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Household Income and Vegetable Consumption among White, Chinese, Korean and Vietnamese Americans

Thanh V Tran[1], Rita Vatcher[1], Hae Nim Lee[1], Phu Tai Phan[2] & Thuc-Nhi Nguyen[1]

[1]Graduate School of Social Work, Boston College, Boston, United States

[2]Department of Social Work, California State University-East Bay, Hayward, United States

Correspondence: Thanh V Tran, Graduate School of Social Work, Boston College, Boston, 140 Commonwealth Avenue, Chestnut Hill, MA 02467, United States. Tel: 617-552-2539. E-mail: thanh.tran@bc.edu

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Abstract

Objectives: This study aims to examine racial/ethnic differences in vegetable consumption between White and three major groups of Asian Americans. We hypothesize that racial/ethnic differences in frequency of vegetable consumption is significantly related to respondents' household income.

Methods: We used the 2009 California Health Survey Interview (CHIS) data set that has a total sample of 47,167 respondents aged 18 and over. The selected sample used in this study consisted of four racial and ethnic groups included Whites (31,582), Chinese (1,014), Korean (909), and Vietnamese (1,411). We used Ordinary Least Square regression and adjusted for complex survey sampling designs in all analyses. Interaction effect is visually presented.

Results: Chinese and White respondents reported a greater frequency of weekly vegetable consumption than Korean and Vietnamese respondents. The significant interaction effect of race/ethnicity and household income revealed that White respondents with an annual household income from $150,000 and over consumed vegetables more frequently than White respondents with an annual household income under $150,000. However, among three selected Asian groups, respondents with an annual household income from $150,000 and over consumed vegetables less frequently than those with an annual household income under $150,000. Other demographic variables including sex, age, marital status, education, BMI also had significant associations with frequency of vegetable consumption.

Conclusion: Culture and economic wealth might play an important role in vegetable consumption. Knowledge regarding racial/ethnic differences in vegetable consumption are important for community-based health education and intervention programs for Asian Americans.

Keywords: healthy food, lifestyles, cultural changes, acculturation

1. Introduction

The Centers for Disease Control and Prevention recommend that Americans consume "5 A Day" – at least 2 servings of fruit and 3 servings of vegetables each day. This is based on strong and consistent evidence that consumption of fruits and vegetables reduces risk of major chronic diseases (Dorgan et al., 1993; Kono & Hirohata 1996; Steinmetz & Potter,1996; Ness, & Powles, 1997; Slattery et al., 1997; Steinmetz & Potter, 2006). However, data show that two-thirds of adults in the United States eat fewer than 2 servings of fruit per day and nearly three-quarters eat fewer than 3 servings of vegetables per day (Serdula et al., 1995; Serdula, et al., 1995, 2004).

Research has shown that sociodemographic, psychosocial, environmental factors, taste preferences (Cotugna, Subar, Heimendinger, & Kahle, 1992; Smith & Owen, 1992; Brug, Lechner, & De Vries, 1995; Domel et al., 1996; Treiman, et al., 1996; Keim, Stewart, & Voichick, 1997; Harrison, et al. 2005;), cost (Brug et al., 1995; Dittus, Hillers, & Beerman, 1995; French et al., 1997; Keim et al., 1997), and availability (Dittus et al., 1995; Harnack, Block, Subar, Lane, & Brand, 1997) could determine food choices and consumption. Many studies found positive associations between nutrition knowledge, self-efficacy and fruit and vegetable consumption

(Anderson, Winett, & Wojcik, 2007; Ball et al., 2009). Fruit consumption can be viewed separately from vegetable consumption because of (1) different culinary uses and taste and (2) the distinct health benefits of vegetables with cancer prevention (Smith, & Owen, 1992; Glanz, et al., 1994; Laforge, Greene, & Prochaska, 1994; Brug et al., 1995; Dittus et al., 1995; Patterson, Kristal, & White, 1996; AbuSabha & Achterberg, 1997; Harnack et al., 1997). General nutrition education programs tend to improve fruit consumption but not vegetable consumption. Thus vegetable intake should be emphasized separately from fruit intake for nutrition education and intervention programs (Trudeau, Kristal, Li, & Patterson, 1998).

