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Socioeconomic, Acculturation, and Lifestyle Factors Affecting the Dietary Patterns of Korean-Americans in California

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This study was conducted to define dietary patterns and to evaluate the effects of socioeconomic, acculturation and lifestyle factors on dietary patterns among 2,746 Korean-Americans in California. It was a cross-sectional telephone survey based on a representative sampling of individuals with a Korean surname using residential phone listings. It was conducted using a food frequency questionnaire that covered 20 food items, socioeconomic variables such as age, gender, income, education and acculturation, and lifestyle factors such as body weight, alcohol consumption, smoking, exercise and consumption of fast food. Four dietary patterns were identified: American Foods (AF), American Breakfast (AB), Korean Foods (KF) and Vegetables (V). AF was associated with younger men, acculturation and fast food consumption. AB was associated with women, higher education, current smoking and fast food consumption. KF was associated with acculturation and lower socioeconomic status. V was associated with lifestyle factors such as smoking, exercising and fast food consumption. The results of the study showed that socioeconomic and lifestyle factors influenced the dietary patterns of Korean-Americans. This should be considered when dietary interventions are designed for Korean-Americans to improve their health status.

Keywords: Dietary patterns, Factor analysis, Acculturation, Korean Americans

INTRODUCTION

There has been an increasing interest in examining the relationships between the dietary patterns and other factors such as socioeconomic characteristics or certain diseases because the components of socioeconomic, demographic, cultural, and lifestyle factors are interrelated with the dietary patterns.[1-4] Analyzing an overall dietary pattern involves characterizing people who adhere to specific dietary patterns and targeting them with public health services in order to improve their health status or prevent chronic diseases.[1,5]

Several studies have reported that dietary patterns are associated with socioeconomic status, lifestyle, ethnicity and biomarkers. Sanchez-Villegas et al.[6] found that young, sedentary and single Spanish men were more likely to have a western dietary pattern. Martikaninet et al.[3] reported that smoking and non-exercise among middle-aged British people was related to an unhealthy diet. Wirfalt et al.[7] found that body mass index and the distribution of gender were different across food pattern clusters for middle-aged Americans. Akin et al.[8] found that ethnic group membership and residence status were the most important socioeconomic factors associated with differences in food patterns among older Americans using the National Food Consumption Survey (NFCS) sample. Fung et al.[9] found that a western dietary pattern was positively associated with insulin, leptin and homocysteine concentration while a prudent dietary pattern was positively associated with plasma folate concentration among U.S. male health professionals.

Since immigrant populations are growing dramatically in the U.S., the health status of immigrant and ethnic groups is an important public health concern.[2]

Kim et al.[10] found that male, highly educated, married Korean-Americans tended to consume a greater amount of calories, protein, total fat and cholesterol. Yang et al.[4] found that a vegetable/fruit dietary pattern was positively associated with length of residence in the U.S. and education level among Korean-American women. Satia et al.[11] found that younger, highly educated working Chinese-American and Chinese-Canadian women had the highest score on a western dietary scale.

Recently, several studies have focused on dietary changes by acculturation for ethnic groups.[11-14] Even though acculturation is an important factor affecting the

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dietary patterns of ethnic groups, few studies have analyzed dietary patterns and important environmental factors such as acculturation and other lifestyle factors.

The purpose of this study was to define clinically important dietary patterns based on food frequency data and to evaluate the effects of socioeconomic, acculturation and lifestyle factors on major dietary patterns among Korean-Americans in California.

METHODS

1. Sampling

Data in this study was drawn from a larger study of tobacco use and health risks among California residents of Korean descent. Telephone interviews were conducted with Korean-American adults over 18 years of age in California. Specific procedures for sampling and interviewing are described in previous studies.[15]

The sampling was based on a random sample of persons with Korean surnames who had listed telephone numbers in the directory of California and all potential respondents were filtered to ensure that they were of Korean descent during the introduction of the survey. Interviews were administered in Korean or English depending on their preference. A total of 2,746 people completed the survey with a response rate of approximately 86.6%. Korean was the language used in about 88% of the interviews. The Institutional Review Board of San Diego State University approved all procedures.

