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Gender Differences in Alcohol Drinking among Adolescents: A School-based Survey in China

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Abstract

Objective To investigate the gender differences in the proportion of alcohol and hazardous drinkers, and the socio-demographic associated factors of hazardous drinkers among primary and middle school students.

Design A school-based cross-sectional survey was conducted in a city in southwestern China, with a total of 89,360 students from primary and middle school.

Setting School-based sample.

Participants 89,360 students (including 44653 boys and 44707 girls), and the age range was 10~20 years.

Primary and secondary outcome measures Alcohol drinking behaviors were assessed by self-reported measures on the Alcohol Use Disorders Identification Test Consumption (AUDIT-C).

Results Of the 89,360 respondents, 19.0% were alcohol drinkers and 4.0% were hazardous drinkers. More boys than girls were alcohol (22.1% for boys vs. 16.0% for girls) or hazardous drinkers (5.2% vs. 2.7%). The mean AUDIT-C score was 1.4 (±2.10) and significantly higher in boys (1.6±2.22) than girls (1.2±1.89, $p<0.001$). There was a polarity between boys and girls beginning at grade 10, with an increasing number of alcohol or hazardous drinkers for boys and a decrease for girls. Multiple logistical regression analysis indicated that older age, boys, living in rural and left-behind children were risk factors while nuclear family and parents do not drink were protective factors associated with being a hazardous drinker.

Conclusions About one-fifth of adolescents were alcohol drinkers and some of them even be hazardous drinkers, especially boys in senior high school. Being a hazardous drinker is more associated with some demographic characteristics, such as being a boy.

Keywords: Gender differences, Adolescents, Alcohol drinker, Hazardous drinker, China

Strengths and limitations of this study

1. This survey investigated the proportion of alcohol or hazardous drinkers of adolescents with a large sample size in a city in southwestern China.
2. More respondents (47.7%) in this study were junior high school students, the sample is not enough to a representative of the drinking status of all range school students in southwestern China.
3. There may exist minor gaps with real alcohol consumption because of the self-reported data.
4. This cross-sectional survey is not enough to prove causality between associated factors and hazardous drinkers.

Introduction

Alcohol drinking is common worldwide, and wine culture has been an important part of Chinese culture for all time. In China, people usually have a drink in which such as the

Spring Festival, a birthday celebration, and a business party, as well as just when they want. However, at the same time, alcohol use has always been considered a significant risk factor for chronic disease or injury [1], which is one of the primary risk factors for the global burden of cancer, accounting for 7.4% of male cancer disability-adjusted life years (DALYs) in 2019[2]. Alcohol consumption caused 1.78 million deaths in 2020[3]. Globally, among individuals aged 15-39, alcohol-related health risk factors are mainly harmful events. For males, alcohol-related DALYs were at 66.3% and 47.9% for females. These include traffic accidents, self-hurt, and interpersonal violence [3]. In current years, alcohol drinking among adolescents is an increasingly critical public health issue [4]. The prevalence of alcohol drinking is highest in the WHO European region (43.8%), followed by the Region of America (38.2%) and the Western Pacific region (37.9%). Globally, 26.5% of 15-19 years old are current alcohol drinkers [5]. Gender differences in alcohol drinking among adolescents with lacking consistency. The America Center for Disease Control and Prevention (CDC)[6] reported that the prevalence of current alcohol drinking was 22.4% among American high school female students and 16.4% for male students. On average, there were 79% of boys with 15 to 16 years old in European reported having alcohol at least once during their lifetime, and 78% of girls did. But in 16 countries of European, more girls were drinkers than boys [7]. A Meta-analysis of alcohol drinking among Chinese adolescents found that 23.6% of boys and 15.3% of girls drank alcohol in junior high school. Among senior high school students with 36.5% of boys and 21.2% of girls [8].

Adolescents experience an increase in impulsive behavior and usually start drinking alcohol [9] in adolescence, which is a critical period for them for development and maturation. Alcohol use during this special period would cause a negative influence. It's associated with alcohol-related damage to the brain importantly, which includes a decrease in the volume of grey matter [10] and changes in white matter as well as its integrality damage [11]. Studies [11] in adolescent rodent models also show that the functional consequences of adolescent alcohol use include reduced cognitive flexibility, behavioral inefficiency, disinhibition, and increased impulsive as well as risk-taking behavior. In addition, alcohol use in adolescents is more

likely to have mood problems such as depression, anxiety [12 13], and sleep problems [14]. Compared with alcohol-naive adolescents, with a history of alcohol use has an estimated 30-60% increased chance of experiencing aggressive behavior syndrome [15]. Furthermore, adolescent drinking is also a key risk factor for alcohol and drug dependence in adulthood [16]. Those who started drinking before 14 years old were more likely to have alcohol dependence within 10 years after their first drinking, compared with those aged 21 or older [17]. Similar research [18] indicated that someone who gets drunk for the first time before the age of 14 was 3 times more likely to have alcohol use disorder (AUD) than those who were at age 19 or later. AUD is a chronic and relapsing brain disease, mainly manifested by uncontrollable use of alcohol despite knowing its harmful effects of it. A Chinese study [19] of 367,120 adult men from 31 provinces found that 10.7% of participants were with AUD, which was associated with a 20% increased risk of all-cause death and a 30% increased risk of cancer death [19]. A retrospective study [20] from the US has found that AUD was an independent risk factor associated with traumatic brain injury (TBI) hospitalization, with a 50% increased risk in children and adolescents compared with non-alcohol users. These at-risk groups are also at higher risk of comorbid mood disorders and increase drug use, including stimulants, marijuana, and tobacco. In a 2.5-year longitudinal study [21] from Australia, 18.4% (N=104) of adolescents met the DSM-5 AUD diagnosis during their lifetime and 16.8% met the ICD-11 diagnosis of alcohol dependence.

Factors related to adolescent alcohol drinking include personal and family factors. For example, those who are impulsive, have the desire to seek new and exciting experiences [9] and with mental health problems are more likely to drink. Young adults with serious mental health problems in the past year were four times more likely to have drunk alcohol at harmful levels in the previous month [22]. A study [23] from the US found that males, with stronger social motives, impulsiveness, and lower self-efficacy were associated with high-intensity drinking. The grade higher, the binge drinking students more, with 2.2% of students binge drinking in the past 30 days in 8th grade and 10.3% in 10th grade [24]. Furthermore, the aspect of parents is especially important for their children. Parental alcohol use is a risk factor for adolescent

drinking [25 26], which would indirectly induce heavy drinking when they become adults [27]. Paternal drinking had a greater impact on their daughters, but there was no gender difference in the effect of maternal drinking [28]. Another study [29] has also shown a link between adolescent drinking and paternal drinking. Controversially, a study [30] from Japan found that maternal drinking puts adolescents at a higher risk of binge drinking. Maybe the different results depended on variable subjects and cultures. In addition, parental alcohol supply is associated with higher rates of alcohol consumption among adolescents [31]. A longitudinal study [32] from Australia found that 10% of children reported being given alcohol by their parents at the mean age of 12.9, and 40% by the mean age of 17.8.

China is a country with a large population and territory. It is divided into 34 provincial-level regions with great economic and cultural differences. Although there were already quite a few studies about the prevalence of alcohol use among Chinese adolescents, most previous research surveyed the eastern or developed regions of China, like Shanghai and Zhejiang Province. Additionally, participants in the past studies most were middle school students. Our study was conducted in southwestern China and old-age primary students were included. Zigong is one of the representative cities of Sichuan Province, which is located in southwest China, and Zigong city was selected as a pilot city for the construction of the national social psychological service system in 2019. Considering the negative influence of adolescent drinking on their future as well as the economic and cultural variety of different regions in China, the large sample-based survey for the prevalence of alcohol drinking among adolescents screening in this city is conducive to early detection of alcohol consumption, and more targeted prevention and intervention of adolescent drinking and alcohol-related problems.

