Received: 21 July 2022 | Revised: 30 October 2022 | Accepted: 10 November 2022

DOI: 10.1002/npr2.12302

NEUROPSYCHOPHARMACOLOGY REPORTS

WILEY

ORIGINAL ARTICLE

Age at onset of alcohol consumption and its association with alcohol misuse in adulthood

Soo Y. Kim[1,2] | Sung H. Jeong[1,2] | Eun-Cheol Park[2,3]

[1]Department of Public Health, Graduate School, Yonsei University, Seoul, Republic of Korea

[2]Institute of Health Services Research, Yonsei University, Seoul, Republic of Korea

[3]Department of Preventive Medicine, Yonsei University College of Medicine, Seoul, Republic of Korea

Correspondence
Eun-Cheol Park, Department of Preventive Medicine, Institute of Health Services Research, Yonsei University College of Medicine, Seoul, Republic of Korea.
Email: ecpark@yuhs.ac

Abstract

Objective: This study aimed to explore the association between early age onset of alcohol consumption and alcohol misuse in adulthood.

Methods: The study sample consisted of 16 829 individuals' (8349 males, 8435 females) survey responses obtained from the Korea National Health and Nutrition Examination Survey (KNHANES) from 2016 through 2019. Alcohol dependence was measured using the AUDIT-C (Alcohol Use Disorder Identification Test-Consumption), and the ages at which alcohol consumption began were grouped into four categories: under 16, 16 to 18, 19 to 23, and over 24. Multiple logistic regression was used to examine the association between current alcohol misuse and age at onset of alcohol consumption.

Results: Compared to individuals who started drinking alcohol after the age of 24, those who began drinking alcohol before the age of 16 were more likely to score 8 or more on AUDIT-C questions (under 16: males, odds ratio [OR] 2.50, confidence interval [CI] 1.97–3.17; females, OR: 1.66, CI: 1.18–2.33). Similar to the main analysis, the earlier the onset of alcohol assumption starts, the more likely one is to develop alcohol misuse in adulthood according to subgroup analysis stratified by independent variables in both gender.

Conclusion: The lower the age at the onset of alcohol consumption, the higher the likelihood of alcohol misuse in adulthood. While both males and females showed the same trend in response to the AUDIT-C questions, males tended to have a stronger association between early onset alcohol consumption and alcohol misuse.

KEYWORDS
age at first use of alcohol, alcohol misuse, alcohol use disorder identification test-consumption, early age drinking, health policy

1 | INTRODUCTION

Alcohol misuse is a longstanding social problem. According to World Health Organization (WHO) report "global health estimates: leading causes of death", 156 546 people died from alcohol use disorders, and 438 006 died from diseases caused by alcohol intake in 2019. During the Corona Virus Disease 2019 (COVID-19) period, alcohol-related deaths did not decrease in number, even though social distancing and other quarantine policies were implemented worldwide Previous studies that investigated alcohol-related deaths during the pandemic claim that the number of deaths related to alcohol increased between year 2019 and 2020 Moreover, it is studied that alcohol misuse is rising harm to the people during the pandemic in the United States and Brazil.[1,2] The studies assume that

stay-at-home policies may have promoted the growth of alcohol consumption. The social problems caused by alcohol misuse demand at least as much global burden as the effects of alcohol on health. Alcohol misuse could result in crime and antisocial behavior, inefficiency in the workforce, and difficulties for the families of people who misuse alcohol. The social cost of alcohol misuse is significant and much higher than that of tobacco or drug abuse.[3] Alcohol a bigger threat to society than tobacco, because alcohol is not strictly regulated like other substances. According to the OECD statistics of 2019, Latvia and Austria had the highest consumption of alcohol, reporting 12.9 and 12.2 L per capita, respectively. Korea reported 8.3 L per capita alcohol consumption among the OECD nations, which indicates mid-high levels of alcohol consumption.[4] Deaths due to alcohol-related illness comprised 42.9% of all-cause mortality in Korea in 2014,[5] with the related economic and social losses[6,7] amounting 2.9% of the Korean GDP.[8]

Although the age limit for drinking alcohol in South Korea is 19 and above, many people start drinking alcohol much earlier than it is legally acceptable. There are no severe or strict consequences of underage drinking in Korea, and this could be a reason that early onset of alcohol consumption has not been modified.[9] Clarifying any association between early tendencies toward alcohol use, especially in to the age of onset of alcohol consumption and later problems with alcohol misuse, is likely to help facilitate a national-level approach to preventing the early onset age of alcohol use.[10] Many studies have found a relationship between early age of onset of alcohol consumption and a later prevalence of alcohol misuse. According to studies, the age group most at risk of engaging in early age at onset alcohol consumption leading that lead to a later prevalence of alcohol-related issues comprises those younger than 14.[10,11] As with many other studies, we assumed that the school environment was a significant factor affecting adolescents.[12] Studies have also demonstrated that places with access to alcohol are varied. Bars or liquor outlets, and convenience stores are the preferred places for adolescents to purchase alcohol, and access to alcohol is not limited to the home environment.[13,14]

Given that major social issues arise from alcohol misuse, such as early death, harm to others, and social and economic losses, the phenomenon needs to be addressed.[15] The aim of this study was to examine association between early age at onset of alcohol consumption and later alcohol misuse. Considering that alcohol behavior is impacted by several covariates, such as gender and other health behaviors, these variables were included in our analysis

