J Community Nutrition 4(2) : 90~98, 2002 □ Original Article □

Diet Related Factors Influencing BMI Changes for Korean-Americans Residing in Eastern Area of America

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ABSTRACT

This study was performed to examine the dietary and BMI change of Koreans after moving to America and to identify the factors influencing changes of BMI. The subjects were 192 Korean-Americans (men : 86, women : 106) residing in the eastern area of the U.S.A. 1) subjects reported significantly increased consumption frequency in American foods like, low fat milk ($p < 0.001$), cold cereals ($p < 0.001$), whole wheat bread ($p < 0.001$), hamburger (only in males $p < 0.01$) and pizza (only in males $p < 0.01$). Whereas significantly decreased consumption frequency in fish ($p < 0.05$), cooked vegetables ($p < 0.001$), kimchi ($p < 0.001$) and cooked rice ($p < 0.001$) were reported. 2) It was reported that weight, accordingly BMI were significantly increased ($p < 0.01$). The smoking habit score was significantly decreased for males ($p < 0.05$). 3) Multiple linear regression analysis for BMI change showed that education years in Korea was the most prominent negative factor ($p < 0.001$) in predicting BMI change in America. Elevated frequencies of alcohol, chicken and soft drink in America were also associated with greater increase of BMI. When the length of residence (increase of age) was included in regression model, the increase of age was the most significant factor ($p < 0.001$). Changes of chicken and soda scores were other significant factors. (*J Community Nutrition* 4(2) : 90~98, 2002)

KEY WORDS : korean-american · consumption frequency change · american food · korean food.

Introduction

There are over 1 million Korean-Americans, contributing 12% of the Asian American population and 0.3% of the total U.S population (Lee et al. 1999). Korean-Americans usually live in a Korean community in a large city in New York and New Jersey. Korean diets centers on steamed rice, usually accompanied by broth garnished with shell fish, meat and /or vegetables (Tchai & Ju 1987), Kimchi, one protein-rich main dish (fish or soybean) and cooked vegetables.

As the number of Korean residents in America is increasing, interest in the change of food habits and food consumption patterns in relation to health and BMI change has brought increasing attention. Immigrants' food habits change significantly as a result of frequent contact with another cultural system (Son 1994). It is known that both acculturation and migration affect health directly at the biological level through diet (Lee 1997). Body weight was one of the issues studied extensively in relation to migration (Curb, Marcus 1991), because obesity is one of the most noticeable changes due to acculturation and dietary change.

Curb, Marcus (1991) reported that increases of body weight observed in Japanese immigrants could be due to increase of the percent caloric intake as fat. Fat energy% was two times greater in Hawaii than in Japan. There were many studies about the change of food habits (Wenkam, Wolff 1970) and obesity in relation to chronic disease in Japanese in Hawaii (Curb, Marcus 1991 ; Yano et al. 1988). However there were only a few studies for Korean-Americans (Kim et al. 1984 ; Lee et al. 1999).

The objective of this study was to examine the dietary and BMI change and to identify the factors influencing changes

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in BMI of Korean-Americans residing in New York and New Jersey states of America.

Subjects and Methods

1. Subjects

The subjects were 192 Korean-Americans consisted of 86 men and 106 women residing in New York and New Jersey states of the U.S.A. Subjects were recruited from groups of attendees at Korean churches and community centers in New York and New Jersey.

2. Questionnaire

The survey tool was assessed for its validity by nutrition professionals familiar with research on culture values and diet before its use. In a pretest, most of the subjects clearly recalled the food consumption frequencies in Korea.

The questionnaires were written in Korean and distributed to the respondents individually after explaining how to fill it out. The data was collected one week later by home visit or mail. Two hundred twenty questionnaires were distributed and 192 were collected.

1) General characteristics

Questionnaire items included in general characteristics were age, sex, length of residence, number of family members, education years in Korea and education years in America. Length of residence in the U.S.A is defined as the periods of time that the individual has lived in the U.S.A.

2) Changes of food consumption

Consumption information was obtained with a self-administered food frequency questionnaire (FFQ), which represents usual intakes over extended periods. Respondents were asked to identify the consumption frequency for each item when they were in Korea and now in America. Food items were divided into "common foods" that are consumed frequently in both Korea and America, "American foods" usually consumed in America but rarely consumed in Korea, and "Korean foods" consumed frequently in Korea but rarely in America. The study of Lee et al. (1999) was used to identify them.