Studies that evaluated behaviors associated with fruit and vegetable consumption in adults had not adequately considered the differences between White American and Asian-American dietary behaviors (Trudeau et al., 1998; Staser, Saywell Jr., Zollinger, Kunapareddy, & Joseph, 2011). People's dietary behaviors tend to reflect their cultural and economic environment. Chinese Americans, especially living with older adults in the household are likely to maintain the traditional Chinese diet consisting of rice, fish, vegetables, and fruit (Satia-Abouta, Patterson, Kristal, Teh, & Tu, 2002). Korean-Americans consume a diet rich with salt and calories but a low consumption of dairy products (Kim, Kim, Juon, & Hill, 2000; Park, Murphy, Sharma, & Kolonel, 2005). For example, Korean Americans eat a traditional diet of steamed rice, kimchi, and a soy sauce stew daily despite their level of acculturation (Kim et al., 2000;Yang, Chung, Kim, Bianchi, & Song, 2007). The typical Vietnamese-American diet includes frequent use of salt, fried or oil-added foods, low use of canned or prepared foods, and moderate use of fresh vegetables (Duong, Bohannon, & Ross, 2001).

Although traditional Asian diets are considered somewhat healthier than typical American diets, many Asian Americans have tried to avoid eating traditional food due to embarrassing experiences at their younger ages. Ethnic diets remind young Asian Americans that they are different from the prototypical American and ethnic foods become a threat to their American identity (Guendelman, Cheryan, & Monin, 2011). The majority of this study's Asian respondents are foreign-born from three developing (e.g. Korea) and transitional (e.g., China and Vietnam) nations where people have steadily increased animal meat consumption due to the rising of economic wealth and incomes. As the results, their health status has also been compromised by rising rates of obesity and chronic diseases (Kearney, 2010). On the contrary, higher household incomes in wealthy European nations and the U.S. tend to be associated with greater consumption of vegetables (Sorensen et al., 2007; Lallukka et al., 2010; Sugerman et al., 2011).

1.1 Theoretical Framework

The literature offers at least four different but related perspectives for the explanation of how race/ethnicity and household income influence vegetable consumption behavior. First, economic development appears to have opposite effects of vegetable consumptions based on stability and length. People from countries with stable and long history of economic development such as the United and Europe, higher income tends to associate with more vegetable consumption. On the other hand, people from developing or transitional economies such as China, Korea, and Vietnam are more likely to consume more animal meats as family income increases (Popkin, 2001; Lallukka et al., 2010). Second, public health education can help people improve their lifestyle including the increase of vegetable consumption. When individuals understand the benefits of vegetables, they tend to eat more (Uusitalo, Pietinen, & Puska, 2002; Anderson et al., 2007). Third, culture including the way of life or religious beliefs does affect what people eat (Kearney, 2010; Allen, 2012). Finally, for immigrants, acculturation into a host society can make people give up their food tradition to adapt to or adopt the dominant culture's diet (Guendelman et al., 2011). As immigrants from China, Korean, and Vietnam adjust to American society and its food culture, they would eventually if not hastily modify their diets as they attempt to identify with American culture and integrate into American society. In summary, vegetable consumption and other food consumption behaviors are best explained by a combination of factors encompassing economic, educational, and cultural conditions.

1.2 Rationale and Hypothesis

As explained in the literature, food choice and consumption is often determined by several factors including ecological environment, cultural heritage, biological predispositions, and economic well-being. Given that race and income encompass cultural and economic factors influencing food choice and consumption, we hypothesize that racial differences in vegetable consumption frequency are also related to household income. More specifically, White respondents with a higher household income would consume vegetables more frequently that those with a lower household income. However, Asian Americans with a higher household income would consume vegetables less frequently than those with a lower household income.

2. Methods

2.1 Data Sources

The 2009 California Health Interview Survey data set (CHIS) was used in this study. This is the 5th CHIS data collection cycle, which has been conducted every other year since 2001. This is one of the largest population-based telephone health surveys conducted in any state and in the nation.

CHIS used Random Digit Dial telephone survey to select and interview one adult aged 18 years old or older in each randomly sampled household. The 2009 CHIS data set consisted of 47,167 interviews conducted among adults aged 18 or older between September 2009 and April 2010. CHIS is also unique in that it is one of the largest health surveys that captures a rich and diverse sample of individuals from different races, ethnicities and language backgrounds.