Materials and methods

Procedure and Participants

This cross-sectional survey, which conducted between October and December 2020 in Zigong city of Sichuan province, China. Zigong city consists of four administrative districts

and two county-level cities. We randomly selected two administrative regions and one county-level city of all to carry out this survey, covering all 132 ordinary schools (the vocational schools and schools with special populations were excluded) in the selected area.

Before the start of the survey, the professional psychometricians of our team conducted offline training for the investigators and made a detailed introduction to the research purpose, measurement criteria, and specific items of the questionnaire to ensure they fully understood the situation of the whole study. Then, investigators went to local schools to introduce the purpose of the study and questionnaires to the participants, ensuring that all of them fully understood and correctly filled in them. All students at school on the day of the survey, including primary (5-6 grades), junior high (7-9 grades), and senior high school students (10-12 grades), were invited and completed an electronic survey in their school computer lab by themselves. The psychological assessment system, a mobile mental health management platform, was installed on computers in advance. Participants completed all questionnaires before data was automatically saved in the system. After the survey was completed, investigators could log in to the system and export all data for subsequent analysis, including conducting quality control at the scene.

There were 90,039 students enrolled, after eliminating the missing data and cleaning outliers, data from 89,360 were eventually included in the follow-up analysis and the overall effective rate was 99.25%. Participants' age ranged from 10 to 20 years old, and the mean years old was 13.4 (SD=2.1).

Patient and public involvement

No patients or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research.

Measurement

Demographic information

A self-made questionnaire was performed to collect participants' demographic information, including gender (boy or girl), age, place of residence (urban or rural), left-behind children (yes or no), nuclear family (yes or no), and parental drinking (yes or no).

Drinking behavior

The Alcohol Use Disorders Identification Test (AUDIT)[33 34] is usually used to measure risk and harmful drinking behaviors and alcohol use disorder, including 10 items. In different standards, the sensitivity and specificity of the test with 51%-97%, and 78%-96% respectively [35]. Three alcohol consumption questions were selected from the AUDIT, the Alcohol Use Disorders Identification Test Consumption (AUDIT-C)[36 37], a modified version of it. First, participants answered whether were a drinker or not. If they chose *yes*, then continued to complete the AUDIT-C. The scale included (1) How often did you have a drink in the past year? (scores: never=0, ≤1 time per month=1, 2-4 times per month=2, 2-3 times per week=3, ≥4 times per week=4), (2) How many did you drink on one occasion when you are drinking in the past year (0.5-1 beer=0, 1.5-2=1, 2.5-3=2, 3.5-4=3, 5 or more=4), (3) How often did you drink about three or more bottles of beer or 100 ml of (Chinese) spirits at a time (never=0, ≤1 time per month=1, 1 time per month=2, 1 time per week=3, 1 time per day=4). The sum of AUDIT-C scores between 0-12, the score 3 was the limitation, meaning that the total scores ≥3 likely to be a hazardous drinker or high risk of AUD [38]. Verified through studies, the sensitivity and specificity of the AUDIT-C for 10 to 18-year populations with 87% and 97%, respectively [39].

Definition

Alcohol drinker

Defined as a person who has drunk equal to or greater than 30 g alcohol weekly (equal to 900 ml beer or 300 ml wine or 30 ml of (Chinese) spirits) and has drunk at least one year.

Hazardous drinker

One score ≥3 in AUDIT-C is defined as a hazardous drinker, regardless of gender.

Statistical Analysis

The statistical package for social science (SPSS), Windows version 25.0, was performed for statistical analysis. All data figures were completed by the GraphPad Prism for Windows (version 8.0.2). The significant level was set for less than 0.05, and two-tailed results through adjusted by multi-comparison. Continuous variables are described as mean and standard

deviation (S.D.), and categorical variables are represented as numbers and percentages.

Descriptive Analysis

Social and demographic information were described according to overall and different groups (primary, junior high, and senior high school). As for drinking behavior, after calculating scaled scores, described the prevalence and degree of drinking for different genders overall and different groups.

The One-way ANOVA was performed to compare the statistical difference of a continuous variable in different groups, like age and scaled scores. If the main effect was significant, then a post hoc test was needed by Bonferroni. The Chi-square test was used to explore the significant contrast of categorical variables in different groups, such as gender, residence, and drinking behavior of parents. Similarly, Bonferroni applied to the post hoc test. The two independent-sample t-test was used to explore the statistical difference in AUDIT-C score between different genders.

Regressive Analysis

Univariate and multivariate logistic regression analysis was used to explore associated factors of the hazardous drinker, which independent variables included age, gender, residence, left-behind children, types of family, parents' drink, and whether the dependent variable was a hazardous drinker or not.

Results

Characteristics information

A total of 89,360 students' demographic characteristic information was shown in **Table 1**. Mean 13.4 years old (SD=2.1) for all subjects, and approximately 50.0% of them were boys. More students lived in urban, more students were from a nuclear family, and fewer students were left-behind children. We can see from table 1, more parents drank, especially in senior high school.

There was statistical significance (p<0.001) of age in different groups by One-way ANOVA. And statistical significance (p<0.001) of gender, residence, nuclear family, left-behind children, and parents drinking existed in different groups by Chi-square test.

Associated factors of hazardous drinkers

What we could see in **Table 2** is that all factors were associated with hazardous drinkers both crude and adjusted regression analysis. After adjusting for cofounders, being a hazardous drinker was associated with age [adjusted odds ratio (aOR) 1.14, 95% confidence interval (CI) 1.12-1.15], boys (2.07, 1.93-2.22), nuclear family (0.66, 0.61-0.71), father not drinking (0.85, 0.78-0.93), mother not drinking (0.54, 0.50-0.58) (p<0.001) and lived in rural (1.13, 1.06-1.22) and left-behind children (0.90, 0.83-0.97) (p<0.05). Especially, the boy has a higher risk (aOR=2.07) than the girl to be a hazardous drinker.

Gender differences in drinking behaviors

As shown in **Table 3**, there were 19.0% alcohol drinkers in total, most drinkers were junior high school students (19.3%). The Post hoc Bonferroni test indicated no difference in the proportion of drinkers in the three groups. More boys were drinkers than girls in total and different three groups (22.1%, 21.6%, 22.0%, and 22.9% for boys vs. 16.0%, 15.9%, 16.4%, and 15.4% for girls, respectively, all p<0.001). The result was shown in **Figure 1**, indicating that more drinkers were boys than girls in all grades. For senior high school students, with the grades increased, the prevalence of alcohol drinkers increased. **Table 3** also showed that the mean AUDIT-C score was higher in middle (including junior and senior high) school students than in primary school students. Meanwhile, there was no statistical difference between junior and senior high school students. Higher mean AUDIT-C score for boys than girls in overall and different groups (all p<0.001). There were more (4.6%) senior high school students' AUDIT-C total scores ≥3. And there was a significant difference in primary and middle school students, but no difference in junior and senior high school students. In overall and three groups, more boys with AUDIT-C score ≥3 (all p<0.001), especially in senior high school (7.5% for boys vs. 2.3% for girls, p<0.001). **Figure 2** shows that the prevalence of hazardous drinkers in boys was higher than in girls in all grades. There was a polarity between boys and girls beginning at grade 10, with an increasing number of alcohol or hazardous drinkers were boys and decreasing for girls

Discussion

Our survey investigated the proportion of alcohol or hazardous drinkers by gender among primary (5-6 grades), all junior high, and senior high school students with a large sample size in mainland China. More alcohol drinkers were boys and tended to have hazardous drinking behavior as measured by AUDIT-C total score. Our survey also found a significant difference that more alcohol and hazardous drinkers were boys than girls. The multiple regression analysis indicated that being a hazardous drinker was associated with some demographic characteristics.

