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# Nutrient Intakes of First Generation Korean-Americans in Hawaii

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## Abstract

To evaluate nutrient intakes of the first generation Korean-Americans in Hawaii, a dietary survey was conducted using a food frequency questionnaire which included 139 food items most often consumed among Korean foods and American foods. The questionnaire surveyed 157 first generation Korean-Americans living in Hawaii. The 66.7~81.1% of first generation Korean-Americans in Hawaii were of healthy weight. The mean value of body mass index was the highest in younger men and the lowest in younger women. The mean percentages of calories obtained from their dietary analyses were 61% carbohydrate, 23% fat and 16% protein. The caloric distribution of their diet appeared to be similar between older women and older men, however it was seen that men consumed a higher percent of calories from fat than women among younger subjects. The mean dietary intakes for first generation Korean-Americans exceeded recommended intakes for protein, thiamin, niacin, vitamin A, vitamin C, folacin, phosphorus and iron, but the intakes of energy, riboflavin, vitamin $B_6$, vitamin E, calcium and zinc were lower than the recommended dietary allowance for Americans. Compared with other groups based on age and gender, younger men had significantly ($p<0.05$) higher intakes of riboflavin, phosohorus, iron and zinc, and lower intake of folacin. Older subjects consumed significantly ($p<0.05$) less protein, riboflavin, vitamin $B_6$ and zinc than did younger subjects, and most of the first generation Korean-Americans in Hawaii consumed adequate levels of saturated fatty acid. The ratio, however, of polyunsaturated fatty acid to saturated fatty acid in the diet of younger men was about 0.61, much lower than the recommended ratio of 1.0 and also was significantly ($p<0.05$) lower than that of other subjects. Moreover, cholesterol intakes of younger men were close to the maximum recommended level of 300mg/day.

**Key words:** nutrient intakes, Korean-Americans, Hawaii

## INTRODUCTION

Dietary behaviors are part of the cultural heritage in any community. What people eat and their nutritional status are strongly influenced by food habits and eating patterns (1, 2). When people are relocated from one society to another, differences in both customs and food production capabilities may influence the foods they eat. Nutrient intake patterns within immigrant groups will be changed according to the changes in their food habits.

The nutrient intakes of modern Native Americans exhibit some common characteristics. Intakes of dietary fiber (3-5) and complex carbohydrates (4) in Native American diets are often below recommended levels, as are intakes of calcium (4-6), ascorbic acid (5,6), vitamin A (6,7), iron (5), and zinc (4). Some of these nutrient imbalances can be linked to the adoption of highly westernized diets by these Native Americans, particularly by children and adults (3-9). Substitution of a Westernized diet (high in fat, low in fiber and complex carbohydrates) for the traditional diet (low in total and saturated fat, high in complex carbohydrates) resulted in significant increases in body weight, body fat, and plasma lipids (10). Thus, diet is an environmental factor that has been changed concomitantly with the life style change noted.

Many Koreans who have immigrated to the United States may employ a mixed diet and have a little change in their nutrient intakes. There, however, have been few studies on nutrient intakes among Korean-Americans living in the United States except reports on food beliefs and diets of pregnant Korean-American women and dietary calcium intakes of elderly Korean-Americans (11,12). Therefore, this study was designed to explore nutrient intakes of the first generation Korean-Americans in Hawaii and to compare their nutrient intakes with recommened dietary allowance (RDA) for Americans (13).

## METHODS

### Subjects and dietary assessment

Subjects were recruited from a local community, and questionnaires were completed by subjects during October and November, 1997. The subjects were consisted of 157 first generation Korean-Americans in Hawaii. The age for participants was over 25 years old. The subjects were classified into the two age groups by RDA for Americans, one from 25 to 50 years old and the other from 51+years old. Approximately 39 percent of the subjects were men and 61 percent were women (Table 1).