Interviews were conducted in five languages: English, Spanish, Chinese (Mandarin and Cantonese dialects), Vietnamese, and Korean. Interviews in all languages were administered using Westat's computer-assisted telephone interviewing (CATI) system. The average length of an adult interview was 35 minutes. CHIS used both landline and cell-phone lists to select sampled households. In order to increase representatives of race ethnic subgroups, CHIS employed both disproportional stratified sampling and multiple frame sampling methods. Detailed description and discussion of CHIS sampling methods can be found online posted on CHIS website (CHIS, 2011).

2.2 Sample Size and Characteristics

The 2009 CHIS consisted of 47,167 respondents aged 18 and over. The selected sample has 31,582 Whites (90.45%), 1004 Chinese (2.90%), 909 Korean (2.60%), and 1,411 Vietnamese (4.05%) adults aged 18 to 85. Females made up 59% of the sample. We used the weighted data that were adjusted for complex sampling design. Details of the weighted variables of the CHIS are available on line (CHIS, 2011).

2.3 Measures and Covariates

2.3.1 Dependent Variable

Vegetable consumption frequency was the actual number of times eating vegetables weekly. The values ranged from 0 to 69 with an average of 7.66 times.

2.3.2 Race/Ethnicity

This variable was self-reported and coded 1 for White, 2 for Chinese, 3 for Korean, and 4 for Vietnamese. Dummy coding was applied in the analysis and White is the reference group.

2.3.3 Household Income

Total annual household income was used. We tested different coding mechanisms of income and found that when total annual household income was collapsed into two groups, $150,000 and higher and under $150,000, the results of the interaction effect are clearer and easier to interpret.

2.3.4 Demographic Covariates

Sex was coded 1 for female and 0 for male. Age ranged from 18 to 85. Education was coded 1 for some college or higher and 0 for high school or less. Marital status was 1 for currently married or lived with partners and 0 for otherwise. Employment status was coded 1 for currently employed and 0 for others. English ability was coded 1 for well, very well or English only and 0 for poor or not at all. Birth place was coded 1 for US born and 0 for foreign born. In this data set, body weigh index (BMI) was coded 1 for underweight (0-18.49), 2 for normal (18.5-24.99), 3 for overweight (25.0-29.99) and 4 for obese (30>).

3. Results

3.1 Statistics and Data Analysis Plan

We used Stata 12.1 to perform both descriptive and Ordinary Least Squares regression (OLS). All analyses were adjusted for complex sampling designs. Two OLS regression models were analyzed to estimate the unadjusted and adjusted interaction effect of race/ethnicity and household income on vegetable consumption. We also used the "testparm" procedure to confirm the statistical significance of the interaction effect in each model. The "margins" and "marginsplot" procedures were used to estimate the predictive margins and to graph the interaction effect. The "marginsplot" procedure produces clearer and more interpretable interaction effect than the results from OLS regression.

3.2 Baseline Data

Table 1 presents descriptive statistics of variables used in the study by race and ethnicity. We present un-weighted statistics and weighted statistics for each variables. The weighted data revealed that this study sample included 88.48% White, 6.65% Chinese, 2.13% Korean and 2.74% Vietnamese adults. Notably, Chinese respondents had the highest average of weekly vegetable consumption (Mean = 9.10) compared to 7.75 for White, 6.03 for Korean, and 6.37 for Vietnamese respondents. Weighted annual household income varied significantly among the four racial/ethnic groups. Korean respondents had the highest percent (24%) of respondents with an average household income at $150,000 or over compared to 18.32% of White, 14.40% of Chinese, and 9.42% of Vietnamese respondents. The Korean sample also had the largest percent of female respondents (70.51%) compared to other three racial/ethnic groups (White= 50.96%, Chinese = 50.66%, and Vietnamese = 49.08%). On average, Korean respondents were younger (38.66 years old) than White (48.65 years), Chinese (44.96 years), and Vietnamese (49.08 years) respondents. The Vietnamese sample had the smallest percent of respondents with some college education or higher (56.98%) and the Korean sample had the highest percent (76.88%). The majority of respondents in all four groups were married. The Vietnamese sample had the largest average household size (4.09 persons) compared to White (2.79 persons), Chinese (3.40 persons), and Korean (3.43 persons). With respect to English Ability, 99% of White respondents speak only English or speak English very well compared to 69.22% of Chinese, 61.87% of Korean, and 58.28% of Vietnamese. Ninety percent (90%) of White respondents were U.S. born compared to 23% of Chinese, 36.73% of Korean, and 19% of Vietnamese. Finally, 23% of White and 20.83% of Vietnamese were obese compared to 2.88% of Chinese and 4% of Korean.

