	512	70.3	1355	35.4
Current Smokers	109	15.4	66	9.1	1762	46.0
Ex-smokers	336	47.3	150	20.6	716	18.7
Hypertensive Medication	102	14.4	112	15.4	413	10.3 (**)

*p<0.05, **p<0.01 by t-test, (**)p<0.01 by χ^2 test

P show the statistical differences between Japanese American men & Native Japanese men

years and greater than 9.0 m/second for those aged 60 years and over (coded "1" for abnormality and "0" for no abnormality), based on the study findings from showing the association between PWV and other atherosclerotic indicators such as hypertension, abnormal arteriolar changes in the retina and ischemic changes in ECG (Suzuki et al., 1996; Namekata et al., 1995; Namekata et al., 1997).

Japanese American were instructed to fill out, before or after screening, a questionnaire asking age, generation, occupation, past history and risk factors, while native Japanese answered a simple self-recording questionnaires developed by the

EARL. Data were analyzed only for the questions contained in both questionnaires. The instruments for the survey on eating habits were the Japanese questionnaire developed by the EARL for native Japanese and the English one developed jointly by the PDPC and the EARL for Japanese Americans.

Since the questionnaire on nutrition intake for Japanese Americans was newly developed for the present study, its effectiveness had to be confirmed. For that purpose, 75 Japanese Americans were asked to keep records of food items they consumed, the amount and the frequency of consuming each item for four days, including a

Figure 3 Prevalence of Abnormally High* PWV among Japanese Americans and Native Japanese (males and females combined)

*Abnormally high PWV was defined as >8.0 mm/sec for <60 years of age and >9.0 m/sec for ≥60 years of age.

**Age-adjusted

Table 2 Odds ratio for presence of abnormally high PWV among Japanese Americans in Seattle, U.S.A. and native urban Japanese

Variable	Reference	Japanese Americans	Native Urban Japanese
Sex	Female-1.0	0.65**	0.98
Age	<60-1.0	3.60***	0.07***
BMI	<27-1.0	1.08	1.34**
Hypertension	no-1.0	2.01***	2.76***
TC/HDL-C ratio	<4.5-1.0	1.61***	1.28**
Diabetes	no-1.0	3.66***	2.43***
Current drinkers	no-1.0	0.45***	0.85
Ex-drinkers	no-1.0	0.47***	1.07
Current smokers	no-1.0	1.47	1.05
Ex-smokers	no-1.0	1.65**	1.05

*p<0.05, **p<0.01, ***p<0.001

weekend

The statistical methods used were t-tests for average comparisons and χ^2 tests for frequency comparisons. Multiple logistic regression analysis was used to examine the association between PWV and its risk factors, reference levels as the

standard were followed with the most popular numerical values used in the U.S. (Ulene, 1989).

III Results

Table 1 compares variables between Japanese American men and native Japanese men. Most

Table 3 Average nutrition intake of the 4-day food diary among 75 Japanese Americans in Seattle