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Table 1. Anthrophometric characteristics of the subjects

| Characteristics | Women | | Men | |
|---|---|---|---|---|
| | Younger[1] (n=53) | Older (n=42) | Younger (n=34) | Older (n=28) |
| Mean age (yr) | 39.7±7.1[2] | 65.5±11.3 | 40.1±6.8 | 66.6±7.8 |
| Weight (kg) | 55.6±7.2 | 56.9±7.3 | 71.9±12.3 | 65.3±8.4 |
| Height (cm) | 160.4±3.9 | 157.5±4.7 | 171.1±5.2 | 166.9±5.3 |
| Body mass index (BMI, kg/m$^2$) | 21.7±2.6 | 22.9±2.6 | 24.5±4.1 | 23.4±3.5 |
| BMI<19 (%) | 13.2 | 11.9 | 2.9 | 3.6 |
| 19≤BMI≤25 (%) | 81.1 | 66.7 | 67.7 | 78.6 |
| BMI>25 (%) | 5.7 | 21.4 | 29.4 | 17.8 |

[1]Younger=Age 25~50 yr ; Older≥Age 51±1 yr
[2]Mean±SD

A Food frequency questionnaire was used to obtain data pertaining to the daily food intakes of subjects. The food frequency questionnaire included 139 food items most often consumed among Korean foods and American foods. The food items used in the food frequency questionnaire were selected on the basis of results obtained from the preliminary test using 3-day food records of the first generation Korean-Americans in Hawaii. A daily number of serving of each food item was calculated for each subject (14). The daily food intake of each food item was obtained by multipling the daily number of serving by serving size of the food item. Height and weight informations of the subjects were also obtained from the questionnaires. Body mass index (BMI, weight divided by the square of height in kg/m$^2$) to assess obesity was calculated.

### Energy and nutrient analysis

The daily food intake data of each subject were entered into a computer. Energy and nutrient intakes were analyzed using a nutrient analysis program (15). American foods used in the food frequency questionnaire were added to the nutrient database, and there were no missing data as a result of the addition of American foods. Percentage of the RDA for Americans was also determined as the basis for the comparison of the nutritional values of the diets. Because the RDAs for specific age and gender groups are different, nutrient intakes were compared with percentage of the RDAs for all groups.

### Statistical analysis

Statistical analyses were performed using the Statistical Analysis System (SAS) (16). Mean and standard deviations for the energy and nutrient intakes were determined. Analysis of variance (ANOVA) was used to determine possible differences in energy and nutrient intakes among the groups based on age and gender; Duncan's multiple range test was used for post hoc comparisions if significant group differences were found.

## RESULTS AND DISCUSSION

### Anthrophometric characteristics

The anthrophometric characteristics of the subjects are shown in Table 1. The subjects ranged in age from 25 to 85 years old; the mean ages were 39 years in the younger women group, 40 years in the younger men group, 65 years in the older women group and 66 years in the older men group, respectively. The mean and standard deviation of height, weight and BMI was calculated. Younger women had lower mean value for weight than that of older women, though the mean value for height was higher in younger women than older women. On the other hand, the mean values for weight and height of younger men were higher than those of older men.

A BMI is currently the preferred weight for-height standard used to define healthy weight. In 1995, the U.S. National Institutes of Health and the American Health Foundation issued new guidelines that defined healthy weight as a BMI below 25. A BMI value greater than 25 is considered as an indication of obesity. Thinness is defined by a BMI of less than 19. A healthy weight for height is a BMI 19 to 25 (17). The mean value of BMI in the first generation Korean Americans was the highest in younger men and the lowest in younger women. The 66.7~81.1% of subjects were of healthy weight by the BMI criterion, although there was a little difference in the proportion of subjects who belonged to healthy weight according to age and gender groups. The small proportion of subjects, the 11.9~13.2% of women and the 2.9~3.6% of men, were thin on the basis of BMI. On the other hand the proportion of younger women, older women, younger men and older men who were obese by the BMI criterion was 5.7%, 21.4%, 29.4% and 17.8%, respectively. In a recent study, 59% of adult Americans exceeded healthy weight and met the current definition of clinical obesity (17). Compared with high percentage of obesity in these adult Americans, the low percentage of obesity in the first generation Korean-Americans may be attributable to the fact that most of them still keep up their original food habit, even if a little dietary change has occured among them (14).