The frequency of food consumption frequency was calculated based on the frequency per week : 0 point for less than once a month, 0.5 points for 1 − 3 times per month, 1 points for once a week, 2.5 points for 2 − 3 times a week, 5 points for 4 − 6 times a week, 7 points for everyday, 14 points for more than 2 times a day. The mean consumption frequency was also obtained for each food group.

Some of the foods were also scored to indicate a Korean style diet. For the "Korean diet score", traditional Korean foods of rice (1 − 4), fish (1 − 4) and Kimchi (1 − 4) were given positive values, while primarily American style foods were reversed scored. Thus white bread (1 − 3), meat (1 − 4), butter and margarine (1 − 4), fatty foods (1 − 4), and soft drink (1 − 5) were all reversed scored (Takada et al. 1998), so that subjects who reported eating more of these items received a lower score for Korean diet. Thus higher "Korean diet score" indicates a diet including more traditional Korean foods and fewer American style foods.

3) Changes in dietary behavior

Eating habits for breakfast, lunch, dinner, snacks and eating out were evaluated on the basis of eating frequency "rarely", "less than once a week", "2 − 3 times a week", "3 − 4 times a week" and "everyday" in America and Korea.

4) Changes in physical and life style factors

Respondents were asked to report their weight and height. These self-reported weight and a height were used to calculate body mass index (BMI). It was reported that self-reported weight was sufficiently accurate to use in epidemiologic research (Yu, Nagey 1992). Life style factors evaluated were activity level, frequency of drinking and smoking habit.

Physical activity was divided into two categories : light physical activity and vigorous one.

Several examples of light activity (walking, dancing, gardening, golfing, bowling etc.) and vigorous activity (aerobics, running, swimming, bicycling etc.) were provided in the questionnaire to clarify the categories.

Questions about frequency of drinking were asked and scored : rarely (0), 1 − 2 times a month (1), 1 − 2 times a week (2), 3 − 4 times a week (3), almost everyday (4). Self-reported smoking habit was evaluated as yes (1) and no (0). Self-diagnosed health status was measured by asking respondents if their health status was : very bad (1), bad (2), good (3), very good (4).

3. Statistical analysis

All of the data was expressed as mean ± SE or frequency distribution N (%). Paired t-test was used to assess the significance of change of the variable in Korea and after

Table 1. Demographic characteristics of Korean subjects (N = 193)

	Male (N = 86)	Female (N = 106)	Total (N = 192)
Categorical variable			
Age			
21 ≤ < 40	51 (59.3)	71 (67.0)	122 (63.5)
40 ≤ < 60	35 (40.7)	35 (33.0)	70 (36.5)
Length of residence (years)			
< 5	20 (23.5)	29 (27.4)	49 (25.7)
5 ≤ < 10	16 (18.8)	18 (17.0)	34 (17.8)
10 ≤ < 15	11 (12.9)	12 (11.3)	23 (12.0)
≥ 15	38 (44.7)	47 (44.3)	85 (44.5)
Numerical variable			
Number of family members	3.2 ± 1.1	3.6 ± 1.1	3.4 ± 1.1
Education years in Korea	16.7 ± 2.7	16.3 ± 2.1	16.5 ± 2.4
Education years in America	12.7 ± 9.0	6.8 ± 8.8	1.6 ± 0.8

Table 2. Changes of consumption frequency of American foods

Food items	Male (N = 86)		Female (N = 106)		Total (N = 192)	
	Korea	America	Korea	America	Korea	America
Low fat or skim milk	0.69 ± 1.72[1)]	2.11 ± 3.10**	0.68 ± 1.60	3.64 ± 3.78***	0.69 ± 1.65	2.98 ± 3.58###
Salad (raw vegetables)	2.94 ± 2.69	2.78 ± 1.89	3.50 ± 3.23	3.31 ± 2.48	3.25 ± 3.01	3.07 ± 2.24
Cold cereals	1.05 ± 2.05	2.05 ± 2.74*	0.87 ± 1.75	2.20 ± 2.30***	0.94 ± 1.88	2.13 ± 2.50###
Whole wheat bread	0.66 ± 1.52	1.02 ± 1.88	0.26 ± 0.98	1.38 ± 2.02***	0.43 ± 1.26	1.22 ± 1.96###
Diet soft drink	0.89 ± 1.86	0.94 ± 1.79	1.14 ± 2.45	1.47 ± 2.88	1.02 ± 2.20	1.25 ± 2.49
Hamburger	1.52 ± 2.18	2.69 ± 2.11**	1.67 ± 2.24	2.23 ± 2.20	1.61 ± 2.21	2.44 ± 2.16##
Pizza	1.28 ± 2.12	2.52 ± 2.28**	2.17 ± 2.48	2.74 ± 2.56	1.80 ± 2.37	2.64 ± 2.43##
Cake, pie	1.93 ± 2.32	2.03 ± 2.30	1.88 ± 2.22	2.27 ± 2.30	1.90 ± 2.26	2.16 ± 2.30
Chips	1.79 ± 2.23	2.20 ± 2.45	2.27 ± 2.38	2.37 ± 2.30	2.06 ± 2.32	2.29 ± 2.36
Mean consumption frequency	1.50 ± 1.08	2.18 ± 1.10***	1.84 ± 1.38	2.52 ± 1.08***	1.69 ± 1.27	2.36 ± 1.10###