Table 1. Descriptive Analysis of Variables Used In the Analysis (N =34,916)

Variables	Un-weighted Percent/Mean (S.E)	95% Conf. Interval	Weighted Survey Designs Percent/Mean (Jknife S.E.)	95% Conf. Interval
Race				
White	90.45%	90.14%, 90.75%	88.04%	88.16%, 88.79%
Chinese	02.90%	02.72%, 03.08%	06.06%	06.64%, 06.90%
Korean	02.60%	02.43%, 02.77%	02.01%	0.2.12%, 02.27%
Vietnamese	04.04%	03.83%, 04.47%	02.07%	0.2.63%, 02.74%
Weekly Vegetable Consumption (Mean)				
	8.29 (.03)	8.27, 8.36	7.75 (.05)	07.64, 07.86
White	8.98 (.17)	8.65, 9.32	9.10 (.53)	08.04, 10.16
Chinese	6.91 (.17)	6.56, 7.26	6.03 (.48)	05.06, 06.98
Korean	6.92 (.13)	6.66, 7.18	6.37 (.37)	05.63, 07.11
Vietnamese				
Household Income ($150,000 and over)				
White	14.40%	14.01%, 14.79%	18.32%	17.54%, 19.12%
Chinese	19.03%	16.61%, 21.45%	14.40%	11.67%, 17.64%
Korean	12.54%	10.38%, 14. 69%	24.46%	13.73%, 39.71%
Vietnamese	07.57%	06.20%, 08.96%	09.42%	17.21%, 19.70%
Sex (Female)				
White	59.27%	58.72%, 59.81%	50.96%	50.59%, 51.33%
Chinese	57.10%	54.05%, 60.14%	50.66%	44.78%, 56.52%
Korean	65.35%	62.25%, 68.44%	70.51%	59.03%, 79.87%
Vietnamese	49.11%	46.50%, 51.72%	49.08%	38.74%, 59.49%
Age (Mean)				

White	59.27 (.09)	59.09, 59.45	48.65 (.13)	48.38, 48.92
Chinese	50.08 (.49)	49.10, 51.06	44.96 (.85)	43.25, 46.67
Korea	53.44 (.55)	52.35, 54.53	38.66 (1.42)	35.83, 41.49
Vietnamese	49.23 (.43)	48.38, 50.07	42.12 (1.26)	39.60, 44.65
Education				
(College Education)				
White	75.66%	75.19%, 76.13%	70.35%	69.59%, 71.10%
Chinese	77.61%	75.04%, 80.18%	68.81%	65.15%, 75.13%
Korean	72.72%	68.82%, 75.61%	76.88%	69.90%, 82.65%
Vietnamese	50.82%	48.20%, 53.42%	56.98%	46.58%, 66.81%
Marital Status				
(Married)				
White	56.62%	56.08%, 57.17%	65.09%	64.00%, 66.17%
Chinese	68.14%	65.17%, 71.01%	63.05%	55.46%, 70.05%
Korean	71.17%	68.23%, 74.12%	55.98%	42.93%, 68.26%
Vietnamese	69.17%	66.76%, 71.58%	64.36%	51.85%, 75.17%
Household Size				
(Mean)				
White	2.18 (.03)	2.17, 2.20	2.79 (.01)	2.76, 2.82
Chinese	2.86 (.04)	2.78, 2.94	3.40 (.15)	3.09, 3.70
Korean	2.69 (.04)	2.61, 2.78	3.43 (.22)	2.99, 3.87
Vietnamese	3.41 (.04)	3.33, 3.50	4.09 (.22)	3.65, 4.54
Employment Status				
(Employed)				
White	49.70%	49.14%, 50.08%	62.22%	61.10%, 63.33%
Chinese	62.62%	59.64%, 65.60%	59.41%	52.55%, 65.92%
Korean	48.07%	44.82%, 51.32%	59.08%	48.12%, 69.20%
Vietnamese	52.79%	50.19%, 55.40%	59.90%	50.81%, 68.35%
English Ability				
(Only English/Well)				
White	99.66%	99.60%, 99.72%	99.51%	99.31%, 99.64%
Chinese	71.89%	69.12%, 74.66%	69.22%	62.95%, 74.85%
Korean	44.77%	41.53%, 48.00%	61.87%	51.59%, 71.19%
Vietnamese	47.55%	44.945, 50.16%	58.28%	49.19%, 66.85%
Birth Place				
(US Born)				
White	91.69%	91.39%, 91.99%	90.90%	90.09%, 91.65%
Chinese	21.89%	19.34%, 24.44%	23.09%	17.19%, 30.28%
Korean	08.80%	06.95%, 10.64%	36.73%	24.78%, 50.56%
Vietnamese	05.81%	04.59%, 07.03%	19.24%	09.80%, 34.30%
BMI				
(Obese)				
White	23.04%	22.57%, 23.50%	23.04%	22.09%, 24.01%
Chinese	05.02%	03.68%, 06.37%	02.88%	01.87%, 04.39%
Korean	03.41%	02.29%, 04.59%	04.02%	01.63%, 09.54%
Vietnamese	08.43%	06.98%, 09.88%	20.83%	19.97%, 21.70%

