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Original Contributions

Binge Drinking and Mortality From All Causes and Cerebrovascular Diseases in Korean Men and Women
A Kangwha Cohort Study

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Background and Purpose—The purpose of this study was to examine the association between binge drinking and risks of mortality due to all causes of death with a focus on cerebrovascular disease in Korean men and women.

Methods—This study followed a cohort of 6291 residents in Kangwha County, aged ≥55 years in March 1985, for their cause-specific mortality for 20.8 years up to December 31, 2005. We calculated hazard ratio of mortality by experience or frequency of binge drinking using the Cox proportional hazard model. Binge drinking was defined as having ≥6 drinks on one occasion.

Results—In men, binge drinkers who drink daily had an increased risk of mortality from all causes (hazard ratio, 1.33; 95% CI, 1.11 to 1.60) as compared with nondrinkers. They showed much increased risks of mortality from total stroke (hazard ratio, 1.86; 95% CI, 1.16 to 2.99) and hemorrhagic stroke (hazard ratio, 3.39; 95% CI, 1.38 to 8.35). Female binge drinkers also showed an increased risk of mortality from cardiovascular disease as compared with female nondrinkers, but the outcome was not statistically significant.

Conclusions—The results of this study suggest that frequent binge drinking has a harmful effect on hemorrhagic stroke in Korean men. These findings need to be confirmed in further studies. (*Stroke*. 2009;40:2953-2958.)

Key Words: alcohol consumption ■ binge drinking ■ hemorrhagic stroke mortality

The proportion of Korean adults who drink alcohol is among the world's highest.[1] It also has been increasing: from 45.8% in 1989 to 59.2% in 2005.[2] According to The Third Korea National Health and Nutrition Examination Survey in 2005, in which a heavy drinker is defined as one who consumes >6 glasses or 60 g of *soju* for men and more than 4 glasses or 40 g of *soju* for women on one occasion at least once a week, 46.3% of male adults and 9.2% of female adults were heavy drinkers in Korea.[2]

The effects of alcohol consumption on health have been widely studied. Several studies show a J-shaped or U-shaped relation between alcohol consumption and mortality in that moderate alcohol consumption has a low risk of mortality, whereas zero to light alcohol consumption and heavy alcohol consumption have a high mortality risk.[3,4] In the same context, a few studies suggest that moderate alcohol consumption is protective for circulatory diseases.[5,6] However, more studies have warned that heavy alcohol consumption may increase the risk for stroke.[7,8] Other studies on alcohol consumption and mortality from cerebrovascular disease have found the risk of stroke is particularly high among binge drinkers who are consuming a lot of alcoholic drinks on one occasion.[9,10] Additionally, several studies observed that the relation between alcohol consumption and cardiovascular disease differed according to the type of alcoholic beverage.[11,12]

Most previous studies have been conducted for whites. Only a few studies have addressed the relation between binge drinking and stroke among Asian populations. This study examined the relationship between binge drinking and mortality from all causes and cerebrovascular disease among Koreans through 20 years of being followed up in the Kangwha cohort data. It also explored whether the relation differs according to the type of alcoholic beverage as shown in previous studies.

Materials and Methods

Study Population

This study used the data of the Kangwha cohort constructed in March 1985.[13] Kangwha County consists of several islands located approximately 50 km west from Seoul. Its population size was 71 116 in 1993.[14] The number of Kangwha County residents who were ≥55 years of age in February 1985 was 9378. Among them, 67.9%, or 6372 residents, participated in interviews and measurements of blood pressure and body mass. Those who were not followed up after the initial survey (n=78), had a stroke before (n=134), or had no information on alcohol intake at entry (n=3) were all excluded, and thus the final study population recruited was 6157 (male, 2624; female, 3533). The Institutional Review Board of Human Research of Yonsei University approved the study (Approval No 4-2007-0182).