Sex		Male						Female					
Age		~ 39		40 ~ 59		60 ~		~ 39		40 ~ 59		60 ~	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Height	cm	172.8	3.6	169.9	4.7	168.8	7.4	156.6	8.1	156.5	4.9	155.9	5.3
Weight	kg	67.5	7.8	73.5	11.1	71.7	8.9	51.2	5.1	54.7	7.8	54.9	4.2
Caloric Consumption	Kcal	2419	286	264.3	436	2744	530	1964	349	2008	378	2186	532
Energy	Kcal	1911	336	215.1	513	2184	371	1858	292	1692	431	1778	416
Carbohydrate	g	233.6	65.9	271.3	67.4	288.4	32.9	267.2	66.6	227.8	64.1	265.6	98.8
Carbohydrate/Energy	%	48.4	7.3	51.0	7.4	53.9	8.7	57.0	7.6	53.8	5.3	58.0	7.6
Total-Fat	g	64.9	15.3	75.2	25.4	68.4	26.4	57.9	13.7	54.5	17.2	48.6	7.0
Total-Fat/Energy	%	30.5	5.3	31.0	4.3	27.3	5.7	28.3	6.3	28.9	4.7	25.9	6.4
Mono	g	18.4	6.1	19.2	9.4	16.0	8.7	13.5	5.9	12.7	4.6	11.9	3.1
Poly	g	9.8	3	9.2	3.9	12.0	4.9	8.1	4.8	7.1	3.0	7.7	2.4
Saturated Fat	g	18.9	4.9	22.8	9.5	17.8	11.0	16.1	4.4	16.4	6.5	13.9	2.6
Protein	g	89.2	18.5	93.3	32.5	101.3	21.5	74.3	12.1	76.6	20.1	72.1	21.1
Protein/Energy	g	18.9	3.3	17.2	2.9	18.5	1.4	16.2	2.7	18.2	2.6	16.3	3.2
Vitamin-A	IU	9317	4257	10068	6483	14351	6609	15179	12003	13353	8018	23208	13813
Vitamin-B1	mg	1.9	0.8	1.5	0.4	2.3	0.8	1.7	0.7	1.6	0.6	2.1	1.1
Vitamin-B2	mg	2	1.1	1.8	0.7	2.6	1.0	1.8	0.8	1.7	0.8	2.2	1.3
Vitamin-C	mg	251.5	378.5	163.6	124.0	299.5	215.2	196.4	160.4	210.2	137.0	287.9	191.4
NaCl	g	10.6	5.4	10.9	3.3	10.4	4.0	10.0	2.6	9.2	2.1	8.5	2.3
Calcium	mg	564.7	174.9	952.1	670.7	1020	475.4	755.3	258.8	727.7	276.0	804.7	419.7
Potassium	mg	2588	741	3137	782	4234	649	3025	1124	2961	875	3023	1232
Magnesium	mg	264.9	107.1	251.4	76.3	343.6	67.1	243.0	100.8	245.5	62.5	267.3	128.5
Iron	mg	20.9	10.4	18.9	5.8	24.0	9.0	19.5	10.7	17.7	7.8	22.4	12.5
Cholesterol	mg	337.2	77.2	317.0	109.2	283.2	125.1	253.1	92.2	245.3	86.2	197.1	85.7
Alcohol	g	6.6	4.5	5.9	11.8	7.9	12.2	1.2	3.6	2.5	4.3	4.6	6.5
Alcohol/Energy	%	2.6	1.9	2.0	3.8	2.5	3.9	0.5	1.5	1.2	2.1	2.2	3.1
Diet-Fiber	g	2.1	1.3	3.7	1.6	5.5	2.1	3.5	2.4	4.0	2.5	5.2	1.9

variables showed significant difference in their means between the two population groups implying higher risk for accelerating atherosclerosis among Japanese American men than among native Japanese men. Figure 3 compares prevalence of PWV abnormality between the two population groups by age. Prevalence of abnormally high PWV was high among Japanese American for all age-groups except for 50–59 years of age. Age-adjusted prevalence of abnormally high PWV was 219.7 per 1,000 persons in Japanese Americans, as compared with 148.5 per 1,000 persons in native Japanese. Consequently, the

degree of atherosclerosis seems to be more accelerated for their age in Japanese Americans than in native Japanese (Table 1, Figure 3).

Table 2 shows the relationship of abnormally high PWV with possible risk factors, as expressed in odds ratio. In Japanese Americans, all variables except body mass index (BMI) and current smoking were significantly related to abnormally high PWV. The possible reason for lower risk of abnormally high PWV in males is longevity of females or higher survival rate of stronger males. In contrast, variables that were significantly related to abnormally high PWV in native

Table 4 Frequency of person in categories of shortage, adequate, or excessive nutrition intake based on the 4-day food diary survey among 75 Japanese Americans in Seattle