3.3 Statistics and Data Analysis

The results from the OLS regression analyses are presented in Table 2. We first tested the interaction effect of race/ethnicity and annual household income with weekly vegetable consumption and found that the interaction effect is statistically significant (F (7/73) = 21.64, p = .001). However, due to the continuous measure of household income, it's difficult to interpret the interaction effect. Subsequently, we recoded the income variable into different categories and found that when household income was collapsed into two categories (equal or greater than $150,000 and under & $150,000) the results are more meaningful and easier to interpret.

Table 2 presents the analysis with household income coded as two categories. Model 1 tested the main and interaction effects of race/ethnicity and household income (equals to or greater than $150k vs. under $150k) on weekly vegetable consumption. As reported, the interaction effect between race/ethnicity and household income remained statistically significant when income was coded in two categories (F (3/77) = 6.94, p = .003). Model 2 tested the interaction effect of race/ethnicity and household income adjusted for 9 selected covariates. The results from Model 2 confirm the statistical significance of the adjusted interaction effect (F (7/73) = 9.54, p = .000). To further explain the interaction effect of race/ethnicity and household income, Table 3 presents the predictive margins of the interaction effect of race/ethnicity and household income with weekly vegetable consumption. The results indicate that the average times of eating vegetables per week increased from 7.60 times among White respondents with and annual household income less than $150,000 to 8.42 times among White respondents with an annual household income equals $150,000 or higher. This accounted for 10.78% increase in vegetable consumption for the higher annual household income bracket. This trend, however, was reversed among the three Asian American groups. Asian American respondents with a higher annual household income tended to consume fewer vegetables than those with a lower annual household income. For Chinese Americans, the change was from an average of 9.22 times per week among respondents with an annual household income under $150,000 down to 8.32 times among those with an annual household income from $150,000 or higher. This accounted for 9.76% decrease in vegetable consumption among Chinese Americans in the higher annual household income bracket. Korean American respondents with an annual income under $150,000 had an average of weekly vegetable consumption at 6.04 times compared to 4.19 times among those with an annual household income equals $150,000 or higher. This accounted for 30.62% decrease in weekly vegetable consumption among Korean American respondents in the higher annual household income bracket. Vietnamese American respondents with an annual household income under $150,000 had a weekly average of vegetable consumption at 6.67 times compared to 4.72 times among those in the higher annual household income bracket. This accounted for 29.23% decrease in weekly vegetable consumption among Vietnamese American respondents in the higher annual household income bracket. Figure 1 further illustrates the interaction effect of race/ethnicity and annual household income with weekly vegetable consumption.

Table 2. OLS Analysis of Interaction Effect of Race/Ethnicity and Household Income on Weekly Vegetable Consumption[a]

Vegetable Consumption	Model 1 Coef. (Se.E.)	95% Confidence Interval	Model 2 Coef. (S.E)[b]	95% Confidence Intervals
Race (Ref.:White)				
Chinese	1.58 (.62)***	0 .34, 2.82	1.61 (.57)***	0.47, 2.7
Korean	-1.09 (.46)**	-2.01, -0.17	-1.56 (.64)**	-2.85,-0.28
Vietnamese	-1.02 (.38)***	-1.79, -0.24	-0.93 (.54)	-2.01. 0 .14
Household Income[c] (Ref.: <$150k)				
$150k and over	1.18 (.16)***	0.85, 1.51	.81 (.15)***	0.50, 1.12
Interaction Effect: Race*Household Income (Ref.: White) (Ref.: <$150k)				

