Original Article

Coffee consumption patterns in Korean adults: the Korean National Health and Nutrition Examination Survey (2001-2011)

Youjin Je ScD[1], Seonghyun Jeong MA[2], Taeyoung Park PhD[2]

[1]*Department of Food and Nutrition, Kyung Hee University, Seoul, South Korea*
[2]*Department of Applied Statistics, Yonsei University, Seoul, South Korea*

We examined coffee consumption patterns over the past decade among Korean adults. This study was based on seven different cross-sectional data from the Korean National Health and Nutrition Examination Survey (KNHANES) between 2001 and 2011 (17,367 men and 23,591 women aged 19-103 y, mean 48.1 y). Information on frequency and type of coffee consumption was derived from frequency questionnaires or 24-hour recalls. For the study period, the prevalence of daily coffee consumption increased by 20.3% (from 54.6 to 65.7%; $p<0.001$). For those who consumed 2 or more cups of coffee daily, it dramatically increased by 48.8% (from 29.1 to 43.3%; $p<0.001$). The instant coffee mix was consumed the most frequently by Korean adults, and it was on the increasing trend among people who were middle aged or older (≥40 y), while it was on the slowdown in young men or on the declining trend in young women. Brewed coffee consumption had an increasing trend by all age groups in recent years. Especially, there was a rapid increase in brewed coffee consumption among young women (strongly) and young men. The instant coffee mix that contains non-dairy creamer and/or sugar still takes up a significant portion of coffee consumption in Korea, which may result in weight gain and insulin resistance, and potential benefits of coffee may be offset. Given high prevalence of coffee consumption in Korea, nutrition education should be conducted to help people (especially the elderly) to make healthy coffee drinking habits.

Key Words: brewed coffee, cross-sectional study, dietary intake, instant coffee mix, Korean population

INTRODUCTION

Coffee is one of the most commonly consumed beverages worldwide, and has been related to various health outcomes. Coffee is not only the primary source of caffeine, but also one of the major sources of antioxidants in the diet.[1,2] Recent epidemiological studies have shown that habitual coffee consumption reduced the risk of diabetes,[3] heart diseases,[4] and some types of cancer.[5] Although coffee components per se could be beneficial against chronic disease incidence and progression, how coffee affects our overall health is likely to depend on the way that coffee is consumed in the long-term, eg, adding substantial amounts of sugar and cream to coffee at every time. Some discrepancies on epidemiological data of coffee consumption and health outcomes may be partly due to lack of consideration for type of coffee being consumed most frequently in specific populations. Over the past decade, South Korea has undergone major shifts in diet and has experienced the westernization of food consumption due to the rapid economic growth and the introduction of Western culture.[6] Along with shifts in diet and the rapid rise of coffee shops, coffee consumption has increased over the past decade, but the patterns of coffee consumption may differ by age, gender, and types of coffee. Especially, "coffee mix" made of instant coffee with non-dairy creamer and sugar in a small sachet has been beloved by Korean adults. Despite the beneficial effects of coffee components, additional calories, fats and sugar in the coffee mix may negate the potential benefits of coffee components and even increase the risk of chronic diseases if it is consumed over many years. Since no studies have examined national trends of coffee consumption patterns formally in Korean population, we examined secular trends of coffee consumption in Korean adults over the age of 19 years during the recent transition period, using the series of seven cross-sectional data from the Korean National Health and Nutrition Examination Survey (KNHANES) conducted in 2001, 2005, 2007, 2008, 2009, 2010, and 2011. We also investigated whether socioeconomic status, anthropometric measurements, and lifestyle factors were related to daily coffee drinking in Korean adults.

MATERIALS AND METHODS

The KNHANES, a national cross-sectional survey of the Korean population, was conducted in five different time

Corresponding Author: Dr Taeyoung Park, Department of Applied Statistics, Yonsei University, 50 Yonsei-ro, Seodaemun-gu, Seoul 120-749, South Korea.
Tel: +82-2-2123-2542; Fax: +82-2-2123-8638
Email: tpark@yonsei.ac.kr
Manuscript received 09 December 2013. Initial review completed 17 December 2013. Revision accepted 10 May 2014.
doi: 10.6133/apjcn.2014.23.4.11

periods, 1998 (1st), 2001 (2nd), 2005 (3rd), 2007-2009 (4th), and 2010-2011 (5th). The current study used data from the KNHANES, which is the nationally representative dietary and health examination surveys of the Korean population.[7] The KNHANES obtained stratified, multistage probability samples of Korean households representing the civilian, non-institutionalized Korean population aged 12 months and older in different geographical areas and in different age and gender groups. The sampling weight represents the inverse probability of selection into the sample, adjusted for non-response, so that the sum of the weights is equal to that year's civilian, non-institutionalized Korean population. The KNHANES contains a health behavior interview, health examination, and nutrition survey including a food frequency questionnaire and a 24-hour dietary recall.

This study is based on seven different cross-sectional data from KNHANES from 2001 to 2011 because dietary data on coffee consumption was not collected in 1998. Participants in the current study were targeted on male and female adults who were at least 19 years old. We excluded participants who were 18 years old or younger or those who did not report coffee consumption on the frequency questionnaires. The study subjects consist of 3,265 men and 3,849 women in 2001, 2,936 men and 3,626 women in 2005, 1,194 men and 1,732 women in 2007, 2,453 men and 3,738 women in 2008, 2,854 men and 3,982 women in 2009, 2,352 men and 3,350 women in 2010, and 2,313 men and 3,314 women in 2011. As a result, a total of 40,958 participants (17,367 men and 23,591 women aged 19-103 y, mean 48.1 y) were included in our study. The study was approved by the Korea Centers for Disease Control and Prevention Institutional Review Board (IRB: 2007-02CON-04-P; 2008-04EXP-01-C; 2009-01CON-03-2C; 2010-02CON-21-C; 2011-02CON-06-C). Written informed consent was obtained from all study participants.

Coffee consumption in the KNHANES was assessed using the frequencies on the 63-item food frequency questionnaires (FFQs) assessed from 2001 through 2011. Participants were asked to indicate how frequently they consumed coffee over the previous year, and the frequencies of coffee consumption were categorized into 10 groups: none or consume very little, 6-11 times/year, 1 or 2-3 time(s)/month, 1, 2-3, or 4-6 time(s)/week; and 1, 2, or 3 time(s)/day. The same participants who completed the FFQs also provided information on types of all coffee beverages that they consumed for the past 24 hours (midnight to midnight). The 24-hour dietary recalls were conducted through in-person interviews by trained dietary staff in mobile examination centers similar to the National Health and Nutrition Examination Survey (NHANES) in the United States. Using the data obtained from the 24-hour dietary recalls, we categorized the type of coffee as brewed coffee, instant coffee mix, and canned coffee, where canned coffee is liquid coffee brewed in advance and ready to drink on the spot, and is typically sweetened and contains milk inside.