Nutrition	Males				Females				Total			
	N	shortage	adequate	excessive	N	shortage	adequate	excessive	N	shortage	adequate	excessive
Energy	31	11 (35.5)	13 (41.9)	7 (22.6)	44	13 (29.5)	15 (34.1)	16 (36.4)	75	24 (32.0)	28 (37.3)	23 (30.7)
Protein	31	5 (16.1)	17 (54.8)	9 (29.0)	44	8 (18.2)	18 (40.9)	18 (40.9)	75	13 (17.3)	35 (46.7)	27 (36.0)
Fat	31	8 (25.8)	5 (16.1)	18 (58.1)	44	11 (25.0)	9 (20.5)	24 (54.5)	75	19 (25.3)	14 (18.7)	42 (56.0)
Calcium	31	15 (48.4)	16 (51.6)	/	44	14 (31.8)	30 (68.2)	/	75	29 (38.7)	46 (61.3)	/
Iron	31	1 (3.2)	30 (96.8)	/	44	5 (11.4)	39 (88.6)	/	75	6 (8.0)	69 (92.0)	/
Vitamin-A	31	1 (3.2)	30 (96.8)	/	44	1 (2.3)	43 (97.7)	/	75	2 (2.7)	73 (97.3)	/
-B1	31	3 (9.7)	28 (90.3)	/	44	4 (9.1)	40 (90.9)	/	75	7 (9.3)	68 (90.7)	/
-B2	31	9 (29.0)	22 (71.0)	/	44	7 (15.9)	37 (84.1)	/	75	16 (21.3)	59 (78.7)	/
-C	31	3 (9.7)	28 (90.3)	/	44	2 (4.5)	42 (95.5)	/	75	5 (6.7)	70 (93.3)	/
NaCl	a little too				a little too				a little too			
	N	adequate	excessive	excessive	N	adequate	excessive	excessive	N	adequate	excessive	excessive
	31	18 (58.1)	3 (9.7)	10 (32.3)	44	27 (61.4)	7 (15.9)	10 (22.7)	75	45 (60.0)	10 (13.3)	20 (26.7)

The range of adequate intake= (daily intake/daily recommended dietary allowance (RDAs)) $\times$ 100 : 1) Energy and Fat : 80-100%, 2) Protein : 80-120%, 3) Calcium, Iron, Vitamin-A, Vitamin-B1, Vitamin-B2, Vitamin-C : 100% $\leq$, 4) NaCl : 100% (10g) $\geq$

Japanese included age, BMI, hypertension, TC/HDL ratio and diabetes; current drinking was close to significance level.

However, the logistic model did not reveal the involvement of smoking as higher risk of abnormally high PWV. In contrast, previous smoking was significantly related to abnormally high PWV in Japanese Americans. This can be explained by the fact that in a population with high total cholesterol, the effect of smoking on atherosclerosis is likely to be magnified (Ball and Mann, 1988) and that mean total cholesterol of Japanese American is considerably higher than that of native Japanese. In the logistic model, PWV was significantly related to most of the known atherosclerotic risk factors, showing its appropriateness as the indicator of aortic atherosclerosis.

Table 3 presents the mean nutritional intake, as determined on the basis of the four-day food diary. Table 4 shows distribution of participants into three levels of nutrition intake; "deficient," "adequate" or "excessive". Table 5 shows corre-

lation coefficients (Pearson's product moment correlation coefficient) between daily mean intake of specific nutrients, as determined on the basis of the four-day food diary, and responses to the corresponding questions in the questionnaire on eating habits, developed for Japanese Americans. Since correlation coefficients were within 0.2 to 0.5 and were significant or close to significance for all nutrients, the eating-habits questionnaire developed for Japanese Americans is considered to moderately reflect actual nutritional intake. One unique feature of this questionnaire is that it is designed to assess nutritional intake conditions not only from foods consumed, but also from eating habits. For example, the habit of skipping breakfast or lunch leads to a decrease in the amount of energy and vitamin B1, B2 and C intake. "Eating out frequently" indicates a tendency toward deficiencies in vitamin A and calcium.

To compare nutritional intake conditions of Japanese Americans with those of native Japan-

Table 5 Correlation coefficients between specific nutrient intake of 4-day diary results and responses from its related question of the questionnaire developed among 75 subjects