2. Dietary Patterns

Data on dietary patterns were assessed using a food frequency questionnaire that covered 20 food items. The 20 major food items were adapted from a pilot study and other studies with Korean-Americans.[16-17]

Frequency of consumption of each food item was measured in six categories, "twice a day or more", "once a day", "4-6 times a week", "1-3 times a week", "1-2 times a month", and "less than once a month". Responses were converted to a weekly consumption rate for further analysis.

Dietary patterns were identified by factor (principal components) analysis of 20 food items with loadings rotated to a simple structure by varimax criteria. Four orthogonal factors were identified after five food items had been excluded due to low communalities.

3. Socioeconomic Characteristics

Respondents were asked about their socioeconomic characteristics including age, gender, family income, marital status, education level, number of people per household, and acculturation level. Family income was originally assessed as total income last year before taxes using a six-category ordinal scale from less than $20,000 to over $80,000 and reduced to a three category ordinal scale with less than $40,000, $40,000-80,000, and greater or equal to $80,000 for simplicity. Education level was measured by asking the number of years of formal schooling completed. Acculturation level was drawn from the previous study[12] and respondents were classified into three groups – traditional, bicultural, and acculturated by cluster analysis. The traditional group accounted for 79.4 percent of total respondents and the acculturated group accounted for 5.9 percent.

4. Body Weight and Lifestyle Characteristics

Respondents were asked about lifestyle characteristics including height, body weight, smoking status, alcohol consumption, exercise and fast food consumption. Body mass index (BMI) was calculated from the reported height and weight and respondents who had a BMI of less than 25 were classified as normal and those with a BMI of 30 and above were classified as obese.[18]

Smoking status was measured by classifying respondents who smoked at least 100 cigarettes during the lifetime and smoked currently as a "current smoker", those who smoked at least 100 cigarettes but none currently, as a "former smoker", and people who never smoked 100 cigarettes and none currently, as a "non-smoker" or "never- smoked".[19]

Other lifestyle practices were dichotomized. Alcohol consumers were dichotomized as "drinkers" if they reported any alcohol consumption in the past month. Otherwise, they were listed as non-drinkers. Exercise was measured based on the number of times that the respondent had engaged in vigorous exercise for at least 20 minutes continuously during a typical week. People who reported exercising 3 times or more per week were classified as "exercisers". All others were classified as non-exercisers. People who reported consuming fast food less than once a week were classified as "non-fast food eaters" while the others were listed as "fast food eaters".

5. Statistical Analysis

All statistical analyses were performed using the Statistical Analysis System.[20] Factor analysis was used to define dietary patterns using the principal component method with varimax rotation after standardization of each variables. To examine the trend of all variables associated with dietary patterns, the chi-square test for categorical and the generalized linear model for continuous variables were used for quintile groups of each dietary pattern. Multiple regression analysis was used to fit the model for each dietary pattern.

RESULTS

Among respondents, the mean age was 46.9 years (SD=15.5), 47 percent were male, mean years of living in the U.S. was 17.4 (SD=9.1) and mean education years was 14.9 or initial college level. These data correspond closely with figures for California reported in the 2000 U.S. Census.[15,21]

Table 1. Factor loading matrix for the major dietary components from food-frequency questionnaire

	Factor 1 American Food	Factor 2 American Breakfast	Factor 3 Korean Food	Factor 4 Vegetable	h^2
Beef	0.73	0.02	0.00	0.05	0.53
Pork	0.66	0.01	0.15	0.00	0.46
Chicken	0.63	0.09	-0.21	0.05	0.45
Fried Food	0.50	0.22	-0.10	0.00	0.30
Soda	0.45	0.04	0.01	-0.22	0.25
Cheese/yogurt	0.10	0.65	-0.02	-0.10	0.44
Butter/margarine	0.14	0.61	-0.09	0.00	0.39
Milk	-0.07	0.60	0.18	-0.02	0.40
Bread	0.00	0.55	-0.25	0.13	0.38
Oil based dressing	0.15	0.44	-0.11	0.14	0.25
Egg	0.31	0.35	0.19	-0.11	0.26
Rice	-0.03	-0.09	0.87	0.07	0.77
Kimchi	-0.03	-0.05	0.87	0.13	0.77
Yellow/white vegetable	-0.03	0.00	0.08	0.86	0.74
Green vegetable	-0.05	0.06	0.09	0.85	0.74
Percent Total Variance Explained	16.7	12.1	10.4	8.4	47.64

Numbers are loadings for principal components (Factor 1 trough Factor 4) and item communalities (h^2).