Chinese * =>$150k	-1.27(.82)	2.92, 0.37	-1.71 (.77)* *	-3.26, -0.17
Korean * =>$150k	-2.87 (1.17)***	-5.20 ,-0.53	-2.66 (1.32)*	-5.30, -0.19
Vietnam. *=>$150k	-2.67 (.91)***	-4.49, -0.85	-2.77 (1.10)**	-4.97, -0.56
Constant	7.53 (.06)***	7.41, 7.65		
Test for Interaction *F* (7, 73) = 16.72, *p* = .000				
Sex (Ref.: Male)				
Female			2.13 (.12)***	1.88, 2.38
Age			0.02 (.003)***	0.01, 0 .03
Education (Ref.: =<High school)				
College			1.48 (.12)***	1.23, 1.72
Marital Status (Ref.: Otherwise)				
Married			1.13 (.15)***	0.82, 1.45
Household Size			0.08 (.06)	-0.03, .20
Employment Status (Ref.: No)				
Employed			0.16 (.15)	-0.14, 0.48
English (Ref.: No/Poor)				
English Only/Well			-0.62 (.73)	-2.08, 0.83
Birth Place (Ref.: Foreign Born)				
U.S. Born			-0.33 (.23)	-0.80, 0.13
BMI			-0.25 (.07)**	-0.41, -0.10
Constant			4.72 (.85)	3.01, 6.40
			Test for Adjusted Interaction Effect Adjusted Wald Test F (7/73)= 9.54, p = .000	

[a.] Jknife Standard Error. * p <.05, ** p< .01, ** p < .001

[b.] Complex sampling design information: Number of Observations = 47,167, Subpopulation no = 34,926, Population size = 27209692, Subpopulation size = 149,41997, Replications =80,Design DF =79, F(16/64) = 51.62, p =.0001

[c.] <$150k = under $150,000.00, =>$150k = $150,000.00 and over.

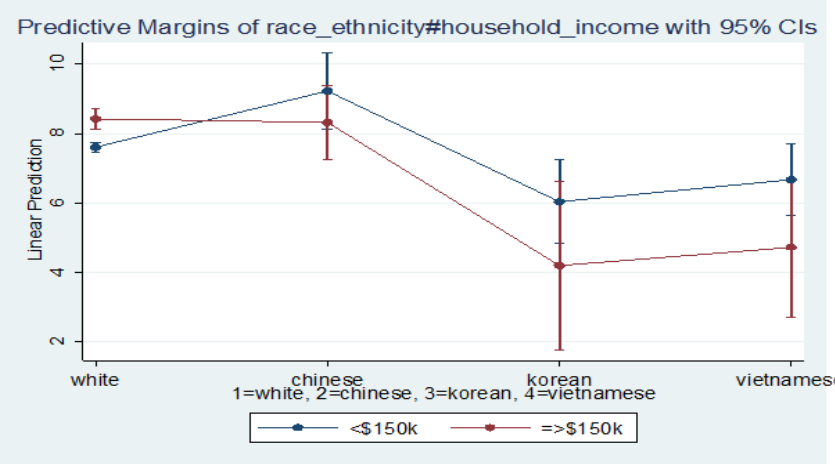

Figure 1. Interaction effect of Race/Ethnicity and Household Income on Weekly Vegetable Consumption Adjusted for Covariates

The results in Table 3 and Figure 1 indicate that all three Asian ethnic groups from higher income households reported a fewer number of times eating vegetables than those from lower income households. On the contrary, White respondents from higher income households reported a greater frequency of eating vegetables than White respondents from lower income households.

The results in Table 2 also reveal that weekly vegetable consumption was associated with sex, age, college education, marital status, and BMI. Regardless of race/ethnicity and income, females tended to eat vegetable more frequently than males (b = 2.13, p < .001). Older respondents reported a higher frequency of weekly vegetable consumption (b = .02, p < .001). College educated respondents had a greater average of weekly vegetable consumption than non-college educated respondents (b = 1.48, p < .001). Married respondents reported a higher frequency of vegetable consumption than non-married (b = 1.13, p < .001). Finally, obese respondents tended to eat vegetable less frequently (b = -.25, p < .01).