Between daily average intake of 4-day food diary and response to a specific question in questionnaire	correlation coefficient	p-value	Between daily average intake of 4-day food diary and response to a specific question in questionnaire	correlation coefficient	p-value
Between total energy intake and :			Between total intake of vitamin B1 and :		
1. Frequency of seafood consumption	-0.352	0.008	1. Freq. of eating canned fish products	0.280	0.038
2. Freq. of shellfish consumption	-0.333	0.013	2. Freq. of eating potatoes	-0.288	0.003
3. Freq. of canned fish product consumption	0.341	0.011	3. Amount of fruits consumption	0.272	0.045
4. Freq. of eating deep fried, broiled or smoked seafood	0.323	0.016	4. Freq. of skipping meals (less skipping+)	0.260	0.056
5. Freq. of skipping meals (less skipping)	0.266	0.049	5. Amount of eating vitamin C rich fruits	0.264	0.051
6. BMI	0.440	0.001	6. BMI	0.219	0.108
7. Energy consumption	0.477	0.000	Between total vitamin B2 intake and :		
Between total protein intake and :			1. Freq. of eating seafood	0.226	0.097
1. Frequency of seafood consumption	-0.334	0.013	2. Freq. of eating tofu, abura-age and soy milk	-0.221	0.105
2. Freq. of shellfish consumption	-0.285	0.035	3. Freq. of eating potatoes	-0.299	0.027
3. Deep fried, broiled or smoked seafood	0.308	0.022	4. Amount of fruits consumption	0.221	0.105
4. Freq. of deep fried or smoked seafood	0.269	0.047	5. Freq. of stir-fried dishes	0.296	0.028
5. Speed of eating	0.295	0.029	6. Freq. of skipping meals (less skipping+)	0.211	0.123
6. BMI	0.373	0.005	7. BMI	0.206	0.131
7. Energy consumption	0.388	0.003	Between total vitamin C intake and :		
Between total fat intake and :			1. Freq. of eating green leafy vegetables	0.311	0.021
1. Deep fried, broiled or smoked seafood	0.357	0.007	2. Freq. of eating dark colored vegetables	0.276	0.041
2. Freq. of eating vitamin C rich fruits	-0.270	0.046	3. Freq. of eating stir-fried dishes	0.275	0.042
3. Amount of salad dressing use	0.280	0.039	4. Length of time to eat breakfast	0.281	0.038
4. Freq. of eating snacks at night	0.351	0.009	Between total iron intake and :		
5. Amount of fruits consumption	-0.284	0.036	1. Freq. of eating canned fish products	0.334	0.013
6. BMI	0.391	0.003	2. Freq. of eating potatoes	-0.306	0.023
7. Energy consumption	0.396	0.003	3. Amount of fruits consumption	0.253	0.062
Between total salt (or sodium) intake and :			4. Freq. of eating stir-fried dishes	0.275	0.042
1. Deep fried, broiled or smoked seafood	0.399	0.003	5. Freq. of skipping meals	0.214	0.117
2. Freq. of eating vitamin C rich fruits	-0.319	0.018	Between total calcium intake and :		
3. Amount of salad dressing use	-0.239	0.079	1. Freq. of eating turkey or chicken	0.309	0.022
4. Freq. of eating snacks at night	0.370	0.005	2. Freq. of eating seafood	0.280	0.038
5. Amount of fruits consumption	-0.293	0.030	3. Freq. of eating shellfish	0.279	0.039
6. BMI	0.305	0.023	4. Deep fried, broiled or smoked seafood	0.381	0.004
Between total vitamin A intake and :			5. Freq. of eating green leafy vegetables	-0.299	0.027
1. Freq. of fast food consumption	-0.380	0.004	6. Freq. of eating steamed dishes	0.268	0.047
2. Freq. of bean product consumption	0.341	0.011	7. Freq. of eating out	-0.285	0.035
3. Freq. of eating tofu, abura-age and soy milk	-0.262	0.053	8. BMI	0.227	0.096
4. Freq. of dark colored vegetables	0.230	0.091			
5. Freq. of eating deep fried or rich food	-0.316	0.019			
6. Freq. of eating out	-0.264	0.036			

Q-22.

How often do you eat eggs?

A-1 : More than 2 eggs a day

A-2 : 1 egg a day

A-3 : 5-6 eggs a week

A-4 : 3-4 eggs a week

A-5 : 1-2 eggs a week

A-6 : Never

Q-23

If you answered "Never" to Question 22, why don't you eat eggs?

A-1 : I dislike eggs

A-2 : I have high cholesterol

A-3 : Because they contain high Cholesterol

A-4 : I am allergic to them

A-5 : Others

Q-28.

How often do you eat vegetables?

A-1 : 3 times a day or more

A-2 : Twice a day

A-3 : Once a day

A-4 : 2-3 times a week

A-5 : Seldom

Q-30.