Table 1 presents the four dietary patterns identified by factor analysis. Factor 1 included beef, pork, chicken, fried foods and soda as being major ingredients of an American diet and was labeled as "American Food." Factor 2 included milk, cheese/yogurt, butter/margarine, bread, oil-based dressing, and egg, which are major ingredients of a typical American breakfast and was labeled "American breakfast." Factor 3 included rice and kimchi (fermented cabbage), which are main components of Korean meals and was labeled "Korean Food." Factor 4 included green and yellow/white vegetables and was labeled "Vegetable." For purposes of analysis and presentation, each factor was divided into quintiles.

Table 2 presents socioeconomic and lifestyle characteristics according to quintiles of American food and American breakfast patterns.

Individuals who had higher scores on the American food pattern were more likely to be younger, male, single and acculturated, and to have a slightly higher income, education and more people per household compared to individuals who had lower scores. Regarding Body Mass

Table 2. Socioeconomic and lifestyle characteristics according to quintiles of "American Food" and "American Breakfast" patterns for Korean Americans in California

	American Food			P for	American Breakfast			P for
	Q1	Q3	Q5	trend	Q1	Q3	Q5	trend
Socioeconomic characteristics								
Age (y)	54.9 (15.2)	46.3 (14.4)	39.6 (14.8)	0.001	48.6 (15.0)	46.9 (15.8)	45.4 (15.7)	0.015
Gender (% male)	31.5	45.9	65.2	0.001	51.1	47.5	36.9	0.001
Income (%)				0.001				0.045
<40,000	44.5	35.8	28.5		41.3	29.3	32.7	
40,000-80,000	37.8	42.7	40.2		37.6	40.4	40.9	
>80,000	17.7	21.5	31.3		21.2	26.3	26.4	
Marital Status (%)				0.001				0.621
Single	8.7	14.0	33.5		16.0	16.3	17.6	
Married	75.7	80.8	64.6		75.7	77.2	77.2	
Widowed	15.6	5.2	1.9		8.3	6.5	5.2	
Education (y)	14.2 (3.4)	15.0 (2.9)	15.1 (2.6)	0.001	14.3 (3.1)	15.0 (2.8)	15.3 (2.8)	0.001
Persons in household (n)	2.8 (1.3)	3.5 (1.7)	3.4 (1.3)	0.001	3.2 (1.5)	3.3 (1.6)	3.3 (1.3)	0.599
Acculturation level (%)				0.001				0.001
Traditional	88.4	81.6	61.9		86.9	78.7	74.3	
Bicultural	8.4	13.8	23.7		10.0	15.7	19.0	
Acculturated	3.3	4.6	14.4		3.1	5.7	6.8	
Lifestyle characteristics								
BMI (kg/m^2)	23.2 (3.8)	23.1 (3.0)	23.2 (3.4)	0.831	23.5 (3.4)	23.1 (3.1)	22.7 (3.1)	0.004
Obesity (%) (BMI ≥ 30)	3.0	2.8	3.1	0.480	2.7	2.5	1.6	0.031
Smokers (%)	8.5	14.4	29.3	0.001	22.2	17.6	11.1	0.001
Drinkers (%)	22.2	37.3	57.9	0.001	37.3	39.2	37.3	0.686
Exercisers (%)	19.5	16.5	20.6	0.272	15.1	18.7	20.0	0.052
Fast food eaters (%)	32.5	51.9	67.8	0.001	37.0	51.9	57.8	0.001

( ), Standard deviation
P for trend, chi-square test for categorical variables, generalized linear model for continuous variables for all quintile groups
Smokers, reported to be current smoker or to smoke at least 100 cigarette during lifetime
Drinkers, reported to take alcohol once or more a month
Exercisers, reported to exercise 3 times or more a week for at least 20 minutes at a time
Fast food eaters, reported to go fast food restaurants once or more a week

Index and lifestyle characteristics, BMI, obesity prevalence and exercise were not associated with the American food pattern. However, smoking, drinking, and eating fast food were positively associated with the American food pattern.