2 | MATERIALS AND METHODS

2.1 | Data

Study data were obtained from the Korea National Health and Nutrition Examination Survey (KNHANES), which was conducted by the Korea Center for Disease Control and Prevention Agency. The KNHANES is a nationwide survey that is annually conducted to evaluate health behavior and health status since 1998. The data set selected for this study was between 2016 and 2019. The health survey and demographic data were collected via medical screening vehicle with necessary medical equipments for physical measurement part, and the nutrition survey was conducted by visiting the target household in person. Medical screening vehicle is a traveling checkup center, usually in a form of a bus, and exist for sociodemographically or economically underprivileged people who have high barrier access to medical utilization. However, in this case, it was used for anthropometric data collection of the targeted study population. Items related to education and economic activities, morbidity, medical use, and nutrition survey items were asked in-person by fieldworkers. The health behavior items of the survey, such as smoking and drinking, were self-reported. A representative sample were extracted for the target population, who are 1 year and older and residing in Korea. As for the sampling method, two-step stratified colony sampling method is applied with the survey district and household as the first and second extraction units. Response rates in 2016, 2017, 2018 and 2019 of KNHANES were 75.4%, 77.9%, 76.5%, and 74.7% each. A total of 32 379 individuals participated in the survey for four consecutive years. Due to the feature of cross-sectional study, overlapping individuals by year were not removed, but they were regarded as another individual study participant. The data from these surveys are used to monitor and estimate the prevalence of chronic diseases and citizens' health in the South Korean population.[16,17]

2.2 | Sample

Of the 32 379 individuals identified, 16 829 were included in the study. We excluded those under the age of 19 years, those who never had alcohol in lifetime, and those who did not answer questions related to the AUDIT-C. Our study did not require ethical approval from our institutional review board because the KNHANES is a secondary dataset available in the public domain and does not contain private information. This investigation was conducted with the approval of the Research Ethics Review Committee of the Korea Centers for Disease Control and Prevention (KCDC), and the results of the investigation are made public by publishing statistics, and disclosing raw data until the year following the investigation. In compliance with the Personal Information Protection Act and the Statistics Act, the KCDC provides only deidentified data so that individuals cannot be estimated from the survey data.

As countries follow different academic curricula, we decided to categorize the onset age of alcohol consumption in terms of the education grade level of adolescents in Korea.[18] Korea has an education system that involves 6 years of elementary school, 3 years of middle and high school each, and 4 years of college. Moreover, we considered that college students' alcohol consumption should be categorized separately, despite there being no limitations on alcohol consumption above the age of 19 years in Korea. Considerable research has noted that college drinking, especially binge drinking, causes a variety of problems.[19–21]

2.3 | Variables

The dependent variable was alcohol misuse, which was measured using the Alcohol Use Disorder Identification Test-Consumption index (AUDIT-C). The AUDIT-C is a self-reported questionnaire for screening alcohol misuse, also known as heavy drinking or excessive consumption of alcohol. Developed by the World Health Organization, the AUDIT-C is derived from the Alcohol Use Disorder Identification Test (AUDIT), which is a tool used to screen patients with suspected alcohol abuse and to assess the extent of alcohol misuse.[22,23] Compared to the Cut, Annoyed, Guilty, Eye-opener (CAGE) questionnaire, AUDIT is designed for patients that report recent alcohol problems.[22] Therefore, questions asked about drinking in KNHANES have a "within a year" condition. AUDIT is consisted of 10 questions, and AUDIT-C is a truncated version that consists of three questions about alcohol consumption specifically. AUDIT-C is currently a widely used measurement within primary care settings to assess an individual's alcohol use. The three questions in the AUDIT-C seek information concerning the frequency of alcohol consumption, the amount consumed in a single sitting, and binge drinking. Each question has a score range of 0–4, adding up to possible total of 12 points. The question on binge drinking, however, differs in relation to sex, as males are asked if they consume 7 or more drinks in a single sitting whereas females are asked if they consume 5 or more drinks.[24–26]

While numerous studies have used the AUDIT-C, all have differed in terms of the reference point, that is, the cutoff score that delineate whether people misuse alcohol. Reference points can vary depending on the alcohol consumption culture involved and differing trends in different areas of the world. Northern European countries, such as Finland and the Netherlands, tend to have a reference point of 6,[27–29] whereas, in the United States and Australia, it tends to be 5.[24,30,31] In contrast, studies in Korea have identified a reference point of either 7 or 8.[32–34] Because this study used data involving Korean individuals, we adopted the cutoff from studies that have the reference point as 8.[34–36] AUDIT-C translated in Korean was also verified valid from the previous research.[37]

The main independent variable of interest in this study was the age at onset of alcohol consumption. The KNHANES asked each participant: "Have you ever had one glass or more of alcohol?" with a note underneath, "Please exclude a few sips taken at traditional memorial services." The response options were "Yes" or "Never." If answered "Yes," then the participants were asked to write down their exact age at which they started consuming alcohol.

We controlled for covariates such as sociodemographic and socioeconomic factors, health behaviors, and health. Referring to the previous studies, sociodemographic and socioeconomic factors are necessary as adjustment factors in cross-sectional study.[38,39] Due to the characteristic of cross-sectional study participants, adjusting those factors would make the sample more diverse and evenly distributed from the population, and especially they are intimately related to the psychological behaviors of individuals.[40–42] We referenced the previous studies regarding which variables should be controlled as independent variables in the study. The sociodemographic factors were age (from age 19 to 70 years, in groups of 10-year ranges) and sex. The socioeconomic factors were education level (below middle school, high school, or university or higher), region (metropolitan areas or rural areas), marital status (living with or without a spouse), occupation (white-, pink-, blue collar, or unemployed), and household income in quartiles. For occupation categories, white collar includes manager, administrator, or office worker. Pink collar category include sales and service worker, and those who work in agriculture, forestry, and fishery, engineers, laborer, soldiers are included in the blue collar according to the International Standard Classification Occupation Codes (ISCOC). Health behaviors included smoking habits (past smokers, current smokers, or nonsmokers) and physical activities undertaken. Health conditions included the number of comorbid diagnosed diseases (0,1, 2 or more), body mass index (BMI; underweight, normal, or overweight) and perceived stress (much or little).