We found that most (19.3%) alcohol drinkers were junior high school students, however, heavier drinking behaviors were among senior high school students, their mean score of AUDIT-C was maximum and most (4.6%) of them were hazardous drinkers. Importantly, there existed 2 times risk for boys than girls to be hazardous drinkers. Thus, we investigated the gender differences in three groups, finding that more boys than girls were alcohol drinkers and they had worse drinking behaviors. In different grades level, we found that the prevalence of hazardous drinking met a decrease at 10th grade in total and increased with grade level during senior high school for boys while decreasing for girls. Chinese students have an entrance examination for senior high school when their end of 9th grade. Then, some students become senior high school students who succeed while others go to vocational high school or have work. Senior high school students, especially boys, are more social and are similar to adult men, they have more chances and are likely to drink, which may explain the findings. Our previous research conducted an online survey [40] between May and August 2020 to investigate the drinking behavior of Chinese adults finding that high-risk drinking was 36% (43.2% of males and 9.3% of females) at all 2,229 drinkers. We also found that 70.2% of males and 46.6% of females were hazardous drinkers.

A previous study [41] surveyed 3,291 Japanese high school students in 2016 and found that the prevalence of current alcohol use in total was 9.6%, 10.7% for boys and 8.6% for girls in the past 30 days, which was lower than our present survey. To Korean [42], the rate of drinking in grade 12 students was 25.1% in boys and 18.7% in girls, which results similar to the present survey (25.8% for boys and 17.0% for girls). A cross-sectional survey carried out

between May and June 2013 in Beijing, Shanghai, and Guangzhou from China's metropolises, including 13,811 middle school students (excluding 9th and 12th graders), found that of all surveyed students, more male than female students (56.3% for males vs. 48.9% for females) had drunk in their lifetime, more male students (43.5% vs. 33.4%) were drinkers in the past 12 months and 6.7% male students had binge drinking [43]. Its prevalence of drinkers in the past year was higher than in the present survey and similar to our study on gender differences, namely more boys were drinkers. The three cities surveyed in that study all are more developed than ours, students may have more chances to get alcohol and be vulnerable to drinking. A school-based survey [44] including 23,543 middle school students from Zhejiang province of China, conducted between April and May 2017, found that 27.0% of boys reported alcohol use total in the past month while 18.2% for girls, and 11.8% boys and 6.5% girls of all reported binge drinking during the past 30 days. The rate of binge drinking in senior high school is higher than in junior high school, which is similar to our present survey. The prevalence of alcohol use in total is higher than in our survey (22.8% vs. 19.3%), the reason may be those primary school students included and vocational senior high school students were excluded from our survey. Previous studies [43 45] found that older age and vocational senior high school students were more likely to drink. A study [46] used data from China Health and Retirement Longitudinal Study (CHARLS) and found that of all 19,841 older adults (age ≥50 years), the prevalence of current alcohol consumption was 48.5% and most of them had chronic disease/condition such as liver disease. The prevalence of drinking or alcohol drinking degree in adults and older adults is higher than in adolescents, which is consistent with general knowledge. However, many adults first onset of drinking when they were adolescents, thus, hitting a brake on adolescent drinking is a critical measure.

The present study also found that older age was one of the risk factors for hazardous drinkers. One who lived in rural [47] than urban were more likely to be hazardous drinkers. Besides, the nuclear family [48], not left-behind children (LBC), and parents not drinking were protective factors for hazardous drinkers. Previous studies [25 30] also indicated that the drinking behaviors of parents would influence their children. Besides, the father not drinking

was more protective than the mother, which may mean that the influence of fathers' drinking behavior was larger than mothers', which is similar to the previous study [29]. For a long time until now, it's paternal society during Chinese development, children are more likely to take their father as an example for their behavior.

There are some limitations. First of all, this study although covering most schools with about eighty thousand students, more respondents (47.7%) were junior high school students, thus, the sample is not enough to a representative of the drinking status of all range school students in southwestern China. Secondly, the data of the survey from self-reported, there may exist minor gaps with real alcohol consumption. Eventually, this is a cross-sectional survey, it's not enough to prove causality between associated factors and hazardous drinkers. It entails more prospective cohort studies in the future to identify the association of those factors with alcohol drinking in primary and middle school students, furthermore, to protect them from being hazardous drinkers.

Conclusion

This school-based survey found that about one-fifth of adolescents were alcohol drinkers and some of them even be hazardous drinkers, especially boys in senior high school, in primary and middle school students in southwestern China. Being a hazardous drinker is more associated with older age, boys, living in rural, not nuclear family, left-behind children, and parents' drinking. Our findings indicated that more strict measures need to be informed to reduce alcohol drinking for this population.

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Contributors JST, XGC, YHL, ZMC and XJK conceived and designed this study. SLR, RNH, YDL, and YGT supervised the data collection process. LL, YL, XS, and SSC were responsible for the statistical analyses. LL did the draft of the manuscript. YHL, XGC, and JST interpreted the results and commented on the manuscript. All authors contributed to the article and approved the submitted version.

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Competing interests None declared.

Ethics approval All respondents or their parents signed informed consent before participating in the survey and this project was approved by the ethics committee of Zigong Mental Health Center [No. 2020-8-01].

Data availability statement Datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Table 1 Demographic characteristics of overall and different groups

Variables	Overall (N=89360)	Primary (N=26235, 29.4)	Junior high (N=42683, 47.7)	Senior high (N=20442, 22.9)
Age (mean ± SD)	13.4±2.1	11.0±0.74	13.4±0.99	16.2±1.13
Gender (%)				
Boys	44653 (50.0)	13492 (51.4)	21941 (51.4)	9220 (45.1)
Girls	44707 (50.0)	12743 (48.6)	20742 (48.6)	11222 (54.9)
Residence (%)				
Urban	53189 (59.5)	15740 (60.0)	24208 (56.7)	13241 (64.8)
Rural	36171 (40.5)	10495 (40.0)	18475 (43.3)	7201 (35.2)
Nuclear family (%)				
Yes	70278 (78.6)	19907 (75.9)	33467 (78.4)	16904 (82.7)
No	19028 (21.4)	6328 (24.1)	9216 (21.6)	3538 (17.3)
LBC (%)				
Yes	29986 (33.6)	7831 (29.8)	14981 (35.1)	7174 (35.1)
No	59374 (66.4)	18404 (70.2)	27702 (64.9)	13268 (64.9)
Paternal drinks (%)				
Yes	66804 (74.8)	18265 (69.6)	32453 (76.0)	16086 (78.7)
No	22556 (25.2)	7970 (30.4)	10230 (24.0)	4356 (21.3)
Maternal drinks (%)				
Yes	21420 (24.0)	5045 (19.2)	10312 (24.2)	6063 (29.7)
No	67940 (76.0)	21190 (80.8)	32371 (75.8)	14379 (70.3)

Data are percentage (number) or mean (SD). Nuclear family, which means that students live with their two biological parents. LBC: Left-behind children. In different groups, all statistical significance <0.001.