Individuals who had higher scores on the American breakfast pattern were more likely to be younger, female, slightly acculturated, and to have higher income and education levels. Marital status and household size were not related to the American breakfast pattern. BMI was significantly lower as the score on the American breakfast pattern increased. Smoking was negatively associated and exercise was positively associated with the American breakfast pattern.

Table 3 presents socioeconomic and lifestyle characteristics according to quintiles of Korean food and vegetable patterns.

Individuals who had higher scores on the Korean food pattern were more likely to be older, married, exclusively traditional, and to have a lower income, education, and more people per household compared to individuals who had lower scores. Gender was not associated. Mean BMI was not associated with the Korean food pattern. However, alcohol and fast food consumption were negatively associated with the Korean food pattern.

Individuals who had higher scores on the vegetable pattern were more likely to be older, married, and to have a slightly higher income. Other factors of socioeconomic characteristics were not associated. Individuals with higher scores on the vegetable pattern were less likely to smoke and consume alcohol and fast food and were more likely to be exercisers compared to individuals with lower scores. The vegetable pattern was more closely associated with lifestyle factors than socioeconomic factors.

Table 4 presents a regression analysis for each dietary pattern. Multiple regression models were fitted to assess the relationship between socioeconomic and lifestyle variables and the adherence to these dietary patterns.

The American food pattern was associated with men, fast food, alcohol consumption, acculturation, and being younger, which explained about 14% of the total

Table 3. Socioeconomic and lifestyle characteristics according to quintiles of "Korea Food" and "Vegetable" patterns for Korean Americans in California

	Korean Food			P for	Vegetable			P for
	Q1	Q3	Q5	trend	Q1	Q3	Q5	trend
Socioeconomic characteristics								
Age (y)	43.0 (16.0)	46.7(14.4)	50.2 (15.1)	0.001	44.2 (15.5)	46.1 (14.9)	48.6 (15.5)	0.001
Gender (% male)	48.6	47.9	47.2	0.756	47.8	49.1	43.5	0.429
Income (%)								0.020
<40,000	27.2	32.5	43.6	0.001	40.2	34.0	30.5	
40,000-80,000	35.6	41.5	43.6		33.7	44.3	46.0	
>80,000	37.2	26.0	12.9		26.0	21.7	23.5	
Marital Status (%)				0.001				0.001
Single	34.1	12.6	8.2		23.6	17.2	13.6	
Married	59.8	82.6	84.1		68.9	76.9	79.9	
Widowed	6.1	4.9	7.8		7.6	5.9	6.5	
Education (y)	15.6 (2.7)	15.0 (2.8)	14.0 (3.2)	0.001	14.7 (3.0)	14.9 (3.0)	15.0 (2.9)	0.545
Persons in household (n)	2.9 (1.3)	3.4 (1.3)	3.3 (1.6)	0.001	3.3 (1.5)	3.2 (1.3)	3.2 (1.4)	0.514
Acculturation level (%)				0.001				0.047
Traditional	50.6	84.2	95.5		77.5	80.5	77.4	
Bicultural	32.6	12.8	4.0		14.4	14.6	15.9	
Acculturated	16.9	3.1	0.6		8.2	4.9	6.7	
Lifestyle characteristics								
BMI (kg/m^2)	23.1 (3.4)	23.0 (3.2)	23.2 (3.6)	0.839	23.1 (3.6)	22.8 (2.9)	23.1 (3.5)	0.124
Obesity (%) (BMI $\geq$ 30)	1.6	0.8	3.1	0.010	3.6	1.6	1.9	0.272
Smokers (%)	19.4	17.2	16.9	0.924	19.9	19.2	13.2	0.001
Drinkers (%)	48.4	35.5	36.6	0.001	46.2	37.1	35.4	0.001
Exercisers (%)	23.9	17.0	15.4	0.002	14.8	17.7	21.8	0.058
Fast food eaters (%)	55.4	53.1	46.8	0.025	64.2	51.2	40.4	0.001

( ), Standard deviation
P for trend, chi-square test for categorical variables, generalized linear model for continuous variables for all quintile groups
Smokers, reported to be current smoker or to smoke at least 100 cigarette during lifetime
Drinkers, reported to drink alcohol once or more a month
Exercisers, reported to exercise 3 times or more a week for at least 20 minutes at a time
Fast food eaters, reported to go fast food restaurants once or more a week