Anthropometric measures including height, weight and waist circumference were assessed and recorded by the medical teams performing the health examination. Body mass index (BMI) was calculated as weight divided by height^2 (kg/m^2). In addition, participants were asked to indicate demographic characteristics (eg, age and gender), socioeconomic status (eg, marital status, household income, educational level and residential area), and lifestyle factors (eg, smoking status, alcohol consumption, and level of physical activity). Participants were also asked about their vitamin or mineral supplement use. Alcohol consumption was calculated as the weekly servings of alcoholic beverages determined by multiplying the frequency of alcohol drinking by the number of alcoholic beverage servings consumed. We calculated physical activity level using Metabolic Equivalent of Task (MET) values based on self-reported frequency and duration of vigorous intensity, moderate intensity, and walking activities during the week.[8] Total weekly physical activity was calculated by summing MET hours per week of walking (3.3 METs), moderate (4.0 METs), and vigorous (8.0 METs) activity.

We combined data from seven surveys of KNHANES (II-V). We first calculated proportion of subjects who belonged to each category of coffee consumption (1 time/week or less, 2-6 times/week, 1 time/day, 2 times/day or more) in year 2001, 2005, 2007, 2008, 2009, 2010, and 2011 separately, and then examined secular changes in the prevalence of coffee consumption from 2001 through 2011. To test for linear trends in frequency of coffee consumption across years (from 2001 to 2011), we used the Wald test for logistic regression accounting for the sampling weights. Also, we tested the overall trend across the ordinal frequency of coffee consumption by using the Wald test for cumulative logistic regression. The secular trends were assessed by age (19-39 y, 40-59 y, ≥60 y), gender (men, women), and type of coffee (brewed coffee, instant coffee mix, canned coffee), accounting for the sampling weights in the stratified, multistage samples. For the type of coffee, we calculated prevalence of brewed coffee, instant coffee mix, or canned coffee consumed at least once within the past 24 hours based on the information on the type of coffee obtained from 24-hour dietary recalls

To investigate factors related to coffee consumption in Korean adults, we estimated crude- and multivariable-adjusted odds ratios (ORs) and 95% confidence intervals (CIs) using multiple logistic regression analyses that modeled daily coffee consumption (≥1 time/day) as a dependent variable. Multiple logistic regression models included age (19-39, 40-59 or ≥60 y), gender (men or women), marital status (single or married), education (<7, 7-12 or >12 y), household income (low, lower middle, upper middle or high), residential area, physical activity (<5.0, 5.0-19.9, 20-49.9 or ≥50 METs-hours/week), smoking status (non-smoker, past smoker, current smoker), alcohol drinking (<1, 1-3 or ≥4 servings/week), BMI (<23, 23-24.9 or ≥25 kg/m^2), waist circumference (inch, continuous variable), and vitamin and mineral supplement use (yes or no). We repeated the analyses for consumption of brewed coffee and instant coffee mix, separately.

All statistical analyses were performed with Statistical Analysis Software (version 9.3, SAS Institute Inc.) and R version 2.15.3 (http://www.r-project.org). $p<0.05$ was considered to be statistically significant.

RESULTS

The percentage of adults consuming different levels of coffee ranging from none to ≥2 times/day in 2001-2011 are presented in Table 1. Over the study period from 2001 to 2011, the percentage of non-coffee drinkers significantly decreased from 20.5% to 9.3% (p<0.0001), similarly for men (from 19.0% to 7.3%, P<0.0001) and women (from 22.1% to 11.2%, P<0.0001). Especially, there was a substantial increase by 48.8% in the prevalence of high coffee drinkers, defined as those who consumed 2 or more cups of coffee daily (from 29.1% to 43.3%, p<0.0001). Both men and women had significant increasing trends of consuming 2 or more cups of coffee per day.

The prevalence of coffee consumption according to type of coffee is given in Table 2. The type of coffee that Korean adults had most frequently consumed was instant coffee mix, and the prevalence of the coffee consumption significantly increased from 47.1% to 59.0% (p<0.0001) over the study period. Although the percentages of adults consuming brewed coffee or canned coffee were relatively low in Korean adults, the consumption of those coffee also increased significantly over time. The instant coffee mix was the most prevalent coffee for both men and women, but the change in the prevalence of consumption was greater in men (from 48.7% to 63.0%, p<0.0001) than women (from 45.5% to 55.1%, p<0.0001). The increasing trend was found for canned coffee as well, although the prevalence of consuming the canned coffee was very low. For the brewed coffee consumption, on the contrary, the increasing trend was greater in women (from 2.9% to 9.1%, p<0.0001) than men (from 2.1% to 5.8%, p<0.0001).

The secular trends of coffee consumption by age groups are shown in Figure 1. The significant increase in the proportion of people who consumed any type of coffee drinking daily (≥1 time/day) was found among participants in the middle age (40-59 years) or the elderly (≥60 years), but not among young adults (19-39 years). Interestingly, overall daily coffee drinking seemed to be decreasing among young female adults in recent years (p=0.01), while no significant change was found in young male adults (p=0.39). By type of coffee, old men and women (≥40 years) had greatly increased the consumption of both instant coffee mix and brewed coffee over the study period. For young adults, however, the consumption prevalence of instant coffee mix was on the declining trend in women or the slowdown in the increasing trend in men. Instead, they showed a rapid increase in the prevalence of brewed coffee drinking in recent years.

Table 3 shows results from the simple and multiple logistic regression analyses that assessed factors related to daily coffee drinking (≥1 time/day) in Korean adults. In the multivariable model, several factors were significantly associated with prevalence of coffee consumption in Korean adults, including middle age, female gender, marriage, relatively high education and household income, moderate alcohol drinking, smoking, and high BMI. By type of coffee, the factors related to instant coffee mix drinking in Korean adults were similar to those for any type of daily coffee drinking, except for household income (Table 4). The brewed coffee consumption, however, was associated with somewhat different characteristics compared with the instant coffee mix drinking among Korean adults. Women were much more likely than men to drink brewed coffee (OR=2.69, 95% CI 1.69, 4.27) adjusting for other factors. While the instant coffee mix was consumed more frequently by married adults than single adults, brewed coffee was consumed less frequently by married adults than single adults (OR=0.73, 95% CI 0.54, 0.99). That is, single adults tended to consume brewed coffee more frequently than married adults, adjusting for age and other factors. In addition, higher educated adults (>12 years) were 5 times more likely to consume brewed coffee than those who had relatively low education (<7 years) (OR=5.13, 95% CI 2.06, 12.7). High household income and Seoul residency were also significantly associated with higher prevalence of brewed coffee consumption. Past smokers compared to non-smokers or overweight subjects compared with normal weight subjects showed relatively higher prevalence of brewed coffee consumption.