2.4 | Statistical analysis

To confirm the association between age at first use of alcohol and alcohol dependence, the covariates were compared using a chi-squared test. A multiple logistic regression analysis was carried out for the main analysis, while controlling for covariates to analyze age at onset of alcohol consumption and alcohol misuse. A subgroup analysis was also performed with multiple linear regression stratified by gender, to investigate the associations between health-related factors and alcohol dependence. A dependent subgroup analysis was performed using ordinal logistic regression. The results were reported using odds ratios (ORs) and confidence intervals (CIs). The data were analyzed and further stratified by sex, using SAS 9.4 (SAS Institute Inc.). A $P < 0.05$ was considered to be statistically significant.

3 | RESULTS

Table 1 shows the general characteristics of the study population. Of the 16 829 individuals deemed eligible for this study, 8394 were male, and 8435 were female. Alcohol misuse was identified in 39.4% (n = 3307) of the males and in 11.9% (n = 1007) of the females, indicating a considerably higher percentage in the male group. The association with alcohol misuse increased as the age at onset of alcohol use became lower in both males and females. The differences between all other independent variables and alcohol misuse measured by AUDIT-C were statistically significant, except for the number of comorbid diseases in males and BMI in females. It is important for the result of this study to be generalized to all people, and thus Table 1 shows the even dispersed of the frequency for each group of each sociodemographic and socioeconomic variables.

Table 2 presents the main logistic regression results in relation to the association between age at onset of alcohol consumption and alcohol misuse. All control variables were adjusted. For both

TABLE 1 General characteristics of the study population

	Alcohol misuse (Audit-C 8 or more)							
	Male				Female			
	Total	Yes	No		Total	Yes	No	
Variables	N	N (%)	N (%)	*P*-value	N	N (%)	N (%)	*P*-value
Total (N = 16 829)	8394	3307 (39.4)	5087 (60.6)		8435	1007 (11.9)	7428 (88.1)	
Age of first alcohol use								
≤15	1062	567 (53.4)	495 (46.6)	<0.0001	443	123 (27.8)	320 (72.2)	<0.0001
16–18	3112	1401 (45.0)	1711 (55.0)		1733	340 (19.6)	1393 (80.4)	
19–23	3622	1201 (33.2)	2421 (66.8)		4040	413 (10.2)	3627 (89.8)	
≥24	598	138 (23.1)	460 (76.9)		2219	131 (5.9)	2088 (94.1)	
Age (years)								
19–29	1225	457 (37.3)	768 (62.7)	<0.0001	1295	306 (23.6)	989 (76.4)	<0.0001
30–39	1498	634 (42.3)	864 (57.7)		1605	241 (15.0)	1364 (85.0)	
40–49	1645	765 (46.5)	880 (53.5)		1902	222 (11.7)	1680 (88.3)	
50–59	1537	703 (45.7)	834 (54.3)		1703	151 (8.9)	1552 (91.1)	
60–69	1425	526 (36.9)	899 (63.1)		1212	71 (5.9)	1141 (94.1)	
≥70	1064	222 (20.9)	842 (79.1)		718	16 (2.2)	702 (97.8)	
Marital Status								
Living with spouse	5991	2340 (39.1)	3651 (60.9)	0.0119	5693	531 (9.3)	5162 (90.7)	0.0355
Living without spouse	2403	967 (40.2)	1436 (59.8)		2742	476 (17.4)	2266 (82.6)	
Region								
Metropolitan city	6906	2719 (39.4)	4187 (60.6)	0.0232	7110	852 (12.0)	6258 (88.0)	<0.0001
Rural	1488	588 (39.5)	900 (60.5)		1325	155 (11.7)	1170 (88.3)	
Occupational categories[a]								
White	2668	1120 (42.0)	1548 (58.0)	<0.0001	2296	297 (12.9)	1999 (87.1)	<0.0001
Pink	920	423 (46.0)	497 (54.0)		1445	250 (17.3)	1195 (82.7)	
Blue	2778	1120 (40.3)	1658 (59.7)		1207	129 (10.7)	1078 (89.3)	
Inoccupation	2028	644 (31.8)	1384 (68.2)		3487	331 (9.5)	3156 (90.5)	
Educational level								
Middle school or less	1691	621 (36.7)	1070 (63.3)	0.0111	2106	182 (8.6)	1924 (91.4)	<0.0001
High school	2996	1233 (41.2)	1763 (58.8)		2904	478 (16.5)	2426 (83.5)	
College or over	3707	1453 (39.2)	2254 (60.8)		3425	347 (10.1)	3078 (89.9)	
Household income								
Low	1170	396 (33.8)	774 (66.2)	<0.0001	1221	135 (11.1)	1086 (88.9)	0.0001
Mid-low	1979	754 (38.1)	1225 (61.9)		2056	274 (13.3)	1782 (86.7)	
Mid-high	2413	994 (41.2)	1419 (58.8)		2405	325 (13.5)	2080 (86.5)	
High	2832	1163 (41.1)	1669 (58.9)		2753	273 (9.9)	2480 (90.1)	
Smoking status								
Past & current smokers	6554	2907 (44.4)	3647 (55.6)	<0.0001	1202	417 (34.7)	785 (65.3)	<0.0001
Non smokers	1840	400 (21.7)	1440 (78.3)		7233	590 (8.2)	6643 (91.8)	
Physical activity								
Yes	4115	1631 (39.6)	2484 (60.4)	0.0162	4710	527 (11.2)	4183 (88.8)	0.0016
No	4279	1676 (39.2)	2603 (60.8)		3725	480 (12.9)	3245 (87.1)	

(Continues)

TABLE 1 (Continued)