1) Mean ± SE
0 point for less than once a month, 0.5 point for 1 – 3 times per month, 1 point for once a week, 2.5 point for 2 – 3 times a week, 5 point for 4 – 6 times a week, 7 point for everyday, 14 point for more than 2 times a day

moving to America. Pearson's correlation between the change or BMI and change in dietary factors and related factors with or without adjustment for possible confounding factors, stepwise multiple regression analysis was performed to examine the correlation between the change in BMI and other possible risk factors. SAS program package was used for statistical analysis.

Results and Discussion

1. General characteristics (Table 1)

Among the 192 replies, more than half (55%) were from women. The mean age of the sample was 39 ± 10 years ranging from 22 to 59. One hundred twenty two (63.5%) of the subjects were included in the range 21 ≤ <40 years.

The mean number of family members were 3.4. Respondents were highly educated. The mean education years in Korea was 16.5 years, which means completing 4 years of college education. Education years in America for men was 12.7 years, which was significantly higher than that of women (6.8 years).

2. Changes in food consumption

It was reported that the mean consumption frequency of low fat milk, cold cereals and whole wheat bread, which can be regarded as desirable foods for healthy Americans (Krauss et al. 1996) were significantly increased ($p < 0.05 - 0.01$) both in males and females (Table 2).

However the consumption frequencies of hamburger and pizza, which can be regarded as high fat foods were significantly increased ($p < 0.01$) only in males.

Table 3. Changes of consumption frequency of common foods

Food items	Male (N = 86)		Female (N = 106)		Total (N = 192)	
	Korea	America	Korea	America	Korea	America
Milk	2.75 ± 2.64[1)]	2.92 ± 3.62	3.33 ± 2.75	3.35 ± 3.37	3.07 ± 2.71	3.14 ± 3.49
Soft drink	3.39 ± 3.00	3.84 ± 3.64	2.70 ± 2.68	2.80 ± 2.77	3.01 ± 2.84	3.29 ± 3.24
Beef	2.80 ± 2.25	2.54 ± 1.42	2.73 ± 1.91	2.58 ± 1.69	2.76 ± 2.06	2.56 ± 1.57
Pork	2.51 ± 1.97	1.98 ± 2.07	2.14 ± 1.97	1.94 ± 2.08	2.31 ± 1.97	1.96 ± 2.07
Chicken	2.59 ± 2.02	2.63 ± 1.99	2.66 ± 2.05	2.46 ± 2.04	2.63 ± 2.03	2.54 ± 2.01
Egg	3.20 ± 2.15	3.51 ± 2.37	3.60 ± 2.43	3.48 ± 2.39	3.42 ± 2.31	3.49 ± 2.37
Fish	3.10 ± 1.64	2.63 ± 1.98	2.97 ± 2.02	2.61 ± 2.04	3.03 ± 1.86	2.62 ± 2.01$^{\#}$
Fruit	5.40 ± 3.33	6.05 ± 3.77	7.38 ± 4.12	7.41 ± 3.91	6.50 ± 3.91	6.80 ± 3.89
White bread	2.16 ± 2.16	2.68 ± 2.65	2.13 ± 1.98	2.71 ± 2.23	2.14 ± 2.05	2.70 ± 2.42$^{\#}$
Butter, Margarine	2.04 ± 2.27	2.41 ± 2.95	2.05 ± 2.18	2.65 ± 2.45	2.05 ± 2.21	2.54 ± 2.68
Other fatty food	2.65 ± 2.16	2.27 ± 2.11	2.56 ± 2.10	2.44 ± 2.22	2.60 ± 2.14	2.37 ± 2.17
Mean consumption frequency	2.99 ± 1.05	3.09 ± 1.06	3.13 ± 1.05	3.21 ± 1.02	3.07 ± 1.05	3.16 ± 1.04