DISCUSSION

Our findings for coffee consumption patterns based on the nationally representative data in South Korea showed that the prevalence of daily coffee consumption greatly increased from 2001 to 2011. Korean adults consumed instant coffee mix most frequently, and it was on the increasing trend of coffee consumption among people who were middle aged or older. For young adults, however, the consumption prevalence of instant coffee mix was on the declining trend in women or a slowdown in the increasing trend in men. Brewed coffee consumption was on the increasing trend of consumption by all age groups in recent years. Especially, there was a rapid increase in the consumption of brewed coffee among young women (strongly) and young men.

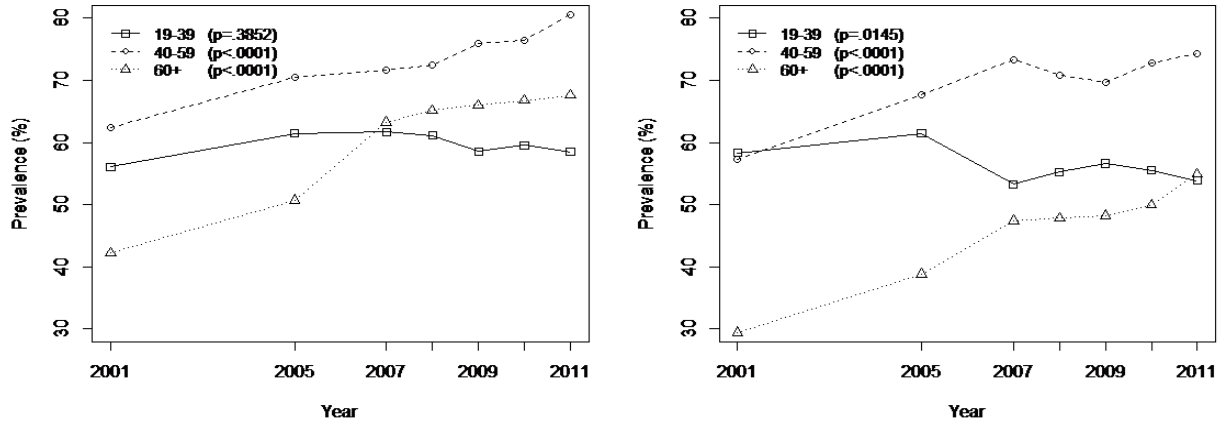
Both instant coffee mix and brewed coffee consumption were significantly associated with female gender and relatively high education status, but the other factors were differently associated with coffee consumption prevalence depending on the type of coffee. In the simple and multivariable models, the ORs for females vs. males were in the opposite directions, having crude OR of 0.81 and adjusted OR of 1.41 after multivariable adjustment (Table 3). When we added one determinant at a time to the simple model, we found that smoking acted as a strong confounder for the relationship between female gender and coffee drinking, thereby changing the association substantially after its adjustment (smoking-adjusted OR for female vs. male=1.23, 95% CI 1.14-1.32). The prevalence of instant coffee mix was higher in married adults than those who were singles, while the prevalence of brewed coffee consumption was higher in singles than married adults. High household income was so strongly associated with brewed coffee drinking, but not with instant coffee mix drinking. People who lived in Seoul, the capital and largest metropolis of South Korea, had higher prevalence of brewed coffee consumption than those who lived in non-Seoul area, while those who lived in the non-Seoul area were more likely to consume the instant coffee mix. The middle age group, obese people, past or current smokers or moderate alcohol drinkers had relatively higher prevalence of instant coffee mix consumption than

Table 1. The prevalence of coffee consumption over the past decade among Korean adults

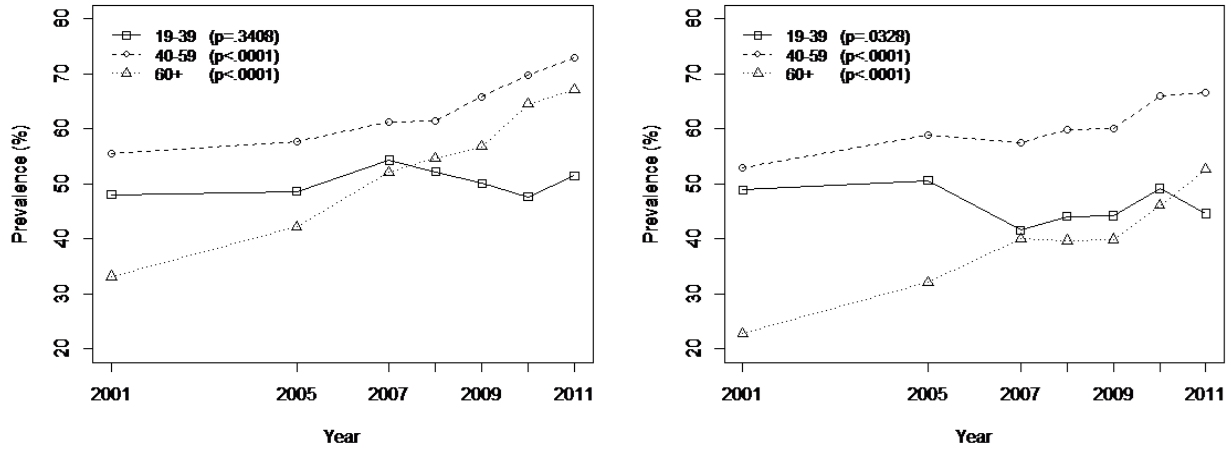
Frequency of coffee consumption	Prevalence of coffee consumption, %							*p* trend	*p* overall trend
	2001	2005	2007	2008	2009	2010	2011		
None	20.5	19.5	14.4	14.3	13.3	10.9	9.3	0.0001	<0.0001
≤1 time/week	12.7	9.1	11.0	10.7	11.3	12.5	11.9	0.66	
2-6 times/week	12.2	10.2	12.1	12.1	12.1	12.3	13.2	0.05	
1 time/day	25.5	25.3	23.9	25.2	24.3	22.8	22.4	<0.0001	
≥2 times/day	29.1	36.0	38.7	37.7	39.0	41.5	43.3	<0.0001	
Men									
None	19.0	17.7	12.4	12.9	11.0	8.4	7.3	<0.0001	<0.0001
≤1 time/week	12.1	8.5	10.9	9.3	10.3	12.8	10.1	0.84	
2-6 times/week	12.5	10.6	10.9	11.6	12.0	11.2	13.5	0.54	
1 time/day	24.4	23.4	19.5	22.1	20.1	19.9	18.3	<0.0001	
≥2 times/day	32.1	39.8	46.3	44.2	46.7	47.7	50.9	<0.0001	
Women									
None	22.1	21.3	16.3	15.7	15.5	13.3	11.2	<0.0001	<0.0001
≤1 time/week	13.4	9.7	11.0	12.1	12.4	12.2	13.6	0.38	
2-6 times/week	11.8	9.8	13.2	12.6	12.3	13.4	12.9	0.02	
1 time/day	26.7	27.1	28.2	28.4	28.4	25.6	26.4	0.82	
≥2 times/day	26.1	32.2	31.2	31.2	31.6	35.5	35.9	<0.0001	