	Alcohol misuse (Audit-C 8 or more)							
	Male				Female			
	Total	Yes	No		Total	Yes	No	
Variables	N	N (%)	N (%)	*P*-value	N	N (%)	N (%)	*P*-value
Obesity status (BMI)[b]								
Underweight	183	58 (31.7)	125 (68.3)	<0.0001	461	54 (11.7)	407 (88.3)	0.0956
Normal	4720	1716 (36.4)	3004 (63.6)		5684	651 (11.5)	5033 (88.5)	
Overweight & obese	3491	1533 (43.9)	1958 (56.1)		2290	302 (13.2)	1988 (86.8)	
Number of comorbid diseases[c]								
0	5539	2168 (39.1)	3371 (60.9)	0.765	6251	844 (13.5)	5407 (86.5)	<0.0001
1	1552	623 (40.1)	929 (59.9)		1234	95 (7.7)	1139 (92.3)	
2<	1303	516 (39.6)	787 (60.4)		950	68 (7.2)	882 (92.8)	
Perceived stress								
Less	6281	2383 (37.9)	3898 (62.1)	<0.0001	5930	588 (9.9)	5342 (90.1)	<0.0001
Much	2113	924 (43.7)	1189 (56.3)		2505	419 (16.7)	2086 (83.3)	
Year								
2016	2028	815 (40.2)	1213 (59.8)	0.7667	2085	230 (11.0)	1855 (89.0)	0.2421
2017	2098	829 (39.5)	1269 (60.5)		2104	250 (11.9)	1854 (88.1)	
2018	2127	837 (39.4)	1290 (60.6)		2163	282 (13.0)	1881 (87.0)	
2019	2141	826 (38.6)	1315 (61.4)		2083	245 (11.8)	1838 (88.2)	

[a]Three groups (white, pink, blue) based on the International Standard Classification Occupations codes. Inoccupation group includes housewives.
[b]BMI: Body mass index/obesity status defined by BMI based on the 2018 Clinical Practice Guidelines for Overweight and Obesity in Korea.
[c]Comorbidities were defined diagnosed diseases: hypertension, diabetes mellitus, dyslipidemia, stroke and myocardial infarction.

males and females, the results showed a linear increase as the age at first use of alcohol decreased. In male group, 15 or under OR was 2.50, 95% CI (1.97–3.17), 16–18 OR 1.82, 95% CI (1.46–2.27), 19–23 OR 1.29, 95% CI (1.04–1.60), and putting those who first started drinking alcohol after they became age 24. In female group, 15 or under group OR was 1.66, 95% CI (1.18–2.33), 16–18 OR 1.61, 95% CI (1.23–2.11), 19–23 OR 1.04, 95% CI (0.81–1.33), and having the same reference group as male group. In the male groups, the OR differences between the age groups were larger than those in the female groups.

Table 3 shows the values obtained from the subgroup analysis stratified by the independent variables. In the male groups, the alcohol misuse showed an overall tendency of higher ORs as the age at onset of alcohol consumption became younger, which was also reflected, albeit to a lesser extent, in the female groups. Table 3 includes factors related to health behavior. When compared to the group that started drinking alcohol after the age of 24, most covariates including smoking status, physical activity, obesity, number of comorbid diseases, and perceived stress had higher ORs and were statistically significant in relation to groups with age at onset of alcohol use under 16 or between 16 and 18. Highlighted parts of the Table 3 shows the clustered tendency. Moreover, this tendency toward increased ORs in all the covariates was related to the age at onset of alcohol use becoming lower in the male groups; among the female groups, the highest ORs in all the covariates were found in the group with age at onset of alcohol consumption between 16 and 18 (Table 3).

4 | DISCUSSION

Our results suggest an inverse linear relationship between age at onset of alcohol consumption and alcohol misuse in adulthood. As the onset age of alcohol use became lower, an individual became more likely to misuse alcohol as an adult. This was especially apparent among males where the relationship became increasingly significant as the age at first use became lower until it reached the lowest age group, those under 16. In contrast, the ORs were highest among females across many variables in relation to age at onset of alcohol use being between 16 and 18, which is the age corresponding to high school attendance within the Korean curriculum. Therefore, as indicated by the trends shown in Table 3, the age at onset of alcohol consumption appears to be relatively higher among females than males, and may be due to specific cultural factors.[43]

Studies have shown that the mechanism behind this association can be explained in terms of longer exposure to a harmful substance (in this case, alcohol) being more likely to result in adverse effects due to use of that substance.[44] According to relevant studies,