1) Mean ± SE
0 point for less than once a month, 0.5 points for 1 – 3 times per month, 1 point for once a week, 2.5 points for 2 – 3 times a week, 5 points for 4 – 6 times a week, 7 points for everyday, 14 points for more than 2 times a day

Table 4. Changes of consumption frequency of Korean foods

Food items	Male (N = 86)		Female (N = 106)		Total (N = 192)	
	Korea	America	Korea	America	Korea	America
Tofu	3.13 ± 2.17[1)]	2.91 ± 1.73	3.09 ± 2.11	2.72 ± 1.69	3.11 ± 2.13	2.80 ± 1.70
Cooked vegetable	5.01 ± 3.58	3.18 ± 2.79***	5.22 ± 3.86	3.43 ± 2.93***	5.13 ± 3.72	3.32 ± 2.83$^{\#\#\#}$
Seaweeds	3.86 ± 2.56	3.79 ± 3.08	4.31 ± 3.27	4.27 ± 3.42	4.10 ± 2.97	4.06 ± 3.27
Kimchi	11.64 ± 3.94	8.46 ± 4.39***	10.61 ± 4.25	8.61 ± 4.51**	11.07 ± 4.14	8.54 ± 4.45$^{\#\#\#}$
Cooked rice	13.16 ± 2.41	10.33 ± 4.1	12.60 ± 3.26	9.91 ± 4.16***	12.85 ± 2.92	10.10 ± 4.07$^{\#\#\#}$
Oriental instant noodle	2.75 ± 2.22	2.56 ± 1.96	2.36 ± 2.16	2.48 ± 1.97	2.53 ± 2.19	2.51 ± 1.96
Mean consumption frequency	6.59 ± 1.54	5.23 ± 1.70***	6.39 ± 1.80	5.29 ± 1.81***	6.48 ± 1.69	5.27 ± 1.75$^{\#\#\#}$

1) Mean ± SE
0 point for less than once a month, 0.5 points for 1 – 3 times per month, 1 point for once a week, 2.5 points for 2 – 3 timesa week, 5 points for 4 – 6 times a week, 7 points for everyday, 14 points for more than 2 times a day

For common foods, only fish consumption frequency was significantly decreased ($p < 0.05$) and white bread consumption frequency was significantly increased ($p < 0.05$) for all subjects group (Table 3). Korean food consumed in Korea showed that the highest mean consumption frequency of 6.48 ± 1.69 times per week over four times that of American foods 2.36 ± 1.10. The consumption frequency of cooked vegetables, Kimchi, and cooked rice were significantly decreased ($p < 0.001$) for both male and female after they moved to America (Table 4).

Lee et al. (1999) reported that American food consumption increased with higher American structural adaptation and less retention of Korean culture. Korean food consumption decreased with less retention of Korean ethnic society and higher American cultural adaptation ; however, others report that rice remained a staple food and Kimchi a side dish after long years of stay in the California bay area of America (Gordon et al. 2000). There was no increased "American-type food" consumption or decreased traditional food consumption with length of residence in the U.S for Korean-Americans suggesting that the large Korean community in the San Francisco bay area may decelerate the rate of cultural and structural acculturation as reported by others (Axelson 1986). Son (1994) suggested that the quantity of Korean food consumed by Korean-Americans was related to marital status, subscription to Korean magazines or newspaper and the length of stay in U.S.

When the "Korean diet score" for each food item and for the total were compared, the score of fish, Kimchi and rice were significantly changed ($p<0.001$) as expected from Table 3 and 4. The beef score was significantly decreased only in male subjects and total "Korean diet score" was significantly decreased after in America.