Baseline Data Collection and Follow-Up

The primary survey for the Kangwha cohort was conducted over 1 month in March 1985. Twenty-six trained interviewers performed data collection for a period of 1 month after 1-week long training. Each subject was interviewed using a structured questionnaire for demographic characteristics data: education, occupation, health conditions at entry, health behaviors, diet, and other factors. Blood pressure, height, and weight were measured by trained investigators. Blood pressure measurements were taken in a seated position by a trained investigator using a standard mercury sphygmomanometer. Hypertension, which is a covariate for analysis in this study, was determined with systolic and diastolic readings of ≥140/90 mm Hg or a history of hypertension. With regard to chronic disease, study subjects were asked to answer yes or no to the question, "Do you have any chronic disease or past accident or injury for which you feel uncomfortable in your daily lives including work?" If he or she answered yes, trained staff interviewed the subject for the kind of chronic disease and entered the data. Eight hundred one subjects reported neuralgia, 304 dyspepsia, 655 hypertension, 134 stroke, 104 arthritis, 104 diabetes mellitus, 287 dyspnea, 75 traffic accident, 94 lumbago, and 335 other diseases. In this study, however, information on the existence of chronic disease (yes or no) only was used as a covariate for analysis. As mentioned in the "Study Population" 134 subjects who reported stroke as a chronic disease were excluded from the study population. The study subjects were followed up until December 31, 2005, and thus the maximum period of follow-up for mortality was 20.8 years.

Outcome Assessment

Deaths among subjects from January 1, 1992, to December 31, 2002, were confirmed by matching the information to death records from the National Statistical Office. Follow-up, performed through record linkage at the national level, is complete, except for emigrants. Data for those who died from March 15, 1985, to December 31, 1991, were collected either through calls and visits of trained surveyors twice a year or from records of burial and death certificates of *eup* and *myeon* offices that are administrative branch offices of the local government in Korea.

The main outcome variables for this study were death due to total, hemorrhagic, and ischemic stroke as defined by the International Classification of Disease, 10th Edition (I60 to I69, I60 to I62, and I63, respectively).

Estimation of Alcohol Consumption

Study participants were asked to answer for the question, "Do you drink alcohol?" and answer "yes" or "no." The frequency of drinking was presented as daily, almost daily, 2 to 3 times a week, one to 4 times a month, or 4 to 12 times a year. The frequency of drinking was merged into 4 groups in further analysis: daily, a few times a week (almost daily plus 2 to 3 times a week), a few times a month (1 to 4 times a month), and nondrinkers. Subjects who drink 4 to 12 times a year were excluded in the analysis for the frequency of drinking. The question on the type of alcoholic beverage and the amount of alcohol consumption was given as: "How much (in bottle, glass) do you drink for a type of alcoholic beverage on one occasion?" Study participants were asked to fill in up to 2 types of alcoholic beverage they usually consume on one occasion. A total of 83.9% of male drinkers filled in one type only and 16.1% 2 types. Accordingly, binge drinking was defined as having ≥6 drinks of one or 2 types of alcoholic beverage on one occasion. Alcoholic beverages they consumed most were *soju* and *makkoli*. *Soju* is a distilled alcoholic beverage native to Korea, similar to liquor or *sake* in Japan, and *makkoli* is an unfiltered alcoholic beverage, also native to Korea. In 1985, at the time of survey for the Kangwha cohort, *soju* contained 25% alcohol by volume and *makkoli* 6% alcohol.[15] By container volume, a glass of *soju* was 60 mL and a bottle of *soju* 360 mL and a glass of *makkoli* 300 mL and a bottle of *makkoli* 1800 mL. Where 0.785 is the specific gravity of ethanol, the amount of pure alcohol contents was 11.8 g in a glass of *soju* and 14.1 g in a glass of *makkoli*.

To validate those questions on alcohol consumption and examine the change of alcohol consumption patterns, the research team implemented the second interview with 3381 survivors in 1994. They were questioned about current drinking status, current drinking frequency, drinking status 10 years ago, and drinking frequency 10 years ago.

Statistical Analysis

Study participants were divided into drinking group and nondrinking group and analyzed for the association between alcohol consumption and the risk of mortality. They were further divided in accordance with the frequency of drinking (daily, a few times a week, a few times a month, none) to examine the dose–response relationship among subgroups. Because there might be a difference in risk of mortality between men and women, all analyses were done stratified by gender. The study participants also were divided, by binge drinking habit, into binge drinkers and nonbinge drinkers; they were further divided in accordance with the frequency of binge drinking (daily, a few times a week, a few times a month, nondrinkers). A separate analysis was made stratified by the participant's type of favored alcoholic beverage. We used the Cox proportional hazard model to test whether mortality risk differs by alcohol consumption after adjusting for age (year of recruitment), history of chronic disease, smoking status (never, past, current smokers), body mass index, hypertension, and education status. The trend test was also conducted with drinking frequency as an ordinal variable. Analyses were performed with SAS Windows Version 9.1.