Table 2 Associated factors of hazardous drinkers among adolescents

Variables	Crude OR (95% CI)	*P value*	Adjusted OR (95% CI)	*P value*
Age (: +1)	1.14 (1.12, 1.16)	<0.001	1.14 (1.12,1.15)	<0.001
Gender				
(Ref. girl)	1.97 (1.83, 2.11)	<0.001	2.07 (1.93,2.22)	<0.001
Residence				
(Ref. Urban)	1.12 (1.04, 1.20)	<0.001	1.13 (1.06,1.22)	0.001
Nuclear family				
(Ref. No)	0.65 (0.61, 0.71)	<0.001	0.66 (0.61,0.71)	<0.001
LBC				
(Ref. Yes)	0.83 (0.78, 0.89)	<0.001	0.90 (0.83,0.97)	0.003
Paternal drinking				
(Ref. Yes)	0.74 (0.68, 0.80)	<0.001	0.85 (0.78,0.93)	<0.001
Maternal drinking				
(Ref. Yes)	0.53 (0.50, 0.57)	<0.001	0.54 (0.50,0.58)	<0.001

OR: odds ratio. CI: 95% confidence interval. Nuclear family, which means that students live with their two biological parents. LBC: Left-behind children. Ref., reference

Table 3 Gender differences in overall and different groups.

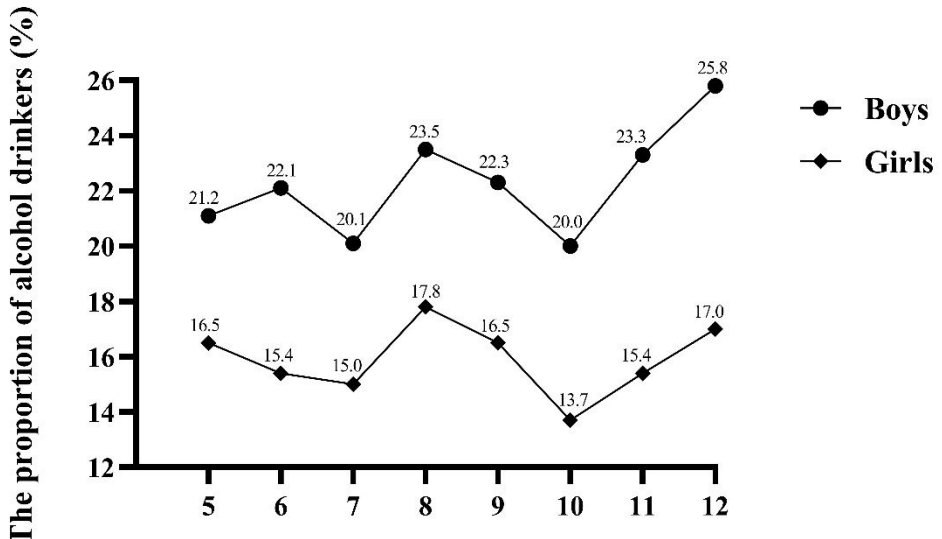
Variables	Overall (N=89360) *			Primary (N=26235, 29.4) *			Junior high (N=42683, 47.8) *			Senior high (N=20442, 22.9) *		
	Overall	Boys	Girls	Overall	Boys	Girls	Overall	Boys	Girls	Overall	Boys	Girls
Drinker (%)	19.0 (17007)	22.1 (9846)	16.0 (7161)	18.8 a (4935)	21.6 (2912)	15.9 (2023)	19.3 a (8230)	22.0 (4824)	16.4 (3406)	18.8 a (3842)	22.9 (2110)	15.4 (1732)
AUDIT-C score (mean ±SD)	1.4 (±2.10)	1.6 (±2.22)	1.2 (±1.89)	0.9 a (±1.77)	1.0 (±1.86)	0.8 (±1.60)	1.6 b (±2.19)	1.7 (±2.27)	1.5 (±2.07)	1.7 b (±2.17)	2.1 (±2.37)	1.1 (±1.74)
AUDIT-C ≥3 (%)	4.0 (3562)	5.2 (2340)	2.7 (3562)	2.6 a (687)	3.4 (453)	1.8 (234)	4.5 b (1930)	5.5 (1198)	3.5 (732)	4.6 b (945)	7.5 (689)	2.3 (256)

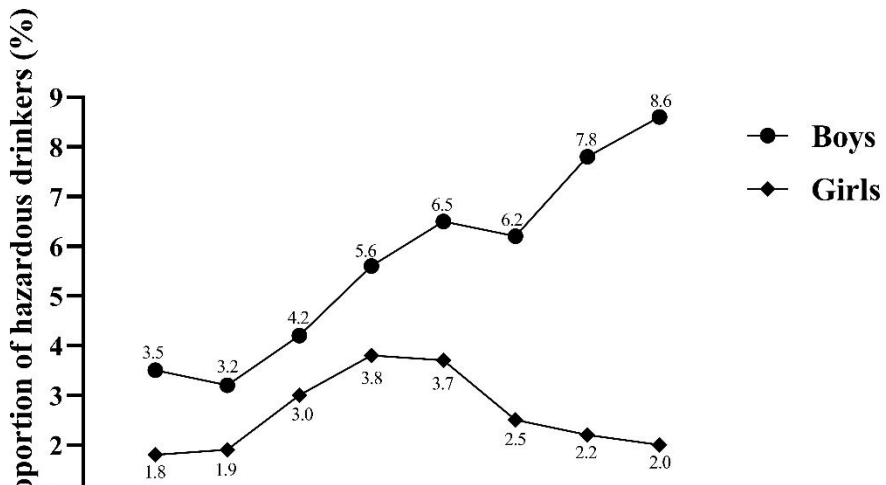
Data are percentage (number) or mean (SD). For each variable, a different letter implies that there exists statistical difference in each group (p<0.001). In alphabetical order, the values increase in sequence. Multiple comparisons adjusted all results.

AUDIT-C, Alcohol Use Disorders Identification Test for Consumption.

AUDIT-C ≥3, hazardous drinking or active AUD.

* There existed significant gender differences in overall and different groups (p<0.001).





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Gender Differences in Alcohol Drinking among Adolescents: A School-based Survey in China

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Abstract

Background Alcohol drinking among adolescents is associated with their health development. However, the prevalence of alcohol drinking among adolescents in Southwestern China remains largely unexplored. This study aimed to investigate the prevalence of alcohol drinking, with a particular focus on gender differences, among primary and middle school students in Zigong, a city in Southwestern China. Additionally, we examined the association between alcohol consumption and demographic and family factors.

Methods A school-based cross-sectional survey was conducted in a city in Southwestern China, encompassing a total of 89,360 students from 132 different ordinary schools, including both

primary and middle schools. Participants were recruited through cluster sampling. The Alcohol Use Disorders Identification Test Consumption (AUDIT-C) was employed to assess alcohol consumption. Gender differences in the prevalence of alcohol drinkers across various schools and grades were analyzed. Multivariable logistic regression analysis was utilized to investigate factors associated with hazardous drinking.

Results Out of the 89,360 participants, 19.0% reported alcohol drinking, with 2.1% classified as hazardous drinkers. There was a higher prevalence of alcohol drinking among boys compared to girls, as well as hazardous drinking. There were significant gender disparities of alcohol drinking observed across various schools and grade levels. A notable divergence between boys and girls was observed starting from grade 10, with a rising prevalence of hazardous drinking among boys and a decline among girls. Additionally, older age, male gender, and being left-behind children were identified as risk factors for hazardous drinking, while belonging to a nuclear family and having parents who do not drink were protective factors against hazardous drinking.

Conclusions Alcohol consumption is prevalent among Chinese adolescents, with some even classified as hazardous drinkers. These findings may offer valuable insights for policymakers and caregivers, guiding them in formulating appropriate interventions and support strategies.