Table 2. The secular trends of different types of coffee drinking, at least once within the past 24 hours, among Korean adults

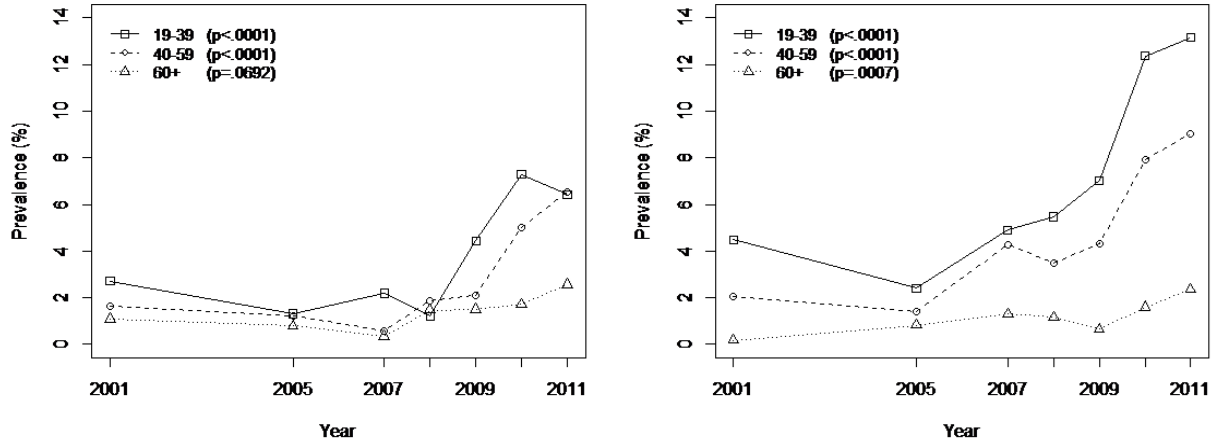
Type of coffee	Prevalence of coffee consumption, %							*p* trend
	2001	2005	2007	2008	2009	2010	2011	
Instant coffee mix								
All subjects	47.1	50.5	51.9	52.6	53.4	57.3	59.0	<0.0001
Men	48.7	51.1	56.7	56.2	57.5	59.5	63.0	<0.0001
Women	45.5	49.9	47.2	49.1	49.3	55.0	55.1	<0.0001
Brewed coffee								
All subjects	2.5	1.5	2.6	2.7	3.8	6.9	7.5	<0.0001
Men	2.1	1.2	1.3	1.5	3.0	5.4	5.8	<0.0001
Women	2.9	1.7	3.9	3.8	4.6	8.3	9.1	<0.0001
Canned coffee								
All subjects	1.2	1.3	2.3	1.9	2.1	2.6	3.8	<0.0001
Men	1.7	1.7	2.9	2.5	3.2	3.7	5.1	<0.0001
Women	0.8	1.0	1.7	1.3	0.9	1.6	2.6	0.0003



(a) Age-specific prevalence of daily coffee drinking (≥1 time/d) in men (left) and women (right)



(b) Age-specific prevalence of instant coffee mix drinking in men (left) and women (right)



(c) Age-specific prevalence of brewed coffee drinking in men (left) and women (right)

Figure 1. Secular trends in prevalence of daily coffee, any type (a), instant coffee mix (b), or brewed coffee (c) drinking according to different age groups (19-39, 40-59, 60+ years of age) in Korean adults, 2001-2011

those who were not. Physical activity, waist circumference, and vitamin-mineral supplement use were, however, not significantly associated with any type of coffee consumption.

There has been an increasing interest in the association between coffee consumption and chronic disease incidence or mortality, given the beneficial effects of coffee components including strong antioxidant properties. Many epidemiological studies conducted in the United States, Europe or Japan provided some evidence that long-term coffee consumption reduced the risk of several disease outcomes,[3-5,9-16] including total mortality.[17,18] Coffee consumption was inversely associated with circulating levels of estrogen, C-peptide, a marker of insulin secretion, and some inflammatory markers, and positively associated with plasma adiponectin levels, an insulin sensitizer,[19-21] which may explain strong inverse associations between coffee consumption and risk of type 2 diabetes,[3]

Table 3. Prevalence odds ratios (ORs) and 95% confidence intervals (CIs) of daily coffee drinking (≥1 time/d) in Korean adults based on the combined data from KNHANES 2001-2011