Table 5. Changes of Korean diet score for each food item and total

Food items score	Male (N = 86)		Female (N = 106)		Total (N = 192)	
	Korea	America	Korea	America	Korea	America
Fish score (unit) [1]	2.80 ± 0.45	2.47 ± 0.78***	2.80 ± 0.59	2.48 ± 0.76*	2.80 ± 0.53	2.48 ± 0.77###
Kimchi score (unit) [1]	3.83 ± 0.43	3.64 ± 0.57*	3.81 ± 0.41	3.67 ± 0.62***	3.82 ± 0.42	3.66 ± 0.60###
Rice score (unit) [1]	3.96 ± 0.18	3.84 ± 0.42***	3.91 ± 0.34	3.84 ± 0.38	3.93 ± 0.28	3.84 ± 0.40###
White bread score (unit) [2]	2.04 ± 0.81	1.93 ± 0.68	2.03 ± 0.68	1.87 ± 0.65	2.03 ± 0.74	1.90 ± 0.66
Beef score (unit) [2]	2.40 ± 0.70	2.31 ± 0.53*	2.44 ± 0.68	2.33 ± 0.61	2.42 ± 0.68	2.32 ± 0.58#
Pork score (unit) [2]	2.59 ± 0.72	2.94 ± 0.85	2.79 ± 0.78	2.96 ± 0.87	2.70 ± 0.76	2.95 ± 0.85
Chicken score (unit) [2]	2.59 ± 0.70	2.55 ± 0.75	2.61 ± 0.75	2.63 ± 0.77	2.60 ± 0.73	2.60 ± 0.76
Butter and margarine score (unit) [2]	2.65 ± 0.84	2.81 ± 0.85	2.63 ± 0.83	2.76 ± 0.86	2.64 ± 0.83	2.78 ± 0.86
Fatty food score (unit) [2]	3.08 ± 0.98	2.83 ± 0.92	2.94 ± 0.99	2.82 ± 0.94	3.00 ± 0.99	2.82 ± 0.93
Soft drink score (unit) [2]	3.01 ± 1.06	2.96 ± 1.15	3.32 ± 1.20	3.29 ± 1.18	3.18 ± 1.15	3.14 ± 1.18
Total Korean diet score (unit)	27.46 ± 4.23	27.22 ± 3.52	27.99 ± 5.03	27.42 ± 4.21	27.76 ± 4.69	27.33 ± 3.91#

1) Traditional Korean foods of rice (1 – 4), fish (1 – 4) and kimchi (1 – 4) were given positive values : higher score (1 – 4) was given for higher frequency

2) American style food were reversed scored : lower score was given for higher frequency, 1 – 3 score for white bread, 1 – 4 for meat, butter and margarine and fatty foods and 1 – 5 for soft drink

Table 6. Changes of dietary behavior N (%)

	Male (N = 86)		Female (N = 106)		Total (N = 192)	
	Korea	America	Korea	America	Korea	America
Breakfast rarely	7(8.4)	9(10.6)	13(12.4)	*4(3.8)	20(10.6)	13(6.8)
Less than Once a week	5(6.0)	6(7.1)	4(3.8)	10(9.5)	9(4.8)	16(8.4)
2–3 times a week	9(10.8)	11(12.9)	11(10.5)	16(15.2)	20(10.6)	27(14.2)
3–4 times a wepk	9(10.8)	7(8.2)	13(12.4)	19(18.1)	22(11.7)	26(13.7)
Everyday	53(63.9)	52(61.2)	64(61.0)	56(53.3)	117(62.2)	108(56.8)
Subtotal	83(49.4)	85(50.6)	105(50.0)	105(50.0)	188(49.7)	190(50.3) ##
Lunch 2–3 times a week	1(1.2)	4(4.7)	5(4.8)	9(8.7)	6(3.2)	13(6.9)
3–4 times a week	3(3.7)	10(11.8)	7(6.7)	15(14.4)	10(5.4)	25(13.2)
Everyday	77(95.1)	71(83.5)	93(88.6)	80(76.9)	170(91.4)	151(79.9)
Subtotal	81(48.8)	85(51.2)	105(50.2)	104(49.8)	186(49.6)	189(50.4)
Dinner 2–3 times a week	0(0.0)	1(1.2)	2(2.0)	4(3.8)	2(1.1)	5(2.7)
3–4 times a week	2(2.4)	1(1.2)	6(6.0)	10(9.5)	8(4.4)	11(5.8)
Everyday	81(97.6)	82(97.6)	92(92.0)	91(86.7)	173(94.5)	173(91.5)
Subtotal	83(49.7)	84(50.3)	100(48.8)	105(51.2)	183(49.2)	189(50.8)
Snackrarely	7(9.9)	12(15.4)	3(3.0)	6(5.9)	10(5.8)	18(10.1)
Less than once a week	11(15.5)	6(7.7)	6(5.9)	9(8.9)	17(9.9)	15(8.4)
2–3 times a week	18(25.4)	17(21.8)	24(23.8)	28(27.7)	42(24.4)	45(25.1)
3–4 times a week	8(11.3)	11(14.1)	13(12.9)	18(17.8)	21(12.2)	29(16.2)
Everyday	27(38.0)	32(41.0)	55(54.5)	40(39.6)	82(47.7)	72(40.2)
Subtotal	71(47.7)	78(52.4)	101(50.0)	101(50.0)	172(49.0)	179(51.0)
Eating-out		*				##
Rarely	3(3.6)	6(7.0)	5(4.9)	7(6.6)	8(4.3)	13(6.8)
Onec to twice a month	19(22.9)	23(26.7)	25(24.3)	32(30.2)	44(23.7)	55(28.7)
Once a month	23(27.7)	36(41.9)	36(35.0)	48(45.3)	59(31.7)	84(43.8)
3–4 times a week	18(21.7)	8(9.3)	26(25.2)	13(12.3)	44(23.7)	21(10.9)
Everyday	20(24.1)	13(15.1)	11(10.7)	6(5.7)	31(16.7)	19(9.9)
Subtotal	83(49.1)	86(50.9)	103(49.3)	106(50.7)	186(49.2)	192(50.8)