Keywords: Gender differences, Adolescents, Alcohol drinker, Hazardous drinker, China

Strengths and limitations of this study

1. This survey examined the prevalence of alcohol drinking and hazardous drinking among adolescents in a city in Southwestern China, utilizing a large sample size. It explored gender differences across various school levels (primary, junior high, and senior high school) and grades.

2. Minor discrepancies with actual alcohol drinking may exist due to the reliance on self-reported data.

3. The students from vocational and special schools were excluded from the present survey due to their different learning and cultural contexts, future research should focus on the populations.

4. This cross-sectional survey does not provide sufficient evidence to establish causality between associated factors and hazardous drinking.

Introduction

Alcohol drinking is common worldwide (1). For a long time, alcohol has been an aspect of human culture (2). However, concurrently, alcohol consumption has consistently been recognized as a significant risk factor for chronic diseases or injuries (3), including its prominent role as one of the primary risk factors for the global burden of cancer. In fact, it accounted for 7.4% of male cancer disability-adjusted life years (DALYs) in 2019 (4). Alcohol consumption led to 1.78 million deaths in 2020 (5). Globally, among individuals aged 15-39, alcohol-related health risk factors primarily involve harmful events. For males, alcohol-related disability-adjusted life years (DALYs) accounted for 66.3%, whereas for females, it was 47.9%. These events encompass traffic accidents, self-harm, and interpersonal violence (5). In recent years, alcohol consumption among adolescents has become an increasingly critical public health issue (1). The prevalence of alcohol consumption is highest in the WHO European region (43.8%), followed by the Region of the Americas (38.2%) and the Western Pacific region (37.9%). Globally, 26.5% of individuals aged 15-19 years are current alcohol drinkers (1). Gender differences in alcohol consumption among adolescents lack consistency. The Centers for Disease Control and Prevention (CDC) in America (6) reported that the prevalence of current alcohol consumption was 22.4% among female high school students and 16.4% among male students. On average, 79% of boys aged 15 to 16 in Europe reported having alcohol at least once during their lifetime, compared to 78% of girls. However, in 16 European countries, more girls were drinkers than boys (7). A meta-analysis of alcohol consumption among Chinese adolescents revealed that 23.6% of boys and 15.3% of girls reported drinking alcohol in junior high school. Among senior high school students, the figures were 36.5% for boys and 21.2% for girls (8).

Adolescents often undergo an increase in impulsive behavior and typically initiate alcohol consumption during adolescence (9), a critical period for their development and maturation.

Alcohol use during this pivotal period can have detrimental effects. It is notably associated with alcohol-related damage to the brain, including a decrease in the volume of grey matter (10) and alterations in white matter integrity (11). Studies in adolescent rodent models also indicate that the functional consequences of adolescent alcohol use include reduced cognitive flexibility, behavioral inefficiency, disinhibition, and increased impulsivity and risk-taking behavior (11). In addition, alcohol use in adolescents is more likely to have mood problems such as depression, anxiety (12, 13), and sleep disturbances (14). Compared to alcohol-naive adolescents, those with a history of alcohol use have an estimated 30-60% increased likelihood of experiencing aggressive behavior syndrome (15). Furthermore, adolescent drinking is also a significant risk factor for alcohol and drug dependence in adulthood (16). Those who initiated drinking before the age of 14 were more likely to develop alcohol dependence within 10 years after their first drinking, compared to those who began drinking at the age of 21 or older (17). Similar research (18) indicates that individuals who experience their first episode of drunkenness before the age of 14 are three times more likely to develop alcohol use disorder (AUD) compared to those who experience it at age 19 or later. AUD is a chronic and relapsing brain disease, characterized primarily by uncontrollable alcohol use despite awareness of its harmful effects. A Chinese study (19) involving 367,120 adult men from 31 provinces found that 10.7% of participants had AUD, which was associated with a 20% increased risk of all-cause death and a 30% increased risk of death from cancer (19). A retrospective study (20) from the US has found that AUD was an independent risk factor associated with traumatic brain injury (TBI) hospitalization and children and adolescents with AUD were found to have a 50% increased risk of TBI hospitalization compared to non-alcohol users. These at-risk groups are also more susceptible to comorbid mood disorders and increased drug use, including stimulants, marijuana, and tobacco. In a 2.5-year longitudinal study (21) from Australia, 18.4% (N=104) of adolescents met the DSM-5 AUD diagnosis during their lifetime, and 16.8% met the ICD-11 diagnosis of alcohol dependence.

Factors related to adolescent alcohol drinking include personal and family factors. For instance, individuals characterized by impulsivity, a propensity for seeking new and exciting

experiences (9) and those grappling with mental health challenges are more inclined to engage in alcohol consumption. Young adults who have experienced serious mental health issues in the past year were found to be four times more likely to engage in alcohol consumption at harmful levels within the previous month (22). A study (23) conducted in the US identified that male gender, along with stronger social motives, impulsiveness, and lower levels of self-efficacy, were associated with high-intensity drinking behaviors. As grade level increases, the prevalence of binge drinking among students also tends to rise. For instance, data indicates that 2.2% of students reported binge drinking in the past 30 days during 8th grade, while this figure increases to 10.3% among students in 10th grade (24). Moreover, the role of parents holds particular significance in shaping the behaviors of their children. Parental alcohol use represents a significant risk factor for adolescent drinking behavior (25, 26), which can indirectly contribute to heavy drinking patterns when they transition into adulthood (27). Paternal drinking tended to have a greater influence on their daughters, whereas there was no gender difference in the effect of maternal drinking (28). Another study (29) has also shown a link between adolescent drinking and paternal drinking. However, finding from Japan suggested that maternal drinking may also elevate the risk of binge drinking among adolescents (30). These discrepancies could be attributed to diverse sample populations and cultural contexts. In addition, parental alcohol supply is associated with higher rates of alcohol consumption among adolescents (31). A longitudinal study (32) conducted in Australia found that a considerable proportion of children reported being given alcohol by their parents, with the prevalence increasing as children age.

While there have been numerous studies investigating the prevalence of alcohol drinking among Chinese adolescents, much of the previous research has focused on eastern or developed regions of China, such as Shanghai and Zhejiang Province. Additionally, the majority of participants in these studies were middle school students. The prevalence of alcohol drinking among adolescents from Southwestern China remains largely unexplored. Considering the negative influence of adolescent drinking on their future, as well as the economic and cultural diversity across different regions in China, our study aimed to address this gap. Specifically,

our study aimed to: 1) investigate the overall prevalence of alcohol drinking among primary and middle school students, 2) examine the association of alcohol drinking with demographic and family factors, and 3) further explore gender differences in the prevalence of alcohol drinking across different schools and grades in Zigong, a city in Southwestern China. By conducting this study, we aim to supplement the existing body of research on alcohol consumption among adolescents, particularly in regions that have been underrepresented in previous studies. This will contribute to a more comprehensive understanding of adolescent alcohol use in China and inform targeted interventions to address this public health concern.

Materials and methods

Procedure and Participants

This cross-sectional survey was conducted between October and December 2020 in Zigong city, located in Sichuan province, China. Zigong city comprises four administrative districts and two county-level cities. Using cluster sampling, we randomly selected two administrative regions and one county-level city to conduct this survey, encompassing all 132 ordinary schools in the selected area. Vocational schools and schools with special populations were excluded from the survey due to their distinct learning and cultural contexts.

Before commencing the survey, professional psychometricians from our team conducted offline training sessions for the investigators. They provided a comprehensive introduction to the research purpose, measurement criteria, and specific questionnaire items to ensure a thorough understanding of the study. Subsequently, investigators visited local schools to introduce the purpose of the study and explain the questionnaire to the participants. Efforts were made to ensure that all participants fully understood the questionnaire and accurately completed it.