Characteristics	Total (n)	Daily coffee drinker, n (%)	Non-daily coffee drinker, n (%)	Crude OR (95% CI)	Adjusted OR† (95% CI)
KNHANE II (2001)	7114	3886 (54.6)	3228 (45.4)		
KNHANES III (2005)	6562	4004 (61.0)	2558 (39.0)		
KNHANES IV (2007-2009)	15953	9922d (62.2)	6031 (37.8)		
KNHANES V (2010-2011)	11329	7396 (65.3)	3933 (34.7)		
Age, years					
19-39	14431	8758 (60.7)	5673 (39.3)	1.00	1.00
40-59	15210	10575 (69.5)	4635 (30.5)	1.58 (1.49-1.68)	1.37 (1.24-1.52)
≥ 60	11317	5875 (51.9)	5442 (48.1)	0.65 (0.60-0.70)	0.86 (0.76-0.98)
Sex					
Male	17367	11388 (65.6)	5979 (34.4)	1.00	1.00
Female	23591	13820 (58.6)	9771 (41.4)	0.81 (0.77-0.85)	1.41 (1.26-1.58)
Marital status					
Single	10933	5515 (50.4)	5418 (49.6)	1.00	1.00
Married	29539	19410 (65.7)	10129 (34.3)	2.03 (1.91-2.15)	1.79 (1.62-1.97)
Education (years)					
<7	10272	5270 (51.3)	5002 (48.7)	1.00	1.00
7-12	17770	11566 (65.1)	6204 (34.9)	1.81 (1.68-1.95)	1.36 (1.20-1.53)
>12	11036	7141 (64.7)	3895 (35.3)	1.67 (1.54-1.81)	1.41 (1.22-1.62)
Household income					
Low	8426	4363 (51.8)	4063 (48.2)	1.00	1.00
Lower middle	10064	6282 (62.4)	3782 (37.6)	1.57 (1.43-1.71)	1.17 (1.03-1.32)
Upper middle	10599	6869 (64.8)	3730 (35.2)	1.69 (1.55-1.84)	1.20 (1.06-1.36)
High	10755	7085 (65.9)	3670 (34.2)	1.79 (1.64-1.96)	1.25 (1.08-1.43)
Location					
Seoul	7557	4707 (62.3)	2850 (37.7)	1.00	1.00
Large city	10859	6929 (63.8)	3930 (36.2)	1.08 (1.00-1.18)	1.14 (1.00-1.29)
Province	22542	13572 (60.2)	8970 (39.8)	0.93 (0.86-1.00)	1.03 (0.92-1.15)
Physical activity (MET-h/week)‡					
<5.0	6231	3816 (61.2)	2415 (38.8)	1.00	1.00
5.0-19.9	8453	5250 (62.1)	3203 (37.9)	1.04 (0.94-1.14)	1.01 (0.89-1.15)
20.0-49.9	8745	5482 (62.7)	3263 (37.3)	1.04 (0.95-1.14)	0.98 (0.87-1.11)
≥50.0	8193	5324 (65.0)	2869 (35.0)	1.15 (1.05-1.26)	1.02 (0.90-1.16)

†Adjusted odds ratios (ORs) were based on multiple logistic regression analysis, adjusted for all the other characteristics included in Table 3.
‡MET score on physical activity from KNHANES 2001 was not available.
§These data are presented as means with their standard deviations.
¶Data on vitamin and mineral supplement use from KNHANES 2010 and 2011 were not available.

Table 3. Prevalence odds ratios (ORs) and 95% confidence intervals (CIs) of daily coffee drinking (≥1 time/d) in Korean adults based on the combined data from KNHANES 2001-2011(cont.)

Characteristics	Total (n)	Daily coffee drinker, n (%)	Non-daily coffee drinker, n (%)	Crude OR (95% CI)	Adjusted OR[†] (95% CI)
Smoking status					
Non-smokers	23036	13174 (57.2)	9862 (42.8)	1.00	1.00
Past smokers	6676	4191 (62.8)	2485 (37.2)	1.24 (1.16-1.34)	1.37 (1.21-1.55)
Current smokers	8617	6202 (72.0)	2415 (28.0)	1.75 (1.64-1.88)	2.39 (2.09-2.74)
Alcohol consumption					
<1 serving/week	21673	12421 (57.3)	9252 (42.7)	1.00	1.00
1-4 servings/week	5416	3696 (68.2)	1720 (31.8)	1.42 (1.31-1.55)	1.40 (1.24-1.59)
≥4 servings/week	11143	7389 (66.3)	3754 (33.7)	1.34 (1.26-1.43)	1.10 (0.99-1.24)
Body mass index (kg/m^2)					
<23	16266	9592 (59.0)	6674 (41.0)	1.00	1.00
23-25	8601	5434 (63.2)	3167 (36.8)	1.23 (1.14-1.32)	1.18 (1.05-1.33)
≥25	11341	7288 (64.3)	4053 (35.7)	1.32 (1.23-1.41)	1.33 (1.15-1.53)
Waist circumference, inch[§]	32.0 (3.9)	32.1 (3.8)	31.8 (4.0)	1.02 (1.02-1.03)	0.99 (0.98-1.01)
Vitamin and mineral supplement use[¶]					
No	23393	13995 (59.8)	9398 (40.2)	1.00	1.00
Yes	5851	3568 (61.0)	2283 (39.0)	1.07 (0.99-1.15)	1.11 (1.00-1.23)

[†]Adjusted odds ratios (ORs) were based on multiple logistic regression analysis, adjusted for all the other characteristics included in Table 3.
[‡]MET score on physical activity from KNHANES 2001 was not available.
[§]These data are presented as means with their standard deviations.
[¶]Data on vitamin and mineral supplement use from KNHANES 2010 and 2011 were not available.

Table 4. Prevalence odds ratios (ORs) and 95% confidence intervals (CIs) of instant coffee mix and brewed coffee consumption in Korean adults based on the combined data from 2001-2011

Characteristics	Non-coffee drinker, n (%)	Instant coffee mix drinker, n (%)†	Brewed coffee drinker, n (%)‡	Instant coffee mix drinking		Brewed coffee drinking	
				Crude OR (95% CI)	Adjusted OR§ (95% CI)	Crude OR (95% CI)	Adjusted OR§ (95% CI)
KNHANE II (2001)	3556 (50.1)	3280 (46.3)	121 (1.7)				
KNHANES III (2005)	3114 (47.7)	3243 (49.7)	59 (0.9)				
KNHANES IV(2007-2009)	7348 (45.4)	8171 (50.5)	264 (1.6)				
KNHANES V (2010-2011)	4171 (35.3)	6601 (55.8)	487 (4.1)				
Age (years)							
19-39	6425 (44.3)	6907 (47.6)	474 (3.3)	1.00	1.00	1.00	1.00
40-59	5549 (36.2)	9025 (58.8)	358 (2.3)	1.64 (1.55-1.74)	1.36 (1.24-1.49)	0.66 (0.55-0.79)	1.00 (0.73-1.36)
≥ 60	6215 (52.8)	5363 (45.6)	99 (0.8)	0.80 (0.75-0.86)	0.92 (0.80-1.05)	0.26 (0.19-0.36)	1.08 (0.46-2.49)
Sex							
Male	7128 (40.4)	9676 (54.8)	256 (1.5)	1.00	1.00	1.00	1.00
Female	11061 (46.2)	11619 (48.5)	675 (2.8)	0.86 (0.82-0.90)	1.24 (1.11-1.39)	1.94 (1.63-2.32)	2.69 (1.69-4.27)
Marital status							
Single	6035 (53.8)	4544 (40.5)	270 (2.4)	1.00	1.00	1.00	1.00
Married	11962 (39.9)	16544 (55.2)	654 (2.2)	1.88 (1.77-2.00)	1.70 (1.54-1.88)	0.83 (0.69-0.99)	0.73 (0.54-0.99)
Education (years)							
<7	5672 (53.7)	4778 (45.3)	46 (0.4)	1.00	1.00	1.00	1.00
7-12	7247 (40.4)	9778 (54.5)	394 (2.2)	1.52 (1.41-1.64)	1.23 (1.09-1.39)	4.62 (2.97-7.18)	3.99 (1.67-9.55)
>12	4411 (39.8)	5664 (51.1)	434 (3.9)	1.28 (1.18-1.39)	1.26 (1.10-1.45)	7.89 (5.13-12.2)	5.13 (2.06-12.7)
Household income							
Low	4594 (52.7)	3948 (45.3)	77 (0.9)	1.00	1.00	1.00	1.00
Lower middle	4434 (43.3)	5404 (52.8)	153 (1.5)	1.38 (1.27-1.49)	1.07 (0.95-1.21)	1.09 (0.75-1.59)	1.21 (0.53-2.77)
Upper middle	4339 (40.5)	5711 (53.3)	269 (2.5)	1.42 (1.30-1.54)	1.06 (0.93-1.21)	1.67 (1.17-2.37)	1.95 (0.91-4.21)
High	4306 (39.5)	5727 (52.6)	414 (3.8)	1.40 (1.28-1.53)	1.05 (0.92-1.21)	2.54 (1.83-3.54)	2.93 (1.34-6.43)
Location							
Seoul	3254 (42.5)	3824 (49.9)	296 (3.9)	1.00	1.00	1.00	1.00
Large city	4624 (42.1)	5815 (52.9)	219 (2.0)	1.15 (1.05-1.26)	1.26 (1.10-1.44)	0.53 (0.41-0.67)	0.50 (0.33-0.77)
Province	10311 (44.9)	11656 (50.7)	416 (1.8)	1.03 (0.95-1.12)	1.11 (0.98-1.25)	0.45 (0.36-0.56)	0.59 (0.38-0.93)