Results

The sociodemographic characteristics of alcohol drinkers and nondrinkers are shown in Table 1. The mean (SD) age of men and women was 66.3 (7.2) and 66.9 (7.1), respectively. On average, alcohol drinkers were younger than nondrinkers. Smoking was associated with alcohol consumption, because alcohol drinkers, in both men and women, were more likely to be current smokers. Binge drinkers accounted for 20.4% of men and 0.5% of women.

During the 20.8 years of follow-up, 1984 of the men and 2081 of the women died. Table 2 provides hazard ratios of mortality from all causes and cause-specific diseases. Male and female drinkers were compared with nondrinkers; male and female binge drinkers were also compared with nondrinkers. The hazard ratio of mortality for alcohol drinking, compared with nondrinking, was not statistically significant regardless of gender in all categories. Among binge drinkers, male binge drinkers had higher risks of mortality from total cardiovascular disease and total stroke than male nondrinkers, but the outcome was not statistically significant. Their hazard ratio (95% CI) of mortality was 1.22 (0.90 to 1.64) for total cardiovascular disease and 1.32 (0.94 to 1.87) for total stroke, respectively. Female binge drinkers also had an increased but not statistically significant risk of mortality from cardiovascular disease.

Table 3 shows hazard ratios of mortality from all causes of death and cause-specific diseases according to the frequency of drinking in male participants. Compared with male nondrinkers, males who drank daily had significantly increased risks of mortality from deaths due to all causes and total cardiovascular disease. The hazard ratio (95% CI) of mortality was 1.25 (1.10 to 1.43) for all causes and 1.36 (1.00 to 1.84) for total cardiovascular disease. In case of total stroke, the increased risk of mortality was shown as the frequency of drinking increased, but it was not statistically significant (P for trend=0.083).

Table 1.   Baseline Characteristics of the Kangwha Cohort, 1985 to 2005, According to the Experience of Alcohol Consumption

	Men			Women		
Characteristics	Alcohol Drinkers (N=1720) Mean±SD	Nondrinkers (N=904) Mean±SD	t or χ² Value	Alcohol Drinkers (N=359) Mean±SD	Nondrinkers (N=3174) Mean±SD	t or χ² Value
Age, years	65.7±6.9	67.3±7.8	5.30†	66.5±7.9	67.0±8.6	1.12
Body mass index, kg/m²	22.4±17.8	23.0±23.7	0.65	23.6±24.8	24.8±31.6	0.82
Systolic blood pressure, mm Hg	150.4±32.0	144.2±28.1	5.04†	149.3±36.8	147.8±31.8	0.77
Diastolic blood pressure, mm Hg	71.9±20.1	70.0±19.6	2.36*	70.2±21.5	70.5±19.9	0.19
	N (%)	N (%)		N (%)	N (%)	
Chronic disease			0.31			4.06*
Ever	753 (43.8)	399 (44.1)		195 (54.3)	1546 (48.7)	
Never	967 (55.2)	505 (55.9)		164 (45.7)	1628 (51.3)	
Education			3.381			0.39
No	704 (40.9)	356 (39.4)		292 (81.3)	2562 (80.7)	
Elementary	889 (51.7)	462 (51.2)		64 (17.8)	573 (18.1)	
High	127 (7.4)	85 (9.4)		3 (0.8)	38 (1.2)	
Smoking			100.7†			219†
Current	1383 (80.4)	575 (63.6)		192 (53.5)	605 (19.1)	
Never	223 (13.0)	256 (28.3)		161 (44.9)	2500 (78.8)	
Past	114 (6.6)	73 (8.1)		6 (1.7)	69 (2.2)	
Hypertension			15.2†			0.001
No	645 (37.5)	410 (45.4)		146 (40.7)	1294 (40.8)	
Yes	1075 (62.5)	494 (54.7)		213 (59.3)	1880 (59.2)	

*P<0.05.
†P<0.01.

The effects of frequency of binge drinking on the hazard ratio of mortality in men are shown in Table 4. Compared with nondrinkers, binge drinkers who drink daily had significantly increased risks of mortality from all causes, total cardiovascular disease, total stroke, and hemorrhagic stroke; in particular, the hazard ratio (95% CI) of mortality from hemorrhagic stroke was 3.39 (1.38 to 8.35). Compared with

soju drinkers, *makkoli* drinkers had a slightly reduced risk of mortality (data not shown). However, the results were essentially the same regardless of alcoholic beverages consumed.