Students who were present at school on the day of the survey were invited to participate and completed an electronic survey using computers in their school computer lab. Recognizing that younger students may not have the cognitive ability to fully comprehend the study and questionnaire, and children may enter period of adolescence at 10 years old (33). So,

participants included primary school students (grades 5-6), junior high school students (grades 7-9), and senior high school students (grades 10-12). To facilitate data collection, the Psychological Assessment System, a mobile mental health management platform, was pre-installed on computers. Participants independently completed all questionnaires, and the data were automatically saved within the system. Following completion of the survey, investigators could access the system to export all data for subsequent analysis, including conducting quality control checks on-site. Informed consent was obtained from all participants and their parents prior to their involvement in the survey.

Out of the initial enrollment of 90,039 students, 275 data were eliminated due to incomplete AUDIT-C questionnaires, 27 data were removed for missing parental alcohol consumption information, 281 data were excluded due to abnormal age values, and 96 data were excluded because the age of the participants was less than 10 years old. As a result, data from 89,360 students were included in the subsequent analysis, yielding an overall effective rate of 99.25%.

Patient and public involvement

No patients or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research.

Measurement

Demographic information

A self-made questionnaire was performed to collect demographic information from participants, covering variables such as gender (boy or girl), age, place of residence (urban or rural), whether the participant is a left-behind child (yes or no), whether they belong to a nuclear family (yes or no), and parental drinking habits (yes or no).

Drinking behavior

The Alcohol Use Disorders Identification Test (AUDIT)(34, 35) is usually used to measure risky and harmful drinking behaviors, as well as alcohol use disorder. It consists of 10 items and has demonstrated varying levels of sensitivity and specificity across different standards,

typically ranging from 51% to 97% for sensitivity and 78% to 96% for specificity (36). Three alcohol consumption questions were selected from the AUDIT to create the Alcohol Use Disorders Identification Test Consumption (AUDIT-C)(37, 38), a modified version used to the present study. First, participants indicated whether they were drinkers. If they answered affirmatively, they proceeded to complete the AUDIT-C questionnaire, which included following items: (1) How often did you have a drink in the past year? (scores: never=0, ≤1 time per month=1, 2-4 times per month=2, 2-3 times per week=3, ≥4 times per week=4), (2) How many drinks did you consume on one occasion when you were drinking in the past year? (0.5-1 beer=0, 1.5-2=1, 2.5-3=2, 3.5-4=3, 5 or more=4), (3) How often did you consume about three or more bottles of beer or 100 ml of (Chinese) spirits at a time? (never=0, ≤1 time per month=1, 1 time per month=2, 1 time per week=3, 1 time per day=4). Studies have verified the sensitivity and specificity of the AUDIT-C for populations aged 10 to 18-year, with reported values of 87% and 97%, respectively (39).

Definition

Alcohol drinker

A person was defined as a drinker if they have consumed an amount of alcohol equal to or greater than 30 g alcohol weekly (equal to 900 ml beer or 300 ml wine or 30 ml of (Chinese) spirits) and has been drinking for a period of at least one year.

Hazardous drinker

A total score of AUDIT-C ≥5 for boy and ≥4 for girl was defined as a hazardous drinker.

Statistical Analysis

The statistical package for social science (SPSS), Windows version 25.0, was performed for statistical analysis. Graphical representations of the data were created using GraphPad Prism for Windows (version 8.0.2). A significant level was set for less than 0.05, and two-tailed results were adjusted for multi-comparison. Continuous variables were described using mean and standard deviation (S.D.), while categorical variables were presented as numbers and percentages.

Descriptive Analysis

Demographic information was analyzed and described for the overall participants, as well as for different school levels (primary, junior high, and senior high schools). Regarding drinking behavior, scaled scores were calculated based on responses to the AUDIT-C questionnaire. These scores were then used to determine the degree of drinking for different genders across the overall participants and within different school and grade levels.

The One-way ANOVA was performed to compare the statistical difference in continuous variables, such as age, across different school levels. If the main effect was found to be significant, post hoc tests, such as Bonferroni correction, were conducted to identify specific pairwise differences between the school levels. For categorical variables, such as gender, place of residence, gender differences of prevalence of alcohol drinking, and parental drinking behavior, the Chi-square test was used to explore significant contrasts across different schools and grades. Similarly, if the Chi-square test yielded significant results, post hoc tests with Bonferroni correction were performed to determine specific differences between groups.

Regressive Analysis

Univariate and multivariate logistic regression analysis was used to explore the associated factors of hazardous drinker. The independent variables included age, gender, place of residence, left-behind children, types of family, and parental drinking behavior. The dependent variable was whether a participant as a hazardous drinker or not.

Results

Characteristics information

Table 1 presents demographic characteristics of the 89,360 students included in the study. The age of participants ranged from 10 to 20 years old, with a mean age of 13.4 years (SD=2.1) across all participants. Approximately half of the participants were boys. More students lived in urban areas, more students came from nuclear families, while fewer students were left-behind children. **Table 1** also indicates that a greater number of parents reported drinking, particularly among senior high school students. There was no significant difference observed

in the prevalence of alcohol drinking among students across the three school levels. Additionally, it was noted that more middle school students were classified as hazardous drinkers compared to primary school students.

One-way ANOVA indicated that a statistically significant difference in age across different schools (p<0.001). Chi-square test showed statistically significant differences (p<0.001) in gender, nuclear family, left-behind children, and parental drinking behavior across different schools.

Associated factors of hazardous drinkers

Table 2 provides the results of both crude and adjusted regression analyses examining the association between various factors and hazardous drinkers both crude and adjusted. After adjusting for cofounders, being a hazardous drinker remained significantly associated with age [adjusted odds ratio (AOR): 1.14, 95% confidence interval (CI): 1.12-1.17] (p<0.001), male gender (AOR: 1.38, 95% CI: 1.23-1.52) (p<0.001), belonging to a nuclear family (AOR: 0.61, 95% CI: 0.55-0.67) (p<0.001), father not drinking (AOR: 0.82, 95% CI: 0.73-0.93) (p=0.001), mother not drinking (AOR: 0.51, 95% CI: 0.46-0.56) (p<0.001) and not being left-behind children (AOR: 0.90, 95% CI: 0.82-1.00) (p=0.047). Particularly noteworthy is that being boy was associated with a higher risk of being a hazardous drinker (AOR=1.38) compared to being girl.

Gender differences in drinking behaviors

Table 3 presents the prevalence of alcohol drinking and hazardous drinking behavior among boys and girls in total and across different school levels. Across all schools, a higher proportion of boys were drinkers than girls in total and different three schools (p<0.001). Specifically, the proportion of drinkers among boys was 22.1% in total, 21.6% in primary schools, 22.0% in junior high schools, and 22.9% in senior high schools, while among girls, it was 16.0% in total, 15.9% in primary schools, 16.4% in junior high schools, and 15.4% in senior high schools. **Figure 1** indicates that more drinkers were boys than girls across all grades. Moreover, among senior high school students, there was an increasing trend in the prevalence of alcohol drinkers

with increasing grades. Additionally, **Table 3** demonstrates that more boys than girls may be hazardous drinkers overall, in primary schools, and senior high schools (all $p<0.05$), particularly in senior high school (3.7% for boys vs. 1.6% for girls, $p<0.001$). However, this difference was not observed in junior high schools. **Figure 2** illustrates the prevalence of hazardous drinkers among boys was higher than girls from grades 9-12. While a gender difference in hazardous drinker was observed in grade 9 ($p=0.049$), with boys exhibiting a higher prevalence compared to girls, this difference became more pronounced starting from 10 to 12 ($p<0.001$), with an increasing number of hazardous drinkers among boys and a decreasing trend observed for girls.