† Instant coffee mix drinkers excluded drinkers who consumed brewed coffee or canned coffee.
‡ Brewed coffee drinkers excluded drinkers who consumed instant coffee mix or canned coffee.
§ Adjusted odds ratio (ORs) were based on multiple logistic regression analysis, adjusted for all other characteristics included in Table 4.
¶ MET score on physical activity from KNHANES 2001 was not available.
†† These data are presented as means with their standard deviations; otherwise data are numbers and percentages.
‡‡ Data on vitamin and mineral supplement use from KNHANES 2010 and 2011 were not available.

Table 4. Prevalence odds ratios (ORs) and 95% confidence intervals (CIs) of instant coffee mix and brewed coffee consumption in Korean adults based on the combined data from 2001-2011(cont.)

Characteristics	Non-coffee drinker, n (%)	Instant coffee mix drinker, n (%)†	Brewed coffee drinker, n (%)‡	Instant coffee mix drinking		Brewed coffee drinking	
				Crude OR (95% CI)	Adjusted OR§ (95% CI)	Crude OR (95% CI)	Adjusted OR§ (95% CI)
Physical activity (MET-h/week)¶							
<5.0	2774 (43.3)	3329 (52.0)	109 (1.7)	1.00	1.00	1.00	1.00
5.0-19.9	3670 (42.8)	4381 (51.0)	244 (2.8)	0.96 (0.88-1.04)	1.01 (0.90-1.14)	1.68 (1.27-2.22)	1.55 (0.96-2.50)
20.0-49.9	3788 (42.8)	4596 (51.9)	226 (2.6)	0.98 (0.90-1.08)	1.03 (0.90-1.17)	1.17 (0.88-1.55)	1.10 (0.65-1.88)
≥50.0	3385 (40.9)	4457 (53.8)	170 (2.1)	1.06 (0.97-1.17)	1.04 (0.91-1.18)	1.22 (0.92-1.61)	1.56 (0.94-2.57)
Smoking status							
Non-smokers	10990 (47.1)	11164 (47.8)	604 (2.6)	1.00	1.00	1.00	1.00
Past smokers	2910 (42.8)	3564 (52.5)	128 (1.9)	1.15 (1.07-1.24)	1.24 (1.08-1.42)	0.79 (0.63-1.00)	1.64 (1.09-2.46)
Current smokers	3084 (35.2)	5194 (59.3)	126 (1.4)	1.48 (1.40-1.58)	1.90 (1.66-2.17)	0.53 (0.41-0.68)	1.32 (0.78-2.22)
Alcohol consumption							
<1 serving/week	10365 (47.0)	10732 (48.7)	471 (2.1)	1.00	1.00	1.00	1.00
1-4 servings/week	2027 (37.1)	3054 (55.8)	172 (3.1)	1.28 (1.19-1.39)	1.24 (1.11-1.38)	1.34 (1.08-1.66)	1.09 (0.77-1.54)
≥4 servings/week	4557 (40.4)	6083 (53.9)	211 (1.9)	1.17 (1.10-1.24)	0.98 (0.88-1.09)	0.81 (0.65-1.00)	0.74 (0.47-1.16)
Body mass index (kg/m^2)							
<23	7501 (45.3)	8137 (49.1)	426 (2.6)	1.00	1.00	1.00	1.00
23-25	3759 (43.0)	4563 (52.2)	176 (2.0)	1.12 (1.05-1.20)	1.08 (0.96-1.21)	0.76 (0.60-0.95)	1.60 (1.06-2.40)
≥ 25	4751 (41.3)	6204 (53.9)	235 (2.0)	1.20 (1.13-1.28)	1.15 (1.01-1.33)	0.79 (0.64-0.97)	1.81 (0.97-3.35)
Waist circumference, inch††	32.0 (3.9)	31.8 (4.0)	32.0 (3.9)	1.02 (1.01-1.03)	1.00 (0.98-1.02)	0.93 (0.91-0.96)	0.95 (0.88-1.02)
Vitamin and mineral supplement use‡‡							
No	11084 (47.3)	11554 (49.3)	305 (1.3)	1.00	1.00	1.00	1.00
Yes	2695 (46.0)	2918 (49.8)	122 (2.1)	1.02 (0.95-1.10)	1.08 (0.98-1.19)	1.72 (1.30-2.28)	1.25 (0.88-1.78)

† Instant coffee mix drinkers excluded drinkers who consumed brewed coffee or canned coffee.
‡ Brewed coffee drinkers excluded drinkers who consumed instant coffee mix or canned coffee.
§ Adjusted odds ratio (ORs) were based on multiple logistic regression analysis, adjusted for all other characteristics included in Table 4.
¶ MET score on physical activity from KNHANES 2001 was not available.
†† These data are presented as means with their standard deviations; otherwise data are numbers and percentages.
‡‡ Data on vitamin and mineral supplement use from KNHANES 2010 and 2011 were not available.

heart diseases,[4] colorectal cancer,[14] and endometrial cancer.[15,16]

In South Korea, there is a rapid increase of colorectal cancer incidence and mortality,[22] which may be related to an increase of metabolic syndrome among Korean adults over the past decade.[23] The recent meta-analysis examining the association between metabolic syndrome and cancer risk showed that people with metabolic syndrome had approximately 1.3 times greater risk of developing colorectal cancer than those without metabolic syndrome, which was shown in both men and women.[24] Although a small number of studies attempted to examine the association between metabolic syndrome and coffee consumption, there was some evidence that high coffee consumption was inversely associated with lower risk of metabolic syndrome.[25-27] Nevertheless, the recent cohort study conducted in Korea showed no association between coffee consumption and metabolic syndrome.[28] Although there might be several explanations for the overall null result of coffee consumption and the disease risk among Korean adults, lack of consideration for type of coffee on that study might be one.