3. Changes of dietary behavior

Distribution of the subjects having lunch and snack were significantly changed after moving to America. Less subjects answered that they have lunch everyday in America. Twenty percent of the subjects skip lunch more than 3 − 4 times a week (Table 6). The proportion of the subjects eating out everyday was lowered (9.9%) in America than in Korea (16.7%).

4. Changes of Physical and lifestyle factors

Table 7 shows changes of physical and lifestyle factors.

The weight, accordingly BMI significantly increased ($p < 0.001$). The smoking habit score was significantly decreased for male after moving to America ($p < 0.05$).

The increase of BMI may be largely due to increase of the age of the subjects as the length of stay in America is increasing and partly due to dietary change shown in Table 2−Table 5, increasing of the mean consumption frequency of American foods and decreasing of Korean foods.

It is well known that many of the American foods are high in fat and energy. The traditional Korean diet is low in fat and cholesterol, but tends to be high in sodium. It was re-

Table 7. Changes of physical and lifestyle factors

	Male (N = 86)		Female (N = 106)		Total (N = 192)	
	Korea	America	Korea	America	Korea	America
Height (cm)	172.03 ± 4.88	171.98 ± 5.13	160.26 ± 4.77	160.15 ± 4.75	165.53 ± 7.59	165.38 ± 7.67
Weight (kg)	65.91 ± 8.38	69.01 ± 8.52**	50.19 ± 5.79	52.93 ± 5.74***	57.32 ± 10.56	60.13 ± 10.70###
BMI (kg/height, m^2)	22.26 ± 2.64	23.33 ± 2.62**	19.55 ± 2.15	20.67 ± 2.41***	20.77 ± 2.73	21.85 ± 2.83###
PIBW (%)	101.77 ± 12.19	106.74 ± 12.24**	92.86 ± 10.99	98.28 ± 12.61**	96.87 ± 12.34	102.04 ± 13.11###
Activity						
Light activity[1)]	1.19 ± 1.09	1.46 ± 1.06	1.17 ± 1.16	1.40 ± 1.21	1.18 ± 1.13	1.43 ± 1.14
Vigorous activity[2)]	1.00 ± 1.11	0.83 ± 1.10	0.86 ± 1.13	0.61 ± 1.00	0.92 ± 1.12	0.71 ± 1.05
Frequency of Drinking[3)]	1.65 ± 1.10	0.84 ± 0.93	0.37 ± 0.71	0.19 ± 0.50	0.95 ± 1.10	0.48 ± 0.79
Smoking[4)]	0.54 ± 0.50	0.38 ± 0.49*	0.03 ± 0.19	0.02 ± 0.16	0.27 ± 0.44	0.18 ± 0.39
Self diagnosed health status[5)]	3.21 ± 0.49	3.17 ± 0.51	3.15 ± 0.55	3.05 ± 0.49	3.18 ± 0.52	3.11 ± 0.50