Discussion

Our survey investigated the prevalence of alcohol and hazardous drinkers by gender among primary (5-6 grades), all junior high, and senior high school students with a large sample size in Zigong, a city in Southwestern China. The findings indicates that boys more likely to be alcohol drinker and hazardous drinker, as measured by AUDIT-C questionnaire. Notably, significant gender differences were observed across different school levels (primary, junior high, and senior high schools), as well as within specific grades (grades 10-12). Furthermore, the multiple regression analysis revealed associations between hazardous drinker and certain demographic characteristics, including older age, being male, and parental alcohol drinking.

We observed that the majority of alcohol drinkers were junior high school students, whereas senior high school students exhibited the highest prevalence of hazardous drinkers. Additionally, we identified ~1.5 times higher risk for boys compared to girls to be hazardous drinkers. Consequently, we delved deeper into gender differences across three schools, revealing that boys outnumbered girls in alcohol consumption, and they also displayed severer drinking behaviors, except among junior high school students. In grades 9-12, we noted a distinct trend: while hazardous drinker among boys steadily increasing with each higher grade level, it showed a contrasting decrease among girls. Interestingly, the gender difference in hazardous drinker was not particularly significant in grade 9 ($p=0.049$), but became more

pronounced in grades 10 through 12. In China, students undergo a pivotal entrance examination for senior high school at the culmination of their 9th grade. Consequently, while some students progress to senior high school, others may opt for vocational high school or enter the workforce. Notably, senior high school students, particularly boys, tend to be more socially active and mirror adult men in their behavior. This increased social exposure likely provides more opportunities for alcohol consumption, potentially contributing to the observed trends in drinking behavior among adolescents. In our previous study (40) conducted between May and August 2020, we conducted an online survey to explore the drinking behavior of Chinese adults. The findings revealed that high-risk drinking was prevalent, with 36% of the 2,229 surveyed individuals exhibiting such behavior. Among these drinkers, a notable gender disparity was observed, with 43.2% of males and 9.3% of females classified as high-risk drinkers. Furthermore, the study identified that a significant proportion of males (70.2%) and females (46.6%) were categorized as hazardous drinkers.

A previous study (41) conducted in 2016 surveyed 3,291 Japanese high school students, revealing a lower prevalence of current alcohol use compared to our present survey. Specifically, the study found that overall prevalence of alcohol use in the past 30 days was 9.6%, with 10.7% for boys and 8.6% for girls. In a study involving Korean students (42), the prevalence of drinking among grade 12 students was reported to be 25.1% in boys and 18.7% in girls, a trend that closely mirrors the findings of our present survey (25.8% for boys and 17.0% for girls). Similarly, a cross-sectional survey conducted between May and June 2013 in Beijing, Shanghai, and Guangzhou, China's metropolises, surveyed 13,811 middle school students (excluding 9th and 12th graders). The results indicated that a higher percentage of male students (56.3%) compared to female students (48.9%) had consumed alcohol in their lifetime. Furthermore, a greater proportion of male students (43.5% vs. 33.4%) reported being drinkers in the past 12 months, with 6.7% of male students engaging in binge drinking (43). The prevalence of drinkers in the past year reported in that study was higher compared to our present survey, aligning with our finding on gender differences, which indicated a higher proportion of male drinkers. It's worth noting that the surveyed cities in that study are all more developed

than the area in our study. Consequently, students in these cities may have greater access to alcohol and be more vulnerable to drinking. In a school-based survey (44) conducted in Zhejiang province, China, involving 23,543 middle school students, findings revealed that 27.0% of boys and 18.2% for girls reported alcohol use in the past month. Additionally, 11.8% boys and 6.5% girls of reported engaging in binge drinking during the past 30 days. These results are similar to our present survey findings. The prevalence of alcohol use in total reported in the referenced survey is higher compared to our findings (22.8% vs. 19.3%). This difference could potentially be attributed to the inclusion of primary school students in our survey, whereas referenced survey focused on middle school students. Additionally, vocational senior high school students were excluded from our survey, which could also contribute to the variation in prevalence rates. Previous studies (43, 45) have indicated that older age and enrollment in vocational senior high schools are associated with a higher likelihood of alcohol consumption. A study (46) utilizing data from China Health and Retirement Longitudinal Study (CHARLS) revealed that among 19,841 older adults aged 50 years and above, the prevalence of current alcohol consumption was 48.5%, with many of them experiencing chronic diseases or conditions such as liver disease. This prevalence of drinking among adults and older adults surpasses that observed among adolescents, which aligns with common knowledge. However, it's crucial to recognize that many adults initiated drinking during adolescence. Therefore, implementing measures to curb adolescent drinking is paramount, as it may help prevent the development of problematic behavior later in life.

The present study identified older age as one of the risk factors for being hazardous drinkers. Additionally, belonging to a nuclear family (47), not being left-behind children (LBC), and having parents who do not drink were identified as protective factors against hazardous drinkers. Previous researches (25, 30) has also underscored the influence of parental drinking behaviors on their children's drinking habits. Moreover, the study found that paternal non-drinking was more protective than maternal non-drinking, suggesting that fathers' drinking behavior may exert a greater influence on their children compared to mothers', a trend consistent with prior study (29). Given the longstanding patriarchal nature of Chinese society,

children may be more inclined to model their behavior after their fathers.

There are several limitations to consider in this study. Firstly, the data collected in the survey relied on self-reporting, which may introduce minor discrepancies compared to actual alcohol consumption. Secondly, students from vocational and special schools were excluded from the present study due to their different learning and cultural contexts. The previous research indicated that these populations were might more vulnerable to alcohol drinking, future studies should focus on the populations. Lastly, being a cross-sectional survey, it cannot establish causality between associated factors and hazardous drinking behaviors. Future research would benefit from prospective cohort studies to better understand the relationship between these factors and alcohol consumption among primary and middle school students, ultimately aiding in the development of interventions to prevent alcohol misuse among adolescents.

Conclusion

This school-based survey revealed that approximately one-fifth of adolescents in primary and middle schools in Southwestern China were alcohol drinkers. Furthermore, a portion of these adolescents even be hazardous drinkers, particularly among boys in senior high schools. Being hazardous drinkers were found to be more prevalent among older individuals, boys, those from non-nuclear families, left-behind children, and those with parents who consume alcohol. Our findings underscore the imperative for implementing stricter measures aimed at reducing alcohol drinking among this population.

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article and approved the submitted version.

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Competing interests None declared.