### Energy and nutrient intakes

Table 2 shows daily energy and nutrient intakes of the first generation Korean-Americans in Hawaii by age and gender group. As a whole, younger subjects consumed more

**Table 2.** Daily energy and nutrient intakes of the first generation Korean-Americans in Hawaii by gender and age group

| Nutrients | Women | | Men | |
|---|---|---|---|---|
| | Younger[1] (n=53) | Older (n=42) | Younger (n=34) | Older (n=28) |
| Energy (kcal) | 2006.14±108.90[2] | 1704.30±138.50 | 2618.12±357.1 | 2056.87±252.31 |
| Protein (g) | 84.86±4.58 | 62.13±8.42 | 116.61±21.59 | 74.86±10.37 |
| % kcal | 16.71±1.03 | 14.71±1.39 | 17.28±1.51 | 14.42±2.26 |
| Carbohydrate (g) | 302.38±11.78 | 272.73±16.79 | 361.37±33.53 | 326.63±38.83 |
| % kcal | 60.29±1.67 | 64.01±3.38 | 55.21±3.28 | 63.52±3.16 |
| Fat (g) | 51.27±6.54 | 40.32±10.15 | 80.03±19.12 | 50.42±14.23 |
| % kcal | 23.00±2.56 | 21.29±3.88 | 27.51±4.98 | 22.06±4.50 |
| Vitamin A (RE) | 958.29±228.16 | 740.56±193.12 | 896.71±293.71 | 747.28±168.49 |
| Thiamin (mg) | 1.90±0.11 | 1.70±0.20 | 2.21±0.30 | 1.80±0.21 |
| Riboflavin (mg) | 1.31±0.18 | 1.03±0.15 | 1.80±0.31 | 1.17±0.19 |
| Niacin (mg) | 23.23±3.35 | 20.09±3.43 | 27.51±3.64 | 22.93±3.25 |
| Vitamin $B_6$ (mg) | 1.76±0.33 | 1.33±0.13 | 2.12±0.41 | 1.57±0.32 |
| Vitamin C (mg) | 138.00±48.85 | 108.26±32.38 | 121.86±63.2 | 107.42±41.51 |
| Vitamin E (mg) | 5.86±1.12 | 5.57±1.18 | 7.85±1.88 | 6.86±1.25 |
| Folacin (μg) | 307.57±68.78 | 236.40±37.20 | 236.43±102.58 | 240.29±54.21 |
| Calcium (mg) | 613.86±121.37 | 561.29±62.05 | 730.28±204.31 | 559.43±108.92 |
| Phosphorus (mg) | 1107.86±118.03 | 963.57±76.67 | 1310.43±326.68 | 1063.86±130.22 |
| Iron (mg) | 15.50±1.94 | 13.52±1.36 | 18.89±27.91 | 15.31±1.87 |
| Zinc (mg) | 9.74±1.06 | 7.87±1.23 | 13.12±2.87 | 8.99±2.10 |

[1]Younger = Age 25~50 yr ; Older≥Age 51+yr
[2]Mean±SD

energy and major nutrients than did older subjects. The mean intakes of calorie, protein, and fat in younger men exceeded those for younger women. The mean intakes of vitamin A, vitamin C and folacin were higher in younger women than in younger men. The calorie distribution of the diet was similar between older women and older men; 14~15% of energy from protein, 63~64% from carbohydrate, and 21~22% from fat. The calorie distribution of diet, however, was different between the two younger groups. Younger men consumed more percent of energy from fat than did younger women.