We found that the middle aged or older people greatly increased the consumption of instant coffee mix from 2001 and 2011, although they increased brewed coffee consumption as well in recent years. Coffee drinking in the form of "coffee mix" may offset the potential benefits of coffee components since the coffee additives in the coffee mix can contribute to weight gain and insulin resistance that are strongly associated with development of several chronic diseases.[29] Fortunately, among young adults, the proportion of people consuming coffee in the form of coffee mix tended to decrease, and there was a rapid increase of brewed coffee consumption in recent years. Based on the results of multiple logistic regression analyses, adjusting for demographic, socioeconomic, anthropometric, and lifestyle factors, we found that those who had relatively high SES (high household income, Seoul residency, high education) or single adults were more likely to consume brewed coffee than those who did not. Although coffee drinkers were related to unhealthy behaviors overall, compared with non-coffee drinkers, the group of people who consumed instant coffee mix were more likely to be associated with unhealthy behaviors including alcohol drinking, current smoking status, and obesity, than those who consumed brewed coffee. This may also suggest the importance of adjusting for those variables to determine the role of different type of coffee consumption on disease risks.

A limitation of this study is that we used a single measure of 24-hour dietary recall to provide information on type of coffee consumption at each survey, which does not account for day-to-day variation and does not represent usual coffee consumption of the participants. Nevertheless, the use of a single 24-hour dietary recall for measurements of dietary intake including coffee consumption has been found to be acceptable in large scale epidemiological surveys.[30] The strength of our study is that we examined the secular trends of coffee consumption, specifically by type of coffee consumption among the Korean adult population. We combined a series of KNHANES data, which was based on a large nationally representative sample, and thus the results may be generalizable to Korean adults.

In conclusion, the instant coffee mix that contains a substantial amount of non-dairy creamer and sugar takes up a significant portion of coffee consumption among Korean adults, and the consumption continue to increase in the middle aged or the elderly population, which may result in weight gain and insulin resistance that are strongly related to risks of several chronic disease outcomes. On the other hand, young Korean adults decreased the consumption of instant coffee mix over the past decade, and the prevalence of brewed coffee consumption noticeably increased in recent years. Although this analysis did not attempt to estimate the effect of coffee consumption on chronic disease incidence or mortality due to the nature of cross-sectional data, our study may provide useful information to address the need for nutrition interventions for healthy coffee drinking in the elderly population of South Korea. Prospective studies of chronic disease risks in relation to different types of coffee consumption should be investigated in Korean population.

ACKNOWLEDGEMENTS

This work was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Science, ICT & Future Planning (NRF-2014R1A1A1002736) and funded by the Ministry of Education, Science and Technology (NRF-2011-0011866).

AUTHOR DISCLOSURES

No conflict of interest in this study.

REFERENCES

1. Higdon JV, Frei B. Coffee and health: a review of recent human research. Crit Rev Food Sci Nutr. 2006;46:101-23. doi: 10.1080/10408390500400009.
2. Svilaas A, Sakhi AK, Andersen LF, Svilaas T, Strom EC, Jacobs DR Jr, Ose L, Blomhoff R. Intakes of antioxidants in coffee, wine, and vegetables are correlated with plasma carotenoids in humans. J Nutr. 2004;134:562-7.
3. Huxley R, Lee CM, Barzi F, Timmermeister L, Czernichow S, Perkovic V, Grobbee DE, Batty D, Woodward M. Coffee, decaffeinated coffee, and tea consumption in relation to incident type 2 diabetes mellitus: a systematic review with meta-analysis. Arch Intern Med. 2009;169:2053-63. doi: 10.1001/archinternmed.2009.439.
4. Wu JN, Ho SC, Zhou C, Ling WH, Chen WQ, Wang CL, Chen YM. Coffee consumption and risk of coronary heart diseases: a meta-analysis of 21 prospective cohort studies. Int J Cardiol. 2009;137:216-25. doi: 10.1016/j.ijcard.2008.06. 051.
5. Yu X, Bao Z, Zou J, Dong J. Coffee consumption and risk of cancers: a meta-analysis of cohort studies. BMC Cancer 2011;11:96. doi: 10.1186/1471-2407-11-96.
6. Lee MJ, Popkin BM, Kim S. The unique aspects of the nutrition transition in South Korea: the retention of healthful elements in their traditional diet. Public Health Nutr. 2002;5:197-203. doi: 10.1079/PHN2001294.
7. Korea Center of Disease and Control and Prevention by Korea Ministry of Health and Welfare. Users' Guide for Korean National Health and Nutrition Examination Survey, Daejeon: Statistics Korea; 2011.
8. Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ et al. Compendium of physical activities: an update of activity codes and MET intensities. Med Sci