TABLE 2 Results of factors associated with alcohol misuse

Variables	Alcohol misuse (AUDIT-C 8 or more)	
	Male	Female
	OR (95% CI)	OR (95% CI)
Age at onset of alcohol use		
≤15	2.50 (1.97–3.17)	1.66 (1.18–2.33)
16–18	1.82 (1.46–2.27)	1.61 (1.23–2.11)
19–23	1.29 (1.04–1.60)	1.04 (0.81–1.33)
≥24	1.00	1.00
Age (years)		
19–29	1.00	1.00
30–39	1.10 (0.91–1.33)	0.78 (0.61–0.99)
40–49	1.19 (0.97–1.45)	0.58 (0.45–0.74)
50–59	1.09 (0.88–1.34)	0.38 (0.28–0.51)
60–69	0.72 (0.58–0.91)	0.20 (0.13–0.29)
≥70	0.35 (0.27–0.46)	0.07 (0.04–0.13)
Marital status		
Living with spouse	1.00	1.00
Living without spouse	1.15 (1.01–1.32)	1.46 (1.21–1.75)
Region		
Metropolitan city	1.00	1.00
Rural	1.05 (0.93–1.19)	1.11 (0.90–1.36)
Occupational categories[a]		
White	1.00	1.00
Pink	1.01 (0.86–1.19)	1.20 (0.96–1.49)
Blue	0.84 (0.73–0.96)	0.93 (0.71–1.22)
Inoccupation	0.80 (0.68–0.93)	0.77 (0.63–0.94)
Educational level		
Middle school or less	1.44 (1.22–1.71)	2.56 (1.90–3.44)
High school	1.20 (1.07–1.35)	1.88 (1.57–2.24)
College or over	1.00	1.00
Household income		
Low	0.98 (0.83–1.17)	1.19 (0.91–1.56)
Mid-low	0.95 (0.83–1.08)	1.17 (0.96–1.44)
Mid-high	0.99 (0.88–1.12)	1.24 (1.03–1.49)
High	1.00	1.00
Smoking status		
Current or past smokers	2.68 (2.35–3.04)	4.07 (3.47–4.79)
Non smokers	1.00	1.00
Physical activity		
Yes	1.00	1.00
No	0.98 (0.89–1.07)	0.97 (0.84–1.12)
Obesity status (BMI)[b]		
Underweight	0.87 (0.62–1.22)	0.73 (0.53–1.00)
Normal	1.00	1.00
Overweight & obese	1.25 (1.14–1.37)	1.32 (1.12–1.56)
Number of comorbid diseases[c]		
0	1.00	1.00
1	1.27 (1.11–1.46)	0.98 (0.75–1.27)
2<	1.31 (1.13–1.52)	1.11 (0.81–1.52)
Perceived stress		
Less	1.00	1.00
Much	1.03 (0.93–1.15)	1.25 (1.07–1.45)
Year		
2016	1.04 (0.91–1.18)	0.88 (0.72–1.09)
2017	1.03 (0.90–1.17)	1.03 (0.84–1.26)
2018	1.02 (0.89–1.16)	1.08 (0.88–1.32)
2019	1.00	1.00

[a]Three groups (white, pink, blue) based on the International Standard Classification Occupations codes. Inoccupation group includes housewives.

[b]BMI: Body mass index/obesity status defined by BMI based on the 2018 Clinical Practice Guidelines for Overweight and Obesity in Korea.

[c]Comorbidities were defined diagnosed diseases: hypertension, diabetes mellitus, dyslipidemia, stroke and myocardial infarction.

neuroadaptive changes occur due to chronic and long-term alcohol consumption, which facilitates more frequent alcohol consumption, eventually leading to alcohol misuse.[45] In one study, the main reason why people become alcoholics is that long-term neuroadaptations induced by continuous consumption of alcohol lead to a negative emotional state, which further encourages excessive alcohol consumption to relieve the consequent negative emotions.[46] These studies suggest that, while alcohol initially has a positive reinforcement effect, continuous consumption renders a negative reinforcement effect, which encourages more frequent drinking to alleviate the resultant negative mental state.

Various studies have examined motivation in relation to excessive alcohol consumption. According to these studies, stress can be a major reason for individuals, especially males, to use alcohol.[47–50] Nevertheless, in our analysis, stress was not identified as a major factor in alcohol misuse. Although the female groups had differing ORs compared to the male groups, these differences were not substantial. This outcome might be explained as due to specific elements within the drinking culture in Korea, varying perceptions of severity concerning alcohol-related problems, or differing views on the degree of stress that people have to cope with.[32,36] Other studies have suggested that more recent generations tend

TABLE 3 The results of subgroup analysis stratified by independent variables

	Alcohol misuse (AUDIT-C 8 or more)			
	Age at onset of alcohol use			
	≤15	16–18	19–23	≥24
Variables	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR
Male				
Smoking status				
Current and past smokers	2.46 (1.88–3.21)	1.84 (1.44–2.35)	1.30 (1.02–1.66)	1.00
Nonsmokers	2.92 (1.64–5.22)	1.96 (1.21–3.18)	1.42 (0.89–2.25)	1.00
Physical activity				
Yes	3.05 (2.09–4.46)	2.19 (1.54–3.12)	1.56 (1.10–2.21)	1.00
No	2.19 (1.60–3.00)	1.61 (1.21–2.13)	1.13 (0.86–1.49)	1.00
Obesity status[a]				
Underweight	3.48 (0.45–26.95)	2.65 (0.37–18.77)	1.89 (0.27–13.21)	1.00
Normal	2.73 (1.97–3.78)	2.14 (1.59–2.89)	1.59 (1.18–2.14)	1.00
Overweight	2.21 (1.54–3.18)	1.50 (1.07–2.08)	0.98 (0.71–1.36)	1.00
Number of comorbid diseases[b]				
0	2.74 (1.93–3.89)	1.91 (1.38–2.66)	1.35 (0.97–1.86)	1.00
1	2.87 (1.75–4.69)	2.12 (1.38–3.26)	1.59 (1.05–2.41)	1.00
2<	1.85 (1.14–3.01)	1.60 (1.04–2.45)	1.04 (0.69–1.58)	1.00
Perceived stress				
Less	2.56 (1.95–3.37)	1.88 (1.47–2.40)	1.35 (1.06–1.71)	1.00
Much	2.23 (1.33–3.72)	1.60 (0.98–2.61)	1.07 (0.66–1.75)	1.00
Female				
Smoking status				
Current and past smokers	1.20 (0.66–2.18)	1.23 (0.71–2.14)	1.10 (0.65–1.87)	1.00
Nonsmokers	2.23 (1.43–3.46)	1.67 (1.22–2.30)	0.93 (0.69–1.25)	1.00
Physical activity				
Yes	1.77 (1.03–3.04)	2.21 (1.41–3.45)	1.38 (0.90–2.10)	1.00
No	1.73 (1.11–2.69)	1.32 (0.93–1.87)	0.90 (0.65–1.23)	1.00
Obesity status[a]				
Underweight	–	–	–	1.00
Normal	1.38 (0.90–2.14)	1.42 (1.00–2.01)	0.83 (0.60–1.15)	1.00
Overweight	1.59 (0.86–2.96)	1.73 (1.09–2.74)	1.32 (0.88–1.98)	1.00
Number of comorbid diseases[b]				
0	1.51 (1.02–2.25)	1.36 (0.98–1.90)	0.87 (0.64–1.19)	1.00
1	1.07 (0.27–4.14)	3.66 (1.81–7.39)	1.86 (1.00–3.44)	1.00
2<	1.47 (0.35–6.19)	0.65 (0.22–1.92)	1.17 (0.61–2.22)	1.00
Perceived stress				
Less	1.45 (0.92–2.30)	1.57 (1.11–2.21)	0.97 (0.71–1.32)	1.00
Much	2.02 (1.18–3.46)	1.64 (1.04–2.59)	1.16 (0.75–1.78)	1.00