Fig. 1 shows mean percentage of energy from carbohydrate, protein and fat of the first generation Korean-Americans in Hawaii. The mean percentages of energy nutrients obtained from their dietary analyses were 61% carbohydrate, 23% fat and 16% protein. The mean percentages of energy nutrients recommended for Americans were 60% carbohydrate, 30% fat and 10% protein (18). On the other hand, the mean percentages of energy nutrients recommended for Koreans were 60~70% carbohydrate, 20% fat and 15% protein (19). These facts may be attributable to the differences of dietary patterns and nutritional policies between these two countries. The intake patterns of energy nutrients in the first generation Korean-Americans were more similar to the percentage recommended for Koreans than to the percentage recommended for Americans, even if they consumed less carbohydrate and more fat than did Koreans in Korea (19). Lower intake of fat than the recommended level for Americans may be related to low intakes of American foods such as rich desserts and fast foods (14), and needs to be encouraged.

All nutrient intakes were compared with the RDA as a standard to evaluate the nutritional quality of the diets. Evaluation of nutrient intake in comparison with the RDA is an important step in determining the adequacy of dietary pattern. Fig. 2 shows mean percentage of RDA for Amer-

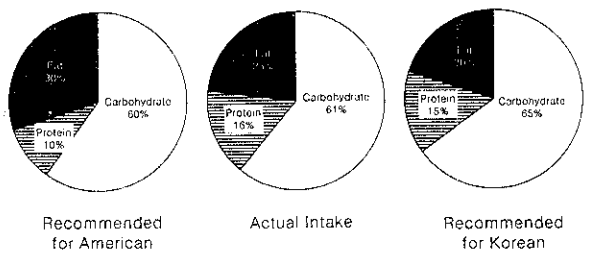


**Fig. 1.** Mean percentage of energy from carbohydrate, protein and fat of the first generation Korean-Americans in Hawaii.

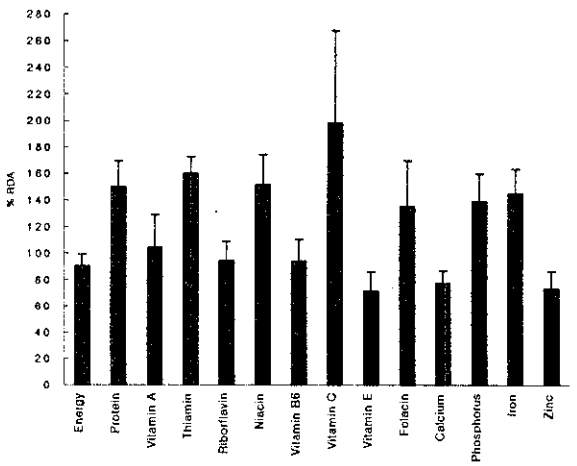


**Fig. 2.** Mean percentage of Recommended Dietary Allowance (RDA) for Americans of energy and nutrient intakes of the first generation Korean-Americans in Hawaii.

icans of energy and nutrient intakes of the first generation Korean-Americans in Hawaii. The mean dietary intakes of the first generation Korean-Americans were found to exceed recommended intakes for protein, thiamin, niacin, vitamin A, vitamin C, folacin, phosphorus and iron. Their intakes for energy, riboflavin, vitamin $B_6$, vitamin E, calcium and zinc were lower than RDA for Americans. The low intakes of energy may be related to the facts that the average subject in the first generation Korean-Americans was smaller than the RDA reference subject, and thus actually required less energy. The high intakes of thiamin and niacin may be attributable to their large intake of rice, whereas the low intake of calcium may be related to low intake of milk products. Milk products are not a part of the traditional Korean diet, so the less acculturated the first generation Korean Americans, the less likely they would be to include milk and milk products in their diet. This fact is consistent with previous study (14) that the first generation Korean Americans did not have much change in their food habits and continued to prefer their traditional foods.