1) Walking, dancing, gardening, golfing, bowling : less than once a month : 0, 1 − 3 times per month : 1, 1 − 2 times per week : 2, more than three times a week : 3
2) Aerobics, running, swimming, bicycling
3) Rarely : 0, 1 − 2 times/month : 1, 1 − 2 times/week : 2, 3 − 4 times a week : 3, almost everyday : 4
4) Smoking : yes : 1, no : 0
5) Very bad : 1, bad : 2, good : 3, very good : 4

Table 8. Correlation of diet related factors with changes of BMI

	Changes of BMI	partial†	partial††
Current age	0.25***		
sex	0.00		
Length of residence (stay)	0.41***	0.32***	
Change in milk consumption frequency	0.16*	0.09	0.12
Change in fruit consumption frequency	0.16*	0.15	0.16*
Education years in Korea	−0.34***	−0.27**	−0.16*
Education years in America	−0.08	0.05	−0.04
Change in alcohol consumption frequency	0.18*	0.14	0.13
Change in mean FFQ for American food	0.01	0.07	0.01
Change in mean FFQ for common food	0.19**	0.20*	0.22*
Change in mean FFQ for Korean food	−0.10	−0.10	−0.09
Change in fish score (score 4−1)	0.15*	0.13	0.04
Change in chicken score (score 1−4)	−0.21**	−0.21**	−0.19*
Change in soda score (score 1−5)	−0.13	−0.16*	−0.14
Change in Total Korean diet score (of 10 item)	−0.10	−0.08	−0.11

† adjusted for age and sex
†† adjusted for age, sex, length of residence

ported that the higher BMI of Japanese in Hawaii compared to Japanese in Japan was not related to total caloric intake but greater percent caloric intake as fat in Hawaii (Curb, Marcus, 1991). In this study, the mean BMI of the subjects in America was similar to that observed in the same age group of the National Health and Nutrition Survey (1998) in Korea.

5. Correlation between the BMI change and life style factors (Table 8)

Pearson's correlation was calculated to examine if the change in BMI is correlated with changes in dietary factors and other related variables. Length of residence (increase of age) showed the highest degree of positive correlation ($p < 0.001$), followed by the current age ($p < 0.001$), the change in alcohol consumption frequency ($p < 0.05$), the change in milk consumption frequency ($p < 0.05$) and the change in fruit consumption frequency ($p < 0.05$). Education years in Korea was the strongest negative factor ($p < 0.001$) related to the change in BMI, which means subjects with more education in Korea showed less BMI increase after in America. While education years in America did not show any significant relationship with the change of BMI.

Because of possible different changes of BMI for various ages, Pearson's correlation coefficient was adjusted for current age. The level of the coefficient for length of residence (0.41 vs 0.32) was lowered.

The correlation coefficient with education years in Korea (−0.34 vs −0.27), and change in fruit consumption frequency (0.16 vs 0.15) were decreased except change in mean FFQ for common food (0.19 vs 0.20). The correlation coefficient for change in fruit consumption frequency ($r = 0.15$) and change in alcohol consumption frequency ($r = 0.14$) showed borderline significance after adjustment.

To exclude the increase of BMI with aging, the correlation coefficient was adjusted for current age and the length of stay (increase of age). It showed only the change in fruit consumption frequency ($r = 0.16$, $p < 0.05$), change in mean FFQ for common food ($r = 0.22$, $p < 0.01$), education years in Korea ($r = -0.16$, $p < 0.05$) were significant. Although we had expected that mean FFQ change in American food groups or in Korean Food groups were correlated with the BMI change in America, the mean FFQ for common food was significantly correlated with change of BMI.

Among the food items used for "Korean diet score" only changes of chicken ($p < 0.01$) and soft drink scores ($p < 0.05$) were negatively correlated with the change of BMI after adjustment for age and sex. Those results mean that the subjects who reported eating chicken or soft drink more frequently than in Korea showed greater increase of BMI in America. The Total Korean diet score tended to be negatively correlated with the change of BMI but it was not significant.