[a]BMI: Body mass index/obesity status defined by BMI based on the 2018 Clinical Practice Guidelines for Overweight and Obesity in Korea.
[b]Comorbidities were defined diagnosed diseases: hypertension, diabetes mellitus, dyslipidemia, stroke and myocardial infarction.

to start using alcohol earlier than previous generations. In one study, respondents over 50 showed the highest rate in starting alcohol consumption after 19, and respondents in their twenties showed the lowest age at onset of alcohol experience, suggesting the decreasing tendency in age at onset of alcohol consumption. Moreover, in a study that examined drinking patterns among three generations in effect of paternal side showed that later generations begun drinking prior to older generations.[18,51] However, no such relationship was identified in this study (age group 19–29 as a reference: OR 1.00, age group 50–59: OR 1.09, 95% CI 0.88–1.34).

Uncovering how adolescents access alcohol could be a major key to address early age drinking. According to one study conducted in Korea, the likelihood of binge drinking increases if an adolescent resides near a liquor store. Legal enforcement in Korea regarding underage drinking exist; according to article 58 of the Juvenile Protection Act, a person who sells, lends, or distributes harmful substances to juveniles shall be punished by imprisonment with labor for not more than 3 years or by a fine not exceeding 30 million won. Even though selling alcohol to underage individuals is banned by legislative regulations, this study demonstrates that about 67% of adolescents trying to purchase liquor succeed.[9] According to a study about liver diseases in the Asia-pacific region, although Korea enforces a minimum age for purchasing alcohol, other legally binding policies, such as restricting the sales of alcoholic beverages or sale restriction in petrol stations and drunkards do not exist.[52] In the US, one study assessed alcohol price and promotions are associated with alcohol consumption among young adults. According to the study, bars or places where they could drink on site are frequent accessible places for adolescents to drink.[13] In order to prevent underage drinking, the regulations regarding consequences of illegal drinking should not only be observed, but a strict penalty should be implemented for any place that sells alcohol to underage adolescents.

There are differences in alcohol consumption between male and female. According to studies regarding gender differences in alcohol misuse, most of them state limitations regarding fewer sample of female participants in the study, and therefore, female are largely underrepresented.[53] Women have smaller prevalence of developing alcohol-related problem, but once they do, they tend to have more physical problems than male.[54] Moreover, one study investigated predictors of frequency and quantity of drinking by gender, and results showed significant sex differences in predictors. Males who reported most frequent drinking tended to have strong expectations of increased social and physical pleasure, and sexual enhancement. On the other hand, frequent consumption among females was best predicted by stronger expectation that alcohol would reduce tension.[55] According to the study, male tend to drink for pleasure or social needs, and female tend to drink for relaxation. Since the expected aspect when drinking alcohol differ by gender, female are less likely to develop alcohol-related disorders.

Our study had some limitations. First, it was a cross-sectional study. Causality and status change over time could not be assessed. Future research that follows a longitudinal or cohort sample would address some of the shortcomings of this study. Second, because the survey involved self-reported data concerning events occurring sometime in the past, there may have been recall bias, for example, in recalling the exact age when at which one started consuming alcohol. To address this limitation, we categorized data concerning age at onset of alcohol consumption into age groups to increase the precision of our analysis. Third, other independent variables regarding health behavior were also acquired through self-entry method, in short of objective measurement using scale or index. Fourth, the data used for this study comprised secondary data obtained from the KNHANES. Therefore, certain key variables that we would have liked to consider were not available for examination. For example, various studies indicate that a family history of alcoholism is an important factor, but we were unable to examine or adjust for that factor in this study.[56,57]

In conclusion, our study showed that there was an association between early age at onset of alcohol consumption and alcohol misuse in adulthood. This association was stronger among males than among females and became stronger as the age at onset of alcohol use became lower. These findings accord with those of many previous studies and provide support to those seeking to ensure that the current legal drinking age is not lowered in Korea or in other countries. Further, children and adolescents need to be educated and informed concerning the risks of alcohol consumption and encouraged to resist drinking alcohol at an early age.

FUNDING INFORMATION

No funding was received.

ETHICS STATEMENT

The KNHANES received the Korean Disease Control and Prevention Agency (KDCA) approval (2018-01-03-P-A, 2018-01-03-C-A) in 2018 and 2019. From 2015 to 2017, the ethics approval for the KNHANES was waived by the KDCA Institutional Review Board (IRB) under the Bioethics and Safety Act in Korea for active academic use. However, KDCA IRB resumed the approval from 2018 in consideration of collection of human specimens and provision of raw data to third parties and such.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Korea National Health & Nutrition Examination Survey at https://knhanes.kdca.go.kr/knhanes/sub03/sub03_02_05.do.