Table 3 shows the percentage of RDA for Americans of energy and nutrient intakes of the first generation Korean Americans in Hawaii by age and gender group. By means of one-way analysis of varience, the age and gender groups of the first generation Korean-Americans in Hawaii were compared with respect to their intakes of energy and nutrients as a percentage of the RDA. The four groups were significantly ($p<0.05$) different in their intakes of nine of the thirteen nutrients. Mean intakes of energy, niacin, vitamin C, vitamin E and calcium were not significantly different among the groups. Compared with other groups, younger men had significantly ($p<0.05$) higher mean intakes of riboflavin, phosohorus, iron and zinc, and lower mean intake of folacin. Conversely, the mean intakes of vitamin A, folacin and vitamin $B_6$ of younger women were significantly ($p<0.05$) higher than those of other subjects. Older subjects consumed significantly ($p<0.05$) less protein, riboflavin, vitamin $B_6$ and zinc than did younger subjects. The results also indicated that younger subjects had higher intakes of energy, vitamin C, vitamin E and calcium than did older subjects, but significant differences in their intakes were not detected. Thus, nutrient intakes of younger subjects of the first generation Korean-Americans in Hawaii seem to be adequate for most nutrients, with the exception of calcium, vitamin E and zinc. However, older subjects consumed less than adequate amounts of riboflavin, vitamin $B_6$, vitamin E, calcium and zinc. Park (20) reported persons of these age groups living in Korea also had low intakes of calcium, vitamin A, riboflavin and iron. These nutrient intakes of the first generation Korean-Americans in Hawaii were high compared with intakes reported for persons of same age group in Korea. These findings suggest that the overall nutritional quality of diets of the first generation Korean-Americans in Hawaii was better than that of persons of same age group in Korea.

Table 4 shows cholesterol and fatty acid intakes of the first generation Korean-Americans in Hawaii by age and gender group. According to the recommendation of the National Cholesterol Education Program, the intake of saturated fatty acid should be less than 10 percent of calories and the recommended ratio of polyunsaturated fatty acid to saturated fatty acid in the diet should be 1.0 (21). The first generation Korean-Americans in Hawaii had an adequate intake of saturated fatty acid (<10% of total calorie). The ratio of polyunsaturated fatty acid to saturated fatty acid in the diet was about 0.98~1.06, that is similar to the recommended ratio of 1.0, for the first generation Korean-Americans except younger men. The ratio of polyunsaturated fatty acid to saturated fatty acid in the diet of younger men

**Table 3.** Percentage of Recommended Dietary Allowances for Americans of energy and nutrient intakes of first generation Korean-Americans in Hawaii by gender and age group (%)

| Energy and nutrients | Women | | Men | |
|---|---|---|---|---|
| | Younger[1] (n=53) | Older (n=42) | Younger (n=34) | Older (n=28) |
| Energy | 91.29±4.95[2] | 89.86±7.38 | 90.14±12.25 | 90.00±10.54 |
| Protein | 169.71±9.16[a] | 124.29±13.96[b] | 184.86±34.23[a] | 121.43±20.53[b] |
| Vitamin A | 129.86±28.52[a] | 102.57±24.14[ab] | 99.71±29.37[ab] | 84.71±16.85[b] |
| Thiamin | 173.00±9.62[a] | 170.04±7.56[a] | 147.29±16.63[b] | 150.00±16.72[b] |
| Riboflavin | 101.14±13.75[ab] | 85.71±12.28[b] | 106.71±18.04[a] | 83.71±13.75[b] |
| Niacin | 154.86±22.41 | 154.71±26.30 | 144.86±19.13 | 152.71±21.67 |
| Vitamin $B_6$ | 110.00±20.84[a] | 83.00±8.05[bc] | 104.29±20.43[ab] | 78.57±16.01[c] |
| Vitamin C | 230.02±81.41 | 180.43±53.94 | 203.00±75.33 | 179.03±67.75 |
| Vitamin E | 73.29±14.01 | 64.57±12.19 | 78.57±18.84 | 68.57±12.45 |
| Folacin | 170.86±38.23[a] | 131.29±20.58[ab] | 118.43±51.29[b] | 120.57±26.96[b] |
| Calcium | 76.86±15.15 | 70.29±7.81 | 92.29±26.89 | 70.01±13.52 |
| Phosphorus | 138.43±14.78[ab] | 120.29±9.60[a] | 163.86±40.67[a] | 134.86±17.19[ab] |
| Iron | 103.43±12.85[c] | 135.29±13.66[b] | 188.86±27.90[a] | 153.14±18.66[b] |
| Zinc | 81.29±8.83[ab] | 65.71±10.32[bc] | 86.14±19.19[a] | 59.71±13.96[c] |