Table 3. Predictive Margins of Interaction Effect of Race/Ethnicity and Household Income with Weekly Vegetable Consumption (N = 34,916)

Race/Ethnicity	Household Income[a]	Predictive Margins of Average Times Eating Vegetables per Week (Delta-method SE)	95% Confident Intervals
White	<$150K	7.60 (.06)***	8.14, 8.71
	=>150K	8.42 (.14)***	7.47, 7.74
Chinese	<$150K	9.22 (.56)***	8.12, 10.33
	=>150K	8.32 (.53)***	7.26, 9.38
Korean	<$150K	6.04 (.61)***	4.83, 7.25
	=>150K	4.19 (1.24)***	2.69, 6.74
Vietnamese	<$150K	6.67 (.51) ***	5.66, 7.68
	=>150K	4.72 (1.03)***	2.69, 6.74

[a] Household Income was collapsed into two categories: Under $150,000 and $150,000 and over
*** p < .001

To further explain the interaction effects of race/ethnicity and household income, we performed a series of pair comparisons for the means of vegetable consumptions for each Asian group with the White group. Table 4 shows that there were statistically significant differences between Chinese and White respondents with a household income less than $150,000. As shown in Table 3, Chinese respondents with an annual household income less than $150,000 consumed significantly more vegetables than White respondents in the same income bracket. There was no statistically significant difference in vegetable consumption between Chinese and White respondents with an annual household income from $150,000 and higher. Korean respondents in both household

income brackets consumed significantly less vegetables than White respondents. There was no statistically significant difference in vegetable consumption between Vietnamese and White respondents with an annual household income less than $150,000. However, Vietnamese respondents with an annual household income from $150,000 and higher consumed significantly less vegetables than White respondents in the same income bracket.

Table 4. Test of Significance of the Pair Comparisons for Race/Ethnicity and Household Income with Weekly Vegetable Consumption (N = 34,916)

Pair Comparison	Household Income[a]	Contrast Means	Chi 2 (df)
Chinese # White	<$150K	1.619***	7.94
Chinese # White	=>150K	-.099	.03
Korean # White	<$150K	-1.566*	5.89
Korean # White	=>150K	-4.228***	12.09
Vietnamese # White	<$150K	-.933	2.94
Vietnamese # White	=>150K	-3.70***	12.28

*p< .05, *** p<.001

4. Discussion

Our results show that while White Americans increase their vegetable consumption as their household income increases, Asian Americans decrease their vegetable consumption as their household income increases. Historically, wealthy nations have consumed more meat and high-fat diets than poorer nations (Drewnowski & Popkin, 1997). However, this trend has reversed in such a way that wealthy nations, including the United States in the past few decades, have funded public health education to its citizens concerning the health benefits of reducing high-fat diets and consuming more whole grain and vegetables (USDA, 2011). In fact, in wealthy European nations, family wealth was found to be a significant factor of children's healthy food habits (Vereecken, Inchley, Subramanian, Hublet, & Maes, 2005). There has been inconsistent evidence that the availability of food is one of the factors of food consumption. For example, research has found that the availability of healthy food such as fruits and vegetables can be a key factor of fruit and vegetable consumption (Jetter & Cassady, 2006). However, there is only a weak association between the density of fruit and vegetable stores in neighborhoods and vegetable consumption (Ball, Crawford, & Mishra, 2006). The increase in vegetable consumption among White respondents from the higher household income bracket is supported by previous research in the United States that has found that vegetable consumption tends to increase with income (Middaugh, Fisk, Brunt, & Rhee, 2012). Although the positive association of income and vegetable consumption might be true for wealthy Western nations and the United States, it could be misleading for Asian Americans who arrived in the US in the last few decades amidst a food transition in their original homelands including China, Korea and Viet Nam. Historically, China, Korea, and Vietnam were predominantly agricultural countries where people eat what is available from their farm such as grains and vegetables more often than meat. Traditional cuisines from these three countries are more vegetable- and-grain-based- than animal meat-based.

It has been well-documented that as developing countries emerge from rural and agricultural societies to more urban and industrial societies, people have also gradually abandoned their traditional low fat diets to more high fat content and high energy diets from animal products (Drewnowski, & Popkin, 1997). For instance, as China's economic conditions have improved many people have viewed traditional low fat Chinese diet a reflection of poverty (Popkin, 2001). Paradoxically, economic development can eliminate hunger and poverty, but it can also make people abandon their traditional low fat diets and physical activities causing many non-communicable diseases associated with changes in lifestyle and food consumption (Uusitalo et al., 2002).