Table 4. Multiple regression of dietary patterns on the relating factors for Korean Americans in California

	American Food	American Breakfast	Korean Food	Vegetable
	b (SE)	b (SE)	b (SE)	b (SE)
Socioeconomic characteristics				
Age (y)	-0.01 (0.00) ***	0.00 (0.00)	-0.01 (0.00) **	0.01 (0.00) *
Gender	-0.25 (0.07) ***	0.28 (0.07) ***	-0.04 (0.07)	0.00 (0.08)
Income	-0.00 (0.01)	0.01 (0.01)	-0.07 (0.01) ***	0.00 (0.01)
Marital Status	-0.17 (0.11)	0.11 (0.11)	0.35 (0.11) **	0.02 (0.12)
Education (y)	-0.00 (0.01)	0.02 (0.01) *	-0.05 (0.01) ***	0.02 (0.01) *
Household Size (n)	0.01 (0.03)	0.01 (0.03)	0.07 (0.02) **	0.03 (0.03)
Acculturation Level	0.19 (0.06) ***	0.18 (0.06) **	-0.61 (0.05) ***	0.04 (0.06)
Lifestyle characteristics				
Body Weight Status	0.01 (0.05)	-0.04 (0.06)	0.03 (0.05)	0.01 (0.06)
Smoking Status	-0.00 (0.04)	0.11 (0.04) *	-0.05 (0.04)	0.03 (0.05)
Drinking	0.29 (0.06) ***	0.02 (0.06)	-0.03 (0.06)	-0.10 (0.07)
Exercising	-0.13 (0.07)	0.08 (0.07)	-0.04 (0.07)	0.20 (0.08) **
Fast Food Eating	0.23 (0.06) ***	0.23 (0.06) ***	-0.08 (0.05)	-0.34 (0.06) ***
Intercept	0.58 (0.36)	-1.76 (0.37)	1.81 (0.34)	-0.88 (0.39)
R^2	0.1401	0.0655	0.2336	0.0564

*p<0.05, **p<0.01, ***p<0.001
b=regression coefficient, SE=standard error
Gender (1=male, 2=female); Income (1=<$10,000 through 11=>$100,000); Marital Status (1=single, 2=married); Acculturation level (1=traditional, 2=bicultural, 3=acculturated); Body Weight Status (1=normal, 2=overweight, 3=obese); Smoking (1=non, 2=former, 3=current); Drinking (1=no, 2=yes for drinking alcohol once or more per week); Exercising (1=no, 2=yes for 3 times or more at least 20 minutes per week); Fast Food eating (1=no, 2=yes for going fast food restaurants once or more per week)

variance. The American breakfast pattern was associated with women, acculturation, fast food consumption, higher education, and non-smoking. The Korean food pattern was associated with being traditional, lower education, more people per household, lower income, and being older, which explained about 23% of total variance. The vegetable pattern was associated with no fast food eating, exercising, no alcohol consumption, higher education, and being older. Among these patterns, acculturation was the strongest factor of the Korean food pattern and lifestyle factors were the strongest of the vegetable pattern. The American food and American breakfast patterns were predicted by both socioeconomic and lifestyle factors.

DISCUSSION

In this study, four major dietary patterns were identified for 2,746 Korean-Americans in California: American Food, American Breakfast, Korean Food and Vegetables. Higher socioeconomic status and riskier lifestyles were associated with the American food pattern while lower socioeconomic status and lower acculturation was associated with the Korean food pattern.

The four major dietary patterns defined in this study for Korean-Americans were similar to those in a study of Korean-Americans in Michigan by Yang et al.[4] in which there were vegetable/fruit, Korean food and American food patterns. Masaki et al.[22] also reported that middle-aged Japanese men in Tokyo had vegetable/fruit, western breakfast, meat and rice/snack patterns. Even though dietary patterns vary, Asian people or Asian immigrant people in the U.S. have diets comprising aspects of both the western (American) and traditional patterns.

Several studies indicated that acculturation was an important factor in determining dietary change or dietary patterns for ethnic groups in the U.S..[11,13-14] Our study supports the contention that acculturation was a major determinant of the Korean food pattern, while the American food or American breakfast patterns were not only associated with acculturation but also lifestyle factors.