[1]Younger = Age 25~50 yr ; Older≥Age 51+yr

[2]Mean±SD

[abc]Within in a row, values not sharing a common superscript differed significantly according to one-way analysis of variance and Duncan's multiple range test ($p<0.05$)

**Table 4.** Cholesterol and fatty acid intakes of the first generation Korean-Americans in Hawaii by gender and age group

| | Women | | Men | |
|---|---|---|---|---|
| | Younger[1] (n=53) | Older (n=42) | Younger (n=34) | Older (n=28) |
| PUFA (g) | 14.00±2.88[2] | 12.29±3.65 | 15.57±5.21 | 13.86±6.62 |
| % kcal | 6.43±1.29 | 6.49±1.93 | 5.35±1.79 | 6.06±2.90 |
| MUFA (g) | 15.29±5.47[b] | 12.14±2.75[b] | 28.29±9.15[a] | 17.14±7.90[b] |
| % kcal | 6.86±2.45[b] | 6.41±1.45[b] | 9.72±3.15[a] | 7.60±3.46[b] |
| SFA (g) | 15.71±2.43[b] | 11.43±3.74[b] | 26.57±6.07[a] | 14.14±4.67[b] |
| % kcal | 7.05±1.09[b] | 6.04±1.98[b] | 9.13±2.09[a] | 6.19±2.04[b] |
| CHOL (mg) | 212.86±33.57[b] | 187.43±33.54[b] | 294.86±102.89[a] | 205.57±75.70[b] |
| P : S | 0.95 : 1.00 | 1.06 : 1.00 | 0.61 : 1.00 | 0.98 : 1.00 |
| P : M : S | 0.95 : 1.04 : 1.00 | 1.06 : 1.05 : 1.00 | 0.61 : 1.09 : 1.00 | 0.98 : 1.25 : 1.00 |

[1]Younger = Age 25~50 yr ; Older≥Age 51+yr
[2]Mean±SD
[ab]Within in a row, values not sharing a common superscript differed significantly according to one-way analysis of variance and Duncan's multiple range test($p<0.05$)
PUFA(P): polyunsaturated fatty acid, MUFA(M): monounsaturated fatty acid, SFA(S): saturated fatty acid, CHOL: cholesterol

was about 0.61, much lower than the recommended ratio of 1.0 and also was significantly ($p<0.05$) lower than those of younger women and older subjects. Moreover, cholesterol intakes of younger men were similar to the maximum recommended level of 300 mg/day. Conversely, the cholesterol intakes of younger women and older subjects were significantly ($p<0.05$) lower than that of younger men. Thus, the intakes of saturated fatty acid and cholesterol were adequate for younger women and older subjects, but their intakes in younger men appeared to be inadequate. This may be due to the fact that younger men adopted more Western fatty foods such as sausages, bacons and hamburgers than did other groups (14).

At present, studies of nutritional status among Korean-Americans living in the United States of America are limited. This study provides data on nutrient intakes of the first generation Korean-Americans living in Hawaii. It suggests that younger men among them had high intakes of saturated fatty acid and cholesterol. Further studies using biochemical and other physiological parameters are recommended to determine the significance of these findings.

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