ORCID

Soo Y. Kim https://orcid.org/0000-0002-7463-161X
Sung H. Jeong https://orcid.org/0000-0002-5581-7929
Eun-Cheol Park https://orcid.org/0000-0002-2306-5398

REFERENCES

1. Clay JM, Parker MO. Alcohol use and misuse during the COVID-19 pandemic: a potential public health crisis? Lancet Public Health. 2020;5:e259.
2. Garcia LP, Sanchez ZM. Alcohol consumption during the COVID-19 pandemic: a necessary reflection for confronting the situation. Cad Saude Publica. 2020;36:e00124520.
3. Rajendram R, Lewison G, Preedy V. Worldwide alcohol-related research and the disease burden. Alcohol Alcohol. 2006;41:99–106.
4. Organisation for Economic Co-operation and Development (OECD). Non-medical determinants of health: alcohol consumption. Health Statistics. Paris, France: Organisation for Economic Cooperation and Development (OECD); 2019. https://stats.oecd.org/index.aspx?queryhld=30126

5. JeKarl J, Kim K, Lee J, Park J. An estimation of alcohol attributable deaths and its associated environmental factors in community level for local government policy. Korea Health Promotion Foundation Reports. Osong, Korea: Ministry of Health and Welfare of Korea; 2014.
6. Lee DW, Kim K, Baek J, Oh SS, Jang S-I, Park E-C. Association of habitual alcohol use on risk-taking behaviors while using a car: the Korean National Health and nutrition examination survey 2009–2013. Accid Anal Prev. 2020;144:105651.
7. Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lancet. 2009;373:2223–33.
8. Lee S, Chung W, Kim IS, Kim HJ, Cho W, Shin E, et al. Socioeconomic costs of alcohol drinking in Korea. J Korean Acad Fam Med. 2008;29:201–12.
9. Lee B. The influencing factors of binge drinking among drinking adolescents. J Korean Soc Sch Health. 2019;32:88–95.
10. DeWit DJ, Adlaf EM, Offord DR, Ogborne AC. Age at first alcohol use: a risk factor for the development of alcohol disorders. Am J Psychiatry. 2000;157:745–50.
11. Hingson RW, Heeren T, Jamanka A, Howland J. Age of drinking onset and unintentional injury involvement after drinking. JAMA. 2000;284:1527–33.
12. Kuntsche E, Knibbe R, Gmel G, Engels R. Why do young people drink? A review of drinking motives. Clin Psychol Rev. 2005;25:841–61.
13. Cox MJ, Moskwiak M, Chaney BH, Garrigues M. Natural observation of alcohol Price and promotions at bars: implications for alcohol misuse prevention. Health Education & Behavior. 2021;49(2):256–64.
14. Paschall MJ, Grube JW, Black C, Ringwalt CL. Is commercial alcohol availability related to adolescent alcohol sources and alcohol use? Findings from a multi-level study. J Adolesc Health. 2007;41:168–74.
15. National Institute on Alcohol Abuse, Alcoholism, US. The physicians' guide to helping patients with alcohol problems. US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism. Bethesda, Maryland: The National Institute on Alcohol Abuse and Alcoholism (NIAAA); 1995.
16. Joo HJ, Kim GR, Choi D-W, Joo JH, Park E-C. Uric acid level and kidney function: a cross-sectional study of the Korean national health and nutrition examination survey (2016–2017). Sci Rep. 2020;10:1–11.
17. Kweon S, Kim Y, Jang M-j, Kim Y, Kim K, Choi S, et al. Data resource profile: the Korea national health and nutrition examination survey (KNHANES). Int J Epidemiol. 2014;43:69–77.
18. Jang S. Does early alcohol initiation increase the risk of alcohol use disorder. Soc Sci Res Rev Kyungsung Univ. 2010;26:199–218.
19. Halim A, Hasking P, Allen F. The role of social drinking motives in the relationship between social norms and alcohol consumption. Addict Behav. 2012;37:1335–41.
20. Oh SS, Ju YJ, Lee S, Park E-C. Primary reason for drinking among current, former, and never flushing college students. Int J Environ Res Public Health. 2019;16:211.
21. Seo JY. Construction of the structural equation model on binge drinking among Korean undergraduate students. Korean J Adult Nurs. 2014;26:78–88.
22. Bradley KA, Bush KR, McDonell MB, Malone T, Fihn SD. Screening for problem drinking. J Gen Intern Med. 1998;13:379–88.
23. Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Arch Intern Med. 1998;158:1789–95.
24. Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a brief screen for alcohol misuse in primary care. Alcohol Clin Exp Res. 2007;31:1208–17.
25. Lee JW. A study on the influencing factors of high risk drinking by gender in single adult households. J Korea Acad-Ind Coop Soc. 2021;22:321–31.
26. Oh SS, Kim W, Han K-T, Park E-C, Jang S-I. Alcohol consumption frequency or alcohol intake per drinking session: which has a larger impact on the metabolic syndrome and its components? Alcohol. 2018;71:15–23.
27. Kaarne T, Aalto M, Kuokkanen M, Seppä K. AUDIT-C, AUDIT-3 and AUDIT-QF in screening risky drinking among Finnish occupational health-care patients. Drug Alcohol Rev. 2010;29:563–7.
28. Levola J, Aalto M. Screening for at-risk drinking in a population reporting symptoms of depression: a validation of the AUDIT, AUDIT-C, and AUDIT-3. Alcohol Clin Exp Res. 2015;39:1186–92.
29. Tuunanen M, Aalto M, Seppä K. Binge drinking and its detection among middle-aged men using AUDIT, AUDIT-C and AUDIT-3. Drug Alcohol Rev. 2007;26:295–9.
30. Calabria B, Clifford A, Shakeshaft AP, Conigrave KM, Simpson L, Bliss D, et al. Identifying aboriginal-specific AUDIT-C and AUDIT-3 cutoff scores for at-risk, high-risk, and likely dependent drinkers using measures of agreement with the 10-item alcohol use disorders identification test. Addict Sci Clin Pract. 2014;9:1–12.
31. Dawson DA, Grant BF, Stinson FS, Zhou Y. Effectiveness of the derived alcohol use disorders identification test (AUDIT-C) in screening for alcohol use disorders and risk drinking in the US general population. Alcohol Clin Exp Res. 2005;29:844–54.
32. Jeon K-S, Kang K-A. Effect of post-traumatic stress and ways of stress coping on problem drinking in firefighters. Korean J Occup Health Nurs. 2017;26:218–26.
33. Lee B, Lee C, Lee P, Choi M, Namkoong K. Development of Korean version of alcohol use disorders identification test (AUDIT-K): its reliability and validity. J Korean Acad Addict Psychiatry. 2000;4:83–92.
34. Seong JH, Lee CH, Do HJ, Oh SW, Lym YL, Choi JK, et al. Performance of the AUDIT alcohol consumption questions (AUDIT-C) and AUDIT-K question 3 alone in screening for problem drinking. Korean J Fam Med. 2009;30:695–702.
35. Khadjesari Z, White IR, McCambridge J, Marston L, Wallace P, Godfrey C, et al. Validation of the AUDIT-C in adults seeking help with their drinking online. Addict Sci Clin Pract. 2017;12:2.
36. Lee JH, Kim J, Sim M, Jeon K, Oh S, Yang J, et al. Relationship between traumatic events, stress coping strategies and post-traumatic stress symptoms among social workers in public sector. Korean J Biol Psychiatry. 2015;22:55–62.
37. Lee JH, Kong KA, Lee DH, Choi YH, Jung KY. Validation and proposal for cut-off values of an abbreviated version of the alcohol use disorder identification test using the Korean National Health and nutrition examination survey. Clin Exp Emerg Med. 2018;5:113–9.
38. Cha W-T, Joo H-J, Park Y-S, Park E-C, Kim S-Y. Depression before and during-COVID-19 by gender in the Korean population. Int J Environ Res Public Health. 2022;19:3477.
39. Joo HJ, Joo JH, Kwon J, Jang BN, Park E-C. Association between quality and duration of sleep and subjective cognitive decline: a cross-sectional study in South Korea. Sci Rep. 2021;11:1–9.
40. Macintyre S, Anderson A. Socio-demographic and psycho-social variables. Design concepts in nutritional epidemiology. Oxford, US: Oxford University Press; 1997. p. 273–88.
41. Matthews KA. Are sociodemographic variables markers for psychological determinants of health? Health Psychol. 1989;8:641.
42. Swendsen J, Conway KP, Degenhardt L, Dierker L, Glantz M, Jin R, et al. Socio-demographic risk factors for alcohol and drug dependence: the 10-year follow-up of the national comorbidity survey. Addiction. 2009;104:1346–55.
43. Berglund K, Berggren U, Fahlke C, Balldin J. Self-reported health functioning in Swedish alcohol-dependent individuals: age and gender perspectives. Nord J Psychiatry. 2008;62:405–12.