6. Multiple regression of the change in BMI with diet related variables (Table 9, Table 10)

The results of multiple linear regression for BMI change (Table 9) showed that education years in Korea was the most prominent negative factor ($p < 0.001$) in predicting BMI change in America. Changes of alcohol consumption frequency ($p < 0.05$), changes of chicken score ($p < 0.05$)

Table 9. Multiple regression analysis of the change in BMI with diet related variables ($R^2 = 0.1763$)

Independent variables	Regression coefficient β	SE	p
Education years in Korea	−0.18	0.05	0.0007
Change in alcohol consumption frequency	0.26	0.12	0.0463
Change in fruit consumption frequency	0.05	0.02	0.0719
Change of chicken score	−0.24	0.11	0.0312
Change of soft drink score	−0.16	0.07	0.0319

Table 10. Multiple regression analysis of the change in BMI with diet related variables when adjusted for length of residence ($R^2 = 0.2366$)

Independent variables	Regression coefficient β	SE	p
Length of residence (increases of age)	0.36	0.09	0.0003
Change in alcohol consumption frequency	0.22	0.12	0.0732
Change in fruit consumption frequency	0.05	0.02	0.0709
Education years in Korea	−0.08	0.05	0.1363
Change of chicken score	−0.21	0.10	0.0455
Change of soft drink score	−0.14	0.07	0.0460

and soft drink score ($p < 0.05$) were other significant factors.

The results mean that shorter education years in Korea was associated with more increase of BMI in America. Elevated frequencies of alcohol, chicken and soft drink in America were associated with greater increase of BMI. All of the 5 factors explained 17.6% of variance in BMI change (Table 9). When the length of residence (increase of age) was included as an adjustment factor in the multiple regression model, increase of age was the most significant factor ($p < 0.001$) in predicting BMI increase in America (Table 10). Changes of chicken and soft drink scores were the other significant negative factors ($p < 0.05$).

Twenty four percent of the total variation of BMI change was explained by the length of residence, the change in chicken score, soft drink score, alcohol consumption frequency, fruit consumption frequency and education years in Korea.

Summary and Conclusion

This study was performed to examine the dietary and BMI change and to identify the factors influencing changes of BMI of Korean-Americans residing in eastern area of America. The subjects were 192 Korean-Americans, consisted of 86 men and 106 women residing in New York and New Jersey states of the U.S.A. The results are as follows :

1) For American foods, the mean consumption frequency of low fat milk, cold cereals and whole wheat bread were significantly reportedly increased ($p < 0.05 \sim 0.01$) both in males and females. However the consumption frequencies of hamburger and pizza, which can be regarded as high fat foods were significantly increased ($p < 0.01$) only in males.

2) For common foods, only fish consumption frequency was significantly reportedly decreased ($p < 0.05$) but white bread consumption frequency was significantly increased ($p < 0.05$). The consumption frequency of cooked vegetables, Kimchi and cooked rice were significantly decreased ($p < 0.001$) for both gender after moving to America.

3) Less subjects reported they have lunch everyday in America. Twenty percent of the subjects skip lunch more than 3 − 4 times a week. The proportion of the subjects eating out everyday was significantly lowered in America.

4) The weight, accordingly BMI, were significantly increased ($p < 0.01$, $p < 0.001$, respectively). The smoking habit score was significantly decreased for males ($p < 0.05$).

5) In bivariate analysis, length of residence (increase of age) showed the highest degree of positive correlation ($p < 0.001$) with the change in BMI, followed by the current age ($p < 0.01$), the change in alcohol consumption frequency ($p < 0.05$), the change in milk consumption frequency ($p < 0.05$), and the change in fruit consumption frequency ($p < 0.05$). Education years in Korea was the strongest negative factor ($p < 0.001$).

When the correlation coefficient was adjusted for current age and the length of stay, only the change in fruit consumption frequency ($r = 0.16$, $p < 0.05$), change in mean FFQ for common food ($r = 0.22$, $p < 0.01$), education years in Korea ($r = 0.16$, $p < 0.05$) were significant in association with the change in BMI in America.

6) Among the food items used for "Korean diet score", only the changes of chicken ($p < 0.01$) and soft drink score ($p < 0.05$) were negatively correlated with the change in BMI. The total Korean diet score tended to be negatively correlated, but it was not significant.

7) Multiple linear regression analysis for BMI change showed that education years in Korea was the most prominent negative factor ($p < 0.001$) in predicting BMI change in America. It means that shorter education in Korea was associated with more increase of BMI in America. Elevated frequencies of alcohol, chicken and soft drink in America were associated with greater increase of BMI.

When the length of residence (increase of age) was included in the multiple regression model, the increase of age was the most significant factor ($p < 0.001$) in predicting BMI increase in America. Changes of chicken and soft drink scores were the other significant negative factors.

In this study food consumption frequency in America and Korea were examined at one point in time. There may be some error for the subjects in recalling food consumption frequency when they were in Korea. Further studies need longitudinal approach observing Koreans for a long time after they have moved to America.

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