Why do Asian Americans from higher income households eat fewer vegetables than those from lower income households? This phenomenon could be attributed by the food transition phenomena in their countries of origin (Uusitalo et al., 2002) as well as their overambitious effort to acculturate to mainstream America. There has been some evidence that Asian Americans tend consume more American food loaded with high calories and fat contents as a way to prove their American identity (Guendelman et al., 2011). It should be noted that the majority of the Asian American respondents in this study were born outside the USA. Once the immigrants have settled in their new homeland, they often have to modify or change their food consumption traditions due to the changes in the new environment. For many Chinese Americans, as they have acculturated to American way of life, their food choice and consumption are also altered in such a way that they tend to consume greater portions

of meats and other local products (Kim et al., 2010). Similarly, acculturated Koreans consume more calories, protein, carbohydrates and fats compared to less acculturated Koreans (Harrison et al., 2005). At the same time, many Vietnamese Americans parents are struggling to maintain their traditional diets while their children often pressured them to eat and buy heavily marketed (and less healthy) foods rather than eat food served at home (Ackerman & Tellis, 2001).

Is it possible that Asian Americans from a lower household income bracket eat more vegetables than their higher household income counterparts? Generally speaking, it is difficult to believe that low income Asian Americans really consume more vegetables than higher income Asian Americans due to the high cost and availability of fresh vegetables. But, the data we used in this study were collected in California where most Chinese, Korean and Vietnamese Americans live in urban areas with a large concentration of Asian Americans. Fresh ethnic vegetables can be found which are significantly cheaper at ethnic Asian groceries than those found at non-Asian-American supermarkets or groceries (Anderson et al., 2007). Thus it is plausible that unlike other low income White Americans, low income Asian Americans can afford vegetables at cheaper prices from Asian food stores. It is also plausible that low income Asian Americans have not acculturated well into mainstream America and therefore still maintain their ethnic diets while higher income Asian Americans avoid eating vegetables as a away to forget their poverty past. There is an old Vietnamese saying that "eat vegetables when you're hungry and take medicine when you're sick" (Đói ăn rau, đau uống thuốc). This old saying reflects the way of life of people who live in poor agricultural societies where farm products such as vegetables are daily staples. As noted in previous research, the food transition in China, Korean, and Vietnam have changed their diet traditions from low fat diets including vegetables and grains to high-energy diets including animal fats and animal meats. At the same time, many people from these countries could perceive that vegetable consumption is a symbol of poverty (Popkin, 2001).

Research by Anderson et al. (2007) shows that, for the general American population, greater nutrition knowledge, easy access to healthy food sources, and psychosocial factors such as self-efficacy and self-regulation positively influence greater consumption of fruits and vegetables (Berrigan, Dodd, Troiano, Krebs-Smith, & Barbash, 2003). The associations of sex, age, and education found in this study are in agreement with findings from previous research. For example, Berrigan et al. (2003) found that women and older individuals were more likely than men to report adherence to all five behaviors. As levels of education and income increase, adherence to all recommendations of healthy behaviors also increases (Baker & Wardle, 2003). Thus, it is possible that White Americans at higher income levels consume more vegetables not only because they can afford fresh produce but they also are more educated and more knowledgeable about the health benefits of vegetable consumption.

This study highlights that race and income should not be viewed as independent predictors of vegetable consumption but as a joint factor. These two variables encompass cultural differences, environmental conditions, and knowledge of healthy behaviors. Indeed, food choices and consumption are parts of socialization and ecological conditions. People eat what their families have eaten and what are available in their surroundings. Similarly people choose certain foods to eat as food can symbolize wealth and status in many developing countries. However, people can alter their food consumption traditions once they have a better education and knowledge about nutrition.

The findings of this study are limited by some obvious reasons. First, the study's data were collected only in California thus limiting the generalizability of the results. Second, vegetable consumption was measured by a self-reported question which might not capture a wide range of vegetable consumption behaviors including amounts and types of vegetables (Carbone, Campbell, & Honess-Morreale, 2002). Although Chinese respondents reported the highest frequency of weekly vegetable consumption, one might wonder how much vegetables are included in Chinese cooking. In fact, several Chinese dishes have only a sprinkle of vegetables that are used to garnish the dishes. Future research should also develop culturally appropriate measures of vegetable intake for both research and intervention efforts. The measure should ask respondents for the amount of vegetables they consumed or used for daily cooking, not just the frequency of eating vegetables per day or week. Nevertheless, the study's results are meaningful and insightful for future research and community-based health prevention efforts for racially and ethnically diverse communities. Finally, the study's findings suggest the need for community-based nutrition education and nutrition intervention programs for Asian Americans.

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