Surprisingly, acculturation was found not to be a major determinant of the vegetable pattern. The Korean traditional diet can be characterized as a plant-based diet, low in fat and high in carbohydrates compared to American food.[23] Acculturation to U.S. society may be accompanied by lower consumption of vegetables/fruits and higher consumption of fat.[2] In this study, however, kimchi was assigned to the Korean traditional pattern not to the vegetable pattern because kimchi was consumed more often with rice. Therefore, the vegetable pattern in this study represents vegetable consumption that does not include traditional Korean vegetables such as kimchi. Lee et al.[13] also reported that vegetable consumption for Korean-Americans was different by acculturation but vegetable consumption without kimchi was not related to acculturation.

It is noteworthy that major variables associated with the vegetable pattern included lifestyle variables such as fast food and alcohol consumption and exercising rather than socioeconomic variables, although being older and a higher education were slightly associated with the vegetable pattern. It appears that vegetable consumption without kimchi can be a predictor of a healthier lifestyle among Korean-Americans.

Numerous epidemiological studies indicate that the vegetable/fruit pattern or vegetable/fruit intake has beneficial effects on health or specific diseases.[22,24-25] If Korean-Americans move away from their traditional diet, the remaining vegetable consumption, excluding kimchi, is as much of a concern for Korean-Americans as it is for Americans. It is important for Korean-Americans to maintain traditional vegetable consumption with interventions drawing attention to the population-wide nutrition education campaigns such as 5 A Day.

We found that single Korean-Americans had higher scores for the American food pattern and lower scores for the Korean food pattern than their married counterparts. This finding was related to studies showing non-married people to be less advantaged regarding diet and health behaviors.[3,6,26] Moreover, single persons tend to choose American food because of its cost and convenience in terms of meal preparation time and a market environment that allows access to traditional foods.[13,27] Larger households were associated with the Korean food pattern, which appeared to support this explanation. Family structure, or more people per household, provides advantages in terms of retaining the Korean food pattern by sharing in the preparation and cost of meals.

Income and education were positively associated with the American food pattern and negatively associated with the Korean food pattern among Korean-Americans. It has been proposed that people of a higher socioeconomic status make healthier decisions about their diet since they have fewer financial restrictions when purchasing foods and are more likely to be concerned with health rather than simply not being hungry.[3,28] Several studies also reported positive relationships between socioeconomic level and healthy dietary intake or patterns.[3,29-30] However, the relationship between socioeconomic status and dietary pattern could be paradoxical for Korean-Americans, as people in lower socioeconomic groups were more likely to maintain the traditional Korean diet while those in higher socioeconomic groups were more likely to follow the American food pattern. Korean traditional food has several health benefits. Nevertheless, for minorities such as Korean-Americans who are in the process of adopting the new cultural patterns of the main country (U.S.), a new cultural pattern may replace the traditional pattern instead of creating a combination of both patterns. Korean-Americans who are more acculturated to the U.S. are more likely to become successful in U.S. society and achieve a higher socioeconomic status. Therefore, Korean-Americans of high socioeconomic status are more likely to adopt the American food pattern. Many immigrant groups would be well advised to retain their traditional healthful dietary pattern while adopting other new patterns of the main country.

This study was designed to explore patterns of diet practices, other lifestyles, BMI and social factors among Koreans in California. These analyses should be considered hypothesis-generating ones due to limitations in measures. The most serious limitation of this study was the reliance on reported diet and other information. The vegetable and Korean traditional food patterns had only two food items. Cappuccio et al.[31] reported, however, that a two-item fruit and vegetable questionnaire had high specificity to biomarkers such as plasma ascorbic acid and beta-carotene. Because it is difficult for people to provide detailed and accurate diet information, our measures were structured as relatively blunt categories. This necessarily delimits their accuracy and the exact nutrient information available. However, this is one of the first studies to provide even these measures for a representative population of immigrant Koreans in California, a rapidly growing subset of the Asian immigrant population. In addition, conducting the survey using the Korean and English languages, depending on the preference of respondents, allowed for the inclusion of people who are linguistically isolated.

With confirmation by future studies with more complete and more accurate measures, the findings from this and future studies will hopefully contribute to the development of interventions that may promote healthy diets for immigrant Koreans, as well as other immigrant populations.

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