How often do you eat any green Leafy vegetables (such as spinach, and mustard greens)?

A-1 : Twice a day

A-2 : Once a day

A-3 : 3-4 times a week

A-4 : 1-2 times a week

A-5 : Seldom

Figure 4 Comparison of dietary habits between Japanese Americans and native Japanese

Q-38.

How often do you eat dishes
with about 2 tablespoons of
vinegar, lemon, or lime?

A-1 : More than twice a day

A-2 : Every day

A-3 : 2-3 times a week

A-4 : Seldom

Q-47.

Do you eat evening snacks or
late-night snacks?

A-1 : Almost every day

A-2 : 3-4 times a week

A-3 : Never

Q-51.

Do you skip meals?

A-1 : I skip at least twice a day

A-2 : I skip at least twice one meal a day

A-3 : I skip 3-4 meals a week

A-4 : I skip 1-2 meals a week

A-5 : I never skip meals

Q-64.

How full are you after you have
eaten your dinner?

A-1 : Very full

A-2 : Just rich, 70-80%

A-3 : Very light

Figure 4

ese, 830 Japanese Americans and 1,841 native Japanese were asked to fill out the questionnaire on eating habits. Figure 4 shows the results of responses to questions to which Japanese Americans and native Japanese gave remarkably different answers. The results are summarized as follows.

(1) Native Japanese eat eggs more frequently than Japanese Americans (Question 22), and most Japanese Americans who never eat eggs cited their cholesterol value and the high cholesterol content in eggs as the reason (Question 23). This implies that education regarding cholesterol in the U.S. is disseminated well among Japanese Americans.

(2) A greater diversity of vegetable (Question 28, 30),

(3) Dishes with vinegar (Question 38) appeared more frequently in native Japanese than in Japanese Americans.

(4) Japanese Americans eat late-night snacks (Question 47),

(5) Skip meals (Question 51) more frequently than native Japanese.

(6) 99% of Japanese Americans eat until feeling full or feeling 70–80% full at dinner, while 59% of Native Japanese do so (Question 64).

IV Discussion and Conclusion

The Ni-Hon-San study, conducted among Japanese men living in Hiroshima, Japanese American men in Hawaii and San Francisco about 30 years ago, reported mean cholesterol and prevalence of coronary heart disease increasing in the above-listed order. Since living habits and lifestyle of both Japanese and American people have been dramatically changed during the past 30 years a joint study by the PDPC and EARI was launched. As mentioned before, the degree of atherosclerosis is higher in Japan-

ese Americans than in native Japanese; the results of survey on eating habits suggest that such a difference depends to some degree on the difference in eating habits between the two populations. This is also supported by our survey results showing that most Japanese Americans preferred fat-rich food, consumed less potatoes and vegetables, and had irregular eating habits.

Based on the results of the present study, the health status of Japanese Americans in Seattle are considered to be quite similar to that of Japanese Americans in San Francisco, as far as cholesterol levels and prevalence of coronary heart disease (Kagan and Yano, 1996; Namekata, 1998; Ohara et al., 1991).

In conclusion, living in the U.S. mainland may be a disadvantage to Japanese Americans in terms of health. It is true that Japanese Americans are much concerned about their health, reflecting their lower percentages of drinkers and smokers compared with other Americans. Namekata and coworkers (1995) previously reported extremely low physical activity level in Japanese Americans in Seattle (20% active in men and 6% active in women), compared with those of Hawaii (67% active in men). A low physical activity level can result in an increased BMI level and a decrease in HDL cholesterol which is considered to prevent atherosclerosis (Ohara et al., 1991). Also, a low percentage of drinkers among Japanese Americans might have same adverse relation on HDL cholesterol levels, thereby increase the degree of atherosclerosis among the Japanese American population in Seattle. Generally, nutrition and food culture is considered to be positively associated with health, but it is not easy to determine how they actually affect health or a specific disease. In this study, we used the questionnaire specifically designed for Japanese Americans and tested for ef-

fectiveness by comparing the survey results between Japanese Americans and native Japanese. Dietary fiber deficiency due to inadequate vegetable intake and less intake of vitamins A and C which act as antioxidants could be largely involved in the acceleration of atherosclerosis among Japanese Americans in Seattle, although we need to confirm this in future studies.

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