Sports Exerc. 2000;32:S498-504. doi: 10.1097/00005768-200009001-00009.
9. Sääksjärvi K, Knekt P, Rissanen H, Laaksonen MA, Reunanen A, Männistö S. Prospective study of coffee consumption and risk of Parkinson's disease. Eur J Clin Nutr. 2008; 62:908-15.
10. Barranco Quintana JL, Allam MF, Serrano Del Castillo A, Fernandez-Crehuet Navajas R. Alzheimer's disease and coffee: a quantitative review. Neurol Res. 2007;29:91-5. doi: 10.1179/174313206X152546.
11. Leitzmann MF, Willett WC, Rimm EB, Stampfer MJ, Spiegelman D, Colditz GA, Giovannucci E. A prospective study of coffee consumption and the risk of symptomatic gallstone disease in men. JAMA. 1999;281:2106-12. doi: 10.1001/jama.281.22.2106.
12. Leitzmann MF, Stampfer MJ, Willett WC, Spiegelman D, Colditz GA, Giovannucci EL. Coffee intake is associated with lower risk of symptomatic gallstone disease in women. Gastroenterology. 2002;123:1823-30. doi: 10.1053/gast.2002.37054.
13. Sang LX, Chang B, Li XH, Jiang M. Consumption of coffee associated with reduced risk of liver cancer: a meta-analysis. BMC Gastroenterol. 2013;13:34. doi: 10.1186/1471-230 X-13-34.
14. Tian C, Wang W, Hong Z, Zhang, X. Coffee consumption and risk of colorectal cancer: a dose-response analysis of observational studies. Cancer Causes Control. 2013;24: 1265-8. doi: 10.1007/s10552-013-0200-6.
15. Je Y, Giovannucci E. Coffee consumption and risk of endometrial cancer: findings from a large up-to-date meta-analysis. Int J Cancer. 2012;131:1700-10. doi: 10.1002/ijc.27408.
16. Je Y, Hankinson SE, Tworoger SS, De Vivo I, Giovannucci E. A prospective cohort study of coffee consumption and risk of endometrial cancer over a 26-year of follow-Up. Cancer Epidemiol Biomarkers Prev. 2011;20:2487-95. doi: 10.1158/1055-9965.EPI-11-0766.
17. Freedman ND, Park Y, Abnet CC, Hollenbeck AR, Sinha R. Association of coffee drinking with total and cause-specific mortality. N Engl J Med. 2012;366:1891-904. doi: 10.1056/NEJMoa1112010.
18. Je Y, Giovannucci E. Coffee consumption and total mortality: a meta-analysis of 20 prospective cohort studies. Br J Nutr. 2014;111:1162-73. doi: 10.1017/S0007114513003814.
19. Wu T, Willett WC, Hankinson SE, Giovannucci E. Caffeinated coffee, decaffeinated coffee, and caffeine in relation to plasma C-peptide levels, a marker of insulin secretion, in U.S. women. Diabetes Care. 2005;28:1390-6. doi: 10.2337/diacare.28.6.1390.
20. Williams CJ, Fargnoli JL, Hwang JJ, van Dam RM, Blackburn GL, Hu FB, Mantzoros CS. Coffee consumption is associated with higher plasma adiponectin concentrations in women with or without type 2 diabetes: a prospective cohort study. Diabetes Care. 2008;31:504-7. doi: 10.2337/dc07-1952.
21. Lopez-Garcia E, van Dam RM, Qi L, Hu FB. Coffee consumption and markers of inflammation and endothelial dysfunction in healthy and diabetic women. Am J Clin Nutr. 2006;84:888-93.
22. Ryu Sy, Crespi CM, Maxwell AE. Colorectal cancer among Koreans living in South Korea versus California: incidence, mortality, and screening rates. Ethn Health. 2014;19:406-23. doi: 10.1080/13557858.2013.801404.
23. Lim S, Shin H, Song JH, Kwak SH, Won YJ, Choi SH, et al. Increasing prevalence of metabolic syndrome in Korea: the Korean National Health and Nutrition Examination Survey for 1998-2007. Diabetes Care. 2011;34:1323-8. doi: 10.2337/ dc10-2109.
24. Esposito K, Chiodini P, Colao A, Lenzi A, Giugliano D. Metabolic syndrome and risk of cancer. A systematic review and meta-analysis. Diabetes Care. 2012;35:2402-11. doi: 10.2337/ dc12-0336.
25. Takami H, Nakamoto M, Uemura H, Katsuura S, Yamaguchi M, Hiyoshi M, Sawachika F, Juta T, Arisawa K. Inverse correlation between coffee consumption and prevalence of metabolic syndrome: baseline survey of the Japan Multi-Institutional Collaborative Cohort (J-MICC) study in Tokushima, Japan. J Epidemiol. 2013;23:12-20. doi: 10.2188/jea.JE20120053.
26. Matsuura H, Mure K, Nishio N, Kitano N, Nagai N, Takeshita T. Relationship between coffee consumption and prevalence of metabolic syndrome among Japanese civil servants. J Epidemiol. 2012;22:160-6. doi: 10.2188/jea.JE20110068.
27. Lutsey PL, Steffen LM, Stevens J. Dietary intake and the development of the metabolic syndrome. The atherosclerosis risk in communities study. Circulation. 2008;117:754-61. doi: 10.1161/CIRCULATIONAHA.107.716159.
28. Baik I, Lee M, Jun NR, Lee JY, Shin C. A healthy dietary pattern consisting of a variety of food choices is inversely associated with the development of metabolic syndrome. Nutr Res Pract. 2013;7:233-41. doi: 10.4162/nrp.2013.7.3.233.
29. Giovannucci E, Harlan DM, Archer MC, Bergenstal RM, Gapstur SM, Habel LA, Pollak M, Regensteiner JG, Yee D. Diabetes and cancer: a consensus report. Diabetes Care. 2010;33:1674-85. doi: 10.2337/dc10-0666.
30. Willett WC. Nature of variation in diet. In Nutritional Epidemiology, 3rd ed., New York: Oxford University Press; 2013. pp. 34-47.

Original Article

Coffee consumption patterns in Korean adults: the Korean National Health and Nutrition Examination Survey (2001-2011)

Youjin Je ScD[1], Seonghyun Jeong MA[2], Taeyoung Park PhD[2]

[1]*Department of Food and Nutrition, Kyung Hee University, Seoul, South Korea*
[2]*Department of Applied Statistics, Yonsei University, Seoul, South Korea*

韩国成年人咖啡消费模式：韩国国家健康与营养调查研究（2001-2011）

我们在过去十年里对韩国成年人的咖啡消费模式进行了调查。此项研究基于 2001 至 2011 年韩国国家健康与营养调查研究的七个横断面调查数据（17367 名男性，12591 名女性，年龄为 19-103 岁，平均年龄 48.1 岁）。咖啡的消费频率和类型由频率问卷调查或 24 小时回顾询问法得到。十年间，每日喝咖啡的流行率增长了 20.3%（从 54.6%增加到了 65.7%，p<0.001）。每日消费 2 杯和 2 杯以上咖啡的人激增了 48.8%（从 29.1%增加到 43.3%，p<0.001）。速溶咖啡是被韩国成年人消费最频繁的，而且在中年以上人群（年龄≥40 岁）中仍有增长趋势，但是年轻男性对咖啡的消费量放缓，年轻女性则有下降趋势。近年，现磨咖啡的消费在各年龄层都有所增长。特别的，现磨咖啡在年轻女性中消费明显增加，在年轻男性中也有增加。含有植脂末和/或糖的速溶咖啡仍占韩国咖啡消费很大比重，由此可导致体重增加和胰岛素抵抗，以及使咖啡有益部分被抵消。咖啡消费在韩国高度流行，那么应当开展营养方面教育（特别是年长者），使人们养成健康的饮用咖啡习惯。

关键词：现磨咖啡、横断面研究、饮食摄入、速溶咖啡、韩国人群