Discussion

In the Kangwha cohort established for people aged ≥55 years in 1985, we analyzed alcohol consumption and mortality

Table 2.   No. of Deaths and Adjusted* Hazard Ratios of Death From All Causes and Cause-Specific Diseases Among Alcohol Drinkers and Binge Drinkers in the Kangwha Cohort, 1985 to 2005

		Men			Women		
Cause of Death	ICD-10	Cases	Alcohol Drinkers† HR (95% CI)	Binge Drinkers† HR (95% CI)	Cases	Alcohol Drinkers HR (95% CI)	Binge Drinkers HR (95% CI)
All causes		1984	1.09 (0.99–1.20)	1.09 (0.96–1.24)	2081	0.96 (0.82–1.11)	1.17 (0.69–1.20)
Total atherosclerotic cardiovascular disease	I10–I25, I60–I74	340	1.12 (0.89–1.42)	1.22 (0.90–1.64)	419	0.84 (0.59–1.19)	2.12 (0.87–5.14)
Ischemic heart disease	I20–I25	35	0.71 (0.36–1.41)	0.58 (0.21–1.63)	46	0.45 (0.14–1.50)	2.64 (0.36–19.6)
Total stroke	I60–I69	247	1.17 (0.89–1.54)	1.32 (0.94–1.87)	303	0.89 (0.60–1.33)	1.21 (0.30–4.88)
Hemorrhagic stroke	I60–I62	45	1.22 (0.63–2.35)	1.67 (0.77–3.60)	64	0.55 (0.19–1.54)	…
Ischemic stroke	I63	41	0.86 (0.45–1.64)	0.43 (0.14–1.30)	40	0.34 (0.08–1.47)	3.14 (0.42–23.7)
Hypertensive disease	I10–I15	55	1.32 (0.72–2.42)	1.31 (0.60–2.85)	63	0.68 (0.24–1.92)	3.27 (0.45–24.0)

*Adjusted for age (year of recruitment), history of chronic disease, smoking habits, body mass index, hypertension, and education status using the Cox proportional hazard model.

†Reference group: nondrinkers.

ICD-10 indicates International Classification of Diseases, 10th Revision; HR, hazard ratio.

Table 3. No. of Deaths and Adjusted* Hazard Ratios of Death From All Causes and Cause-Specific Diseases Among Men According to the Frequency of Alcohol Consumption

Cause of Death	Drinking Frequency				P for Trend
	Nondrinkers (n=906)	Few Times a Month (n=298)	Few Times a Week (n=938)	Daily (n=446)	
All causes					
No. of cases	693	224	703	364	
HR (95% CI)	1.00	1.03 (0.89–1.20)	1.04 (0.93–1.16)	1.25 (1.10–1.43)	0.144
Total atherosclerotic cardiovascular disease					
No. of cases	111	36	122	68	
HR (95% CI)	1.00	0.98 (0.67–1.42)	1.06 (0.82–1.37)	1.36 (1.00–1.84)	0.152
Ischemic heart disease					
No. of cases	16	4	8	6	
HR (95% CI)	1.00	0.85 (0.28–2.56)	0.51 (0.22–1.21)	0.93 (0.36–2.42)	0.673
Total stroke					
No. of cases	78	26	92	49	
HR (95% CI)	1.00	1.00 (0.64–1.57)	1.14 (0.84–1.55)	1.40 (0.97–2.01)	0.083
Hemorrhagic stroke					
No. of cases	13	3	16	13	
HR (95% CI)	1.00	0.71 (0.20–2.49)	1.13 (0.54–2.38)	2.12 (0.97–4.65)	0.203
Ischemic stroke					
No. of cases	16	4	15	6	
HR (95% CI)	1.00	0.81 (0.27–2.46)	0.94 (0.46–1.93)	0.96 (0.37–2.50)	0.984
Hypertensive disease					
No. of cases	16	6	20	13	
HR (95% CI)	1.00	1.05 (0.41–2.71)	1.17 (0.60–2.30)	1.69 (0.80–3.56)	0.107

*Adjusted for age (year of recruitment), history of chronic disease, smoking habits, body mass index, hypertension, and education status using the Cox proportional hazard model.