44. Clapp P, Bhave SV, Hoffman PL. How adaptation of the brain to alcohol leads to dependence: a pharmacological perspective. Alcohol Res Health. 2008;31:310–39.
45. Kalivas PW, O'Brien C. Drug addiction as a pathology of staged neuroplasticity. Neuropsychopharmacology. 2008;33:166–80.
46. Heilig M, Koob GF. A key role for corticotropin-releasing factor in alcohol dependence. Trends Neurosci. 2007;30:399–406.
47. Abbey A, Smith MJ, Scott RO. The relationship between reasons for drinking alcohol and alcohol consumption: an interactional approach. Addict Behav. 1993;18:659–70.
48. Blomeyer D, Buchmann AF, Schmid B, Jennen-Steinmetz C, Schmidt MH, Banaschewski T, et al. Age at first drink moderates the impact of current stressful life events on drinking behavior in young adults. Alcohol Clin Exp Res. 2011;35:1142–8.
49. Carpenter KM, Hasin DS. Reasons for drinking alcohol: relationships with DSM-IV alcohol diagnoses and alcohol consumption in a community sample. Psychol Addict Behav. 1998;12:168–84.
50. Cooper ML, Frone MR, Russell M, Mudar P. Drinking to regulate positive and negative emotions: a motivational model of alcohol use. J Pers Soc Psychol. 1995;69:990–1005.
51. Hong Y, Chun S, Yun M, Asante LS, Chu C. A study of high-risk drinking patterns among generations based on the 2009 Korea National Health and nutrition examination survey. Osong Public Health Res Perspect. 2014;5:46–53.
52. Sarin SK, Kumar M, Eslam M, George J, Al Mahtab M, Akbar SMF, et al. Liver diseases in the Asia-Pacific region: a lancet gastroenterology & hepatology commission. Lancet Gastroenterol Hepatol. 2020;5:167–228.
53. Peltier MR, Verplaetse TL, Mineur YS, Petrakis IL, Cosgrove KP, Picciotto MR, et al. Sex differences in stress-related alcohol use. Neurobiol Stress. 2019;10:100149.
54. Erol A, Karpyak VM. Sex and gender-related differences in alcohol use and its consequences: contemporary knowledge and future research considerations. Drug Alcohol Depend. 2015;156:1–13.
55. Mooney DK, Fromme K, Kivlahan DR, Marlatt GA. Correlates of alcohol consumption: sex, age, and expectancies relate differentially to quantity and frequency. Addict Behav. 1987;12:235–40.
56. Hill KG, Hawkins JD, Bailey JA, Catalano RF, Abbott RD, Shapiro VB. Person–environment interaction in the prediction of alcohol abuse and alcohol dependence in adulthood. Drug Alcohol Depend. 2010;110:62–9.
57. Pilatti A, Caneto F, Garimaldi JA, Vera BDV, Pautassi RM. Contribution of time of drinking onset and family history of alcohol problems in alcohol and drug use behaviors in Argentinean college students. Alcohol Alcohol. 2014;49:128–37.

How to cite this article: Kim SY, Jeong SH, Park E-C. Age at onset of alcohol consumption and its association with alcohol misuse in adulthood. Neuropsychopharmacol Rep. 2023;43:40–49. https://doi.org/10.1002/npr2.12302