HR indicates hazard ratio.

finding that the frequency of drinking was associated with risks of mortality from death due to all causes and cardiovascular disease. Binge drinkers also had a higher risk of mortality from cardiovascular disease than nondrinkers; in the binge drinking group, as compared with nondrinkers, binge drinkers who drank daily had increased risks of mortality from cardiovascular disease and, in particular, hemorrhagic stroke.

In this study, binge drinking was defined as having ≥6 alcoholic drinks on one occasion; classified by this definition, 20.4% of male participants were binge drinkers. A previous study conducted for male adults in the United States reported heavy drinkers consuming not <6 drinks in a day (60 g/d) were 3.5% of the total study population.[4] Compared with the American study, the proportion of male binge drinkers in the present study is noticeably higher. However, it is lower than the result of a Finnish study showing 22% of adults were binge drinkers[10] and far lower than 30%, the percentage of drinkers consuming not <120 g of alcohol on one occasion, of a Russian study.[9] Comparing the findings of the present study with those of previous studies directly, however, one must be cautious because the study population of the present study was limited to Koreans aged ≥55 years living in an agricultural community.

The J-shaped or U-shaped relation between alcohol consumption and mortality due to all causes was suggested by many earlier studies, whereas some other studies are reporting that the J-shaped or U-shaped relationship was not detected.[16,17] In the present study, the frequency of drinking was not associated with J-shaped or U-shaped mortality. However, because we did not analyze the relation between alcohol consumption and mortality based on the amount of pure alcohol contents consumed, comparing our results with those of earlier studies had a limitation.

In a meta-analysis on the relationship between alcohol consumption and stroke, Reynolds et al[18] showed that moderate alcohol consumption had a protective effect on the risk of stroke mortality. Further analyzed by the type of stroke, however, moderate alcohol consumption was protective for ischemic stroke, whereas hemorrhagic stroke tended to have a linear correlation to the frequency of drinking. A recent cohort study conducted for Japanese adults suggested that heavy alcohol consumption was associated with stroke, especially hemorrhagic stroke.[7] A Chinese study confirmed that alcohol consumption was related to hemorrhagic stroke rather than ischemic stroke.[8] Like these previous studies, the present study also observed that hemorrhagic stroke was more strongly related to alcohol consumption than ischemic stroke.

Table 4.   No. of Deaths and Adjusted* Hazard Ratios of Death From All Causes and Cause-Specific Diseases Among Male Binge Drinkers According to the Frequency of Binge Drinking

Cause of Death	Nondrinkers (n=906)	Frequency of Binge Drinking		
		Few Times a Month (n=50)	Few Times a Week (n=302)	Daily (n=182)
All causes				
No. of cases	693	35	217	147
HR (95% CI)	1.00	1.01 (0.72–1.42)	0.99 (0.84–1.16)	1.33 (1.11–1.60)
Total atherosclerotic cardiovascular disease				
No. of cases	111	9	38	30
HR (95% CI)	1.00	1.58 (0.80–3.13)	1.00 (0.68–1.46)	1.73 (1.15–2.62)
Ischemic heart disease				
No. of cases	16	1	2	2
HR (95% CI)	1.00	1.25 (0.16–9.51)	0.38 (0.09–1.70)	0.83 (0.19–3.71)
Total stroke				
No. of cases	78	7	29	23
HR (95% CI)	1.00	1.72 (0.79–3.75)	1.07 (0.69–1.67)	1.86 (1.16–2.99)
Hemorrhagic stroke				
No. of cases	13	1	5	8
HR (95% CI)	1.00	1.44 (0.19–11.1)	1.03 (0.36–2.97)	3.39 (1.38–8.35)
Ischemic stroke				
No. of cases	16	0	3	1
HR (95% CI)	1.00	…	0.54 (0.15–1.91)	0.45 (0.06–3.45)
Hypertensive disease				
No. of cases	16	1	6	5
HR (95% CI)	1.00	1.27 (0.17–9.85)	1.19 (0.44–3.20)	2.22 (0.78–6.34)

*Adjusted for age (year of recruitment), history of chronic disease, smoking habits, body mass index, hypertension, and education status using the Cox proportional hazard model.

HR indicates hazard ratio.

In addition, although not statistically significant, when compared with abstainers, the risk of mortality from ischemic heart disease and ischemic stroke was shown to be slightly reduced in alcohol drinkers.

Recently, an increasing number of studies have shown that the risk of stroke is related to binge drinking. A Finnish study reported that binge drinking was associated with an increased risk of stroke compared with nonbinge drinkers.[10] The Finnish study also suggested even the risk of ischemic stroke was related to binge drinking. In contrast to this Finnish study, the present study could not find any association between binge drinking and the risk of ischemic stroke, possibly due to the small number of ischemic stroke cases. Instead, the risk of hemorrhagic stroke was shown to be highly related to binge drinking.

The present study also showed that risks of death due to cardiovascular disease and stroke were high in frequent binge drinkers. The results are similar to those of a Russian study published in 2002.[9] This Russian study found no relationship between the frequency of drinking and the risk of mortality from cardiovascular disease among people who consume small amounts of alcohol on one occasion, whereas in the binge drinking group who consumed not <120 g of alcohol on one occasion, the risk of mortality from cardiovascular disease was high in frequent binge drinkers.

Probable mechanisms for the association between alcohol consumption and stroke have been presented in several studies. Through 20 years of follow-up of the Framingham cohort of 5209 patients, Gordon et al[19] explained that alcohol increases blood pressure, which can lead to cerebrovascular disease, whereas it can also increase high-density lipoprotein, which would reduces the incidence of coronary artery disease. A recent Finnish study found that binge drinking was related to an increased risk of stroke, even after adjusting for the hypertensive effects of alcohol.[10] The present study also found a positive relation between binge drinking and the risk of stroke after adjusting for hypertension.

This study has several limitations. First, alcohol consumption variables data were collected through a questionnaire for the Kangwha cohort of people aged ≥55 years. Some could raise an issue of validity for this. However, when a Korean study collected alcohol consumption variables data for elderly people through a questionnaire in 1998, its reliability and validity were highly evaluated.[20] Besides, the research team implemented the second interview/test with 3381 survivors in 1994. Percent agreement between drinking status data collected in 1985 and those in 1994 is 87% and Cohen's κ value is 0.697. They show substantial agreement between the 2 data. However, not to research into the intake of >2

types of alcohol on one occasion could be a limitation of alcohol assessment. Second, alcohol consumption is likely to change over a follow-up period of 20 years. There are many reasons to believe that drinking patterns would change overtime as the population ages. For example, those with comorbidities or illness may stop drinking. Because the present study relied on the baseline data only, we need to be cautious in interpreting results. Meanwhile, of 1034 drinkers in 1985, 694 (67.1%) still drank alcohol in 1994, whereas of 2147 nondrinkers in 1985, 205 (9.5%) were drinkers in 1994. Calculating Spearman's ranking correlation coefficients between data sets of drinking frequency collected in 1985 and in 1994, it was 0.41, indicating the drinking frequency of drinkers was not so different over 10 years. Third, death record follow-up is different between 1985 to 1991 and 1992 to 2002. However, stroke deaths from 1985 to 1991 were relatively small because they were 110 cases (19.9%), and even when the analysis was made with cases from 1992 to 2002 only, the result was similar. Fourth, the validity of diagnosis of stroke in the death certificates was not examined separately. CT and MRI started to be widely used in the diagnosis of stroke in Korea from mid-1990s.[21] Therefore, there is a limitation in the validity of diagnosis of stroke made in late 1980s and early 1990s. However, it may be the nondifferential misclassification irrelevant to alcohol consumption. Fifth, selection bias is often an issue in studies of alcohol because very heavy drinkers may not readily participate in research studies. However, this study was conducted for the whole population aged ≥55 years living in Kangwha County and the participation rate was as high as 67.9%. Therefore, there would be little selection bias in our study. With regard to the selection relative to health status, although subjects who died during first 2 years of follow-up were excluded from the analysis, the result of analysis was not so different. Sixth, some sample sizes were small with a limited number of cases. Analyses of stroke subtypes, ischemic heart disease, hypertensive disease, and the frequency of binge drinking may have a limited statistical power with insufficient cases. Seventh, the drinking habit of women is much different from that of men.[22] Because of a practical reason that drinkers accounted for only 10.1% in women and female heavy drinkers were scarce, we could not examine the relationship between alcohol consumption and mortality in women as fully as we did in men.

In conclusion, when the mortality risk of binge drinkers was compared with that of nondrinkers, mortality risks from total cardiovascular disease, stroke, and hemorrhagic stroke in particular were high in binge drinkers who drank daily. However, because the study population was people aged ≥55 years living in an agricultural community with a small population of female drinkers, further studies need to be undertaken to truly understand the risks of binge drinking in the entire population.

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