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Data availability statement Datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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Table 1 Demographic characteristics of overall and different schools

Variables	Overall (N=89360)	Primary (N=26235, 29.4)	Junior high (N=42683, 47.7)	Senior high (N=20442, 22.9)
Age *	13.4±2.1	11.0±0.74	13.4±0.99	16.2±1.13
Gender				
Boys	44653 (50.0)	13492 (51.4)	21941 (51.4)	9220 (45.1) #
Girls	44707 (50.0)	12743 (48.6)	20742 (48.6)	11222 (54.9)
Residence *				
Urban	53189 (59.5)	15740 (60.0)	24208 (56.7)	13241 (64.8)
Rural	36171 (40.5)	10495 (40.0)	18475 (43.3)	7201 (35.2)
Nuclear family *				
Yes	70278 (78.6)	19907 (75.9)	33467 (78.4)	16904 (82.7)
No	19028 (21.4)	6328 (24.1)	9216 (21.6)	3538 (17.3)
LBC				
Yes	29986 (33.6)	7831 (29.8) #	14981 (35.1)	7174 (35.1)
No	59374 (66.4)	18404 (70.2)	27702 (64.9)	13268 (64.9)
Paternal drinks *				
Yes	66804 (74.8)	18265 (69.6)	32453 (76.0)	16086 (78.7)
No	22556 (25.2)	7970 (30.4)	10230 (24.0)	4356 (21.3)
Maternal drinks *				
Yes	21420 (24.0)	5045 (19.2)	10312 (24.2)	6063 (29.7)
No	67940 (76.0)	21190 (80.8)	32371 (75.8)	14379 (70.3)
Drinker				
Yes	17007 (19.0)	4935 (18.8)	8230 (19.3)	3842 (18.8)
No	72353 (81.0)	21300 (81.2)	34453 (80.7)	16600 (81.2)
Hazardous drinking				
Yes	1848 (2.1)	330 (1.3) #	999 (2.3)	519 (2.5)

Variables	Overall (N=89360)	Primary (N=26235, 29.4)	Junior high (N=42683, 47.7)	Senior high (N=20442, 22.9)
No	87512 (97.9)	25905 (98.7)	41684 (97.7)	19923 (97.5)

Data are number (percentage) or mean ±SD. Nuclear family, which means that students live with their two biological parents. LBC: Left-behind children.

* There are significant differences among the three schools. # The variable of this group is significantly different from the others. (p<0.05).

Table 2 Associated factors of hazardous drinkers among overall participants

Variables	Crude OR (95% CI)	*P value*	Adjusted OR (95% CI)	*P value*
Age (: +1)	1.15 (1.13, 1.18)	<0.001	1.14 (1.12,1.17)	<0.001
Gender				
(Ref. girl)	1.32 (1.20, 1.44)	<0.001	1.38 (1.23, 1.52)	<0.001
Residence				
(Ref. Urban)	1.03 (0.94, 1.13)	0.535	1.04 (0.95, 1.15)	0.407
Nuclear family				
(Ref. No)	0.61 (0.56, 0.68)	<0.001	0.61 (0.55, 0.67)	<0.001
LBC				
(Ref. Yes)	0.85 (0.77, 0.94)	<0.001	0.90 (0.82, 1.00)	0.047
Paternal drinking				
(Ref. Yes)	0.70 (0.62, 0.79)	<0.001	0.82 (0.73, 0.93)	0.001
Maternal drinking				
(Ref. Yes)	0.48 (0.43, 0.52)	<0.001	0.51 (0.46, 0.56)	<0.001

OR: odds ratio. CI: 95% confidence interval. Nuclear family, which means that students live with their two biological parents. LBC: Left-behind children. Ref., reference

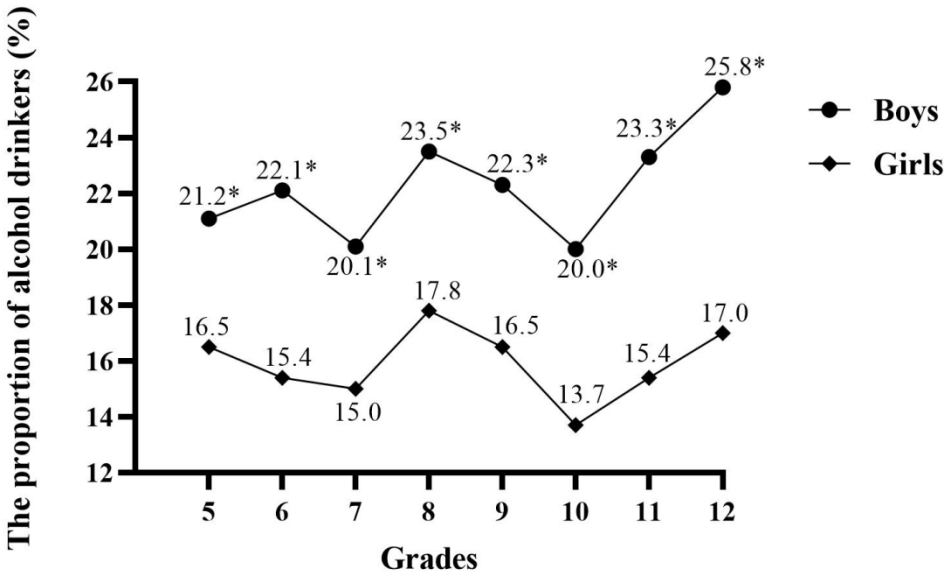
Table 3 Gender differences in the prevalence of drinkers and hazardous drinkers in overall and different schools.

Variables	Overall (N=89360)		Primary (N=26235, 29.4)		Junior high (N=42683, 47.8)		Senior high (N=20442, 22.9)	
	Boys	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**	**Boys**	**Girls**
Drinker	22.1* (9846)	16.0 (7161)	21.6* (2912)	15.9 (2023)	22.0* (4824)	16.4 (3406)	22.9* (2110)	15.4 (1732)
Hazardous drinker	2.3* (1047)	1.8 (801)	1.4* (188)	1.1 (142)	2.4 (520)	2.3 (479)	3.7* (339)	1.6 (180)

Data are percentage (number).
AUDIT-C, Alcohol Use Disorders Identification Test for Consumption.
* There exists significant gender differences in overall and different groups, respectively (p<0.05).

Figure 1 Gender differences in the prevalence of drinkers in different grades.

Figure 2 Gender differences in the prevalence of hazardous drinkers in different grades.



Gender differences in the prevalence of drinkers in different grades.

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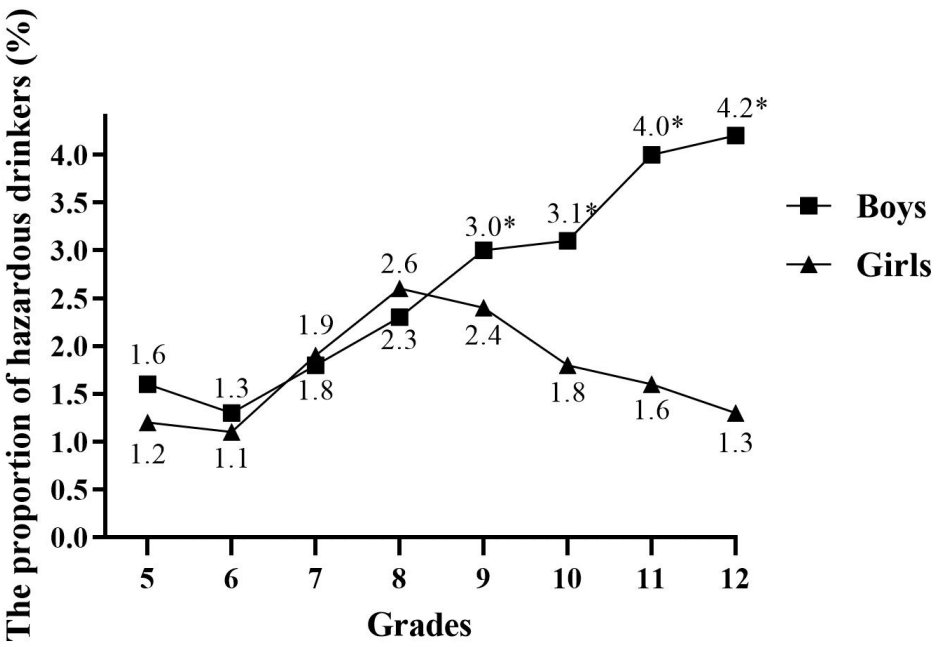

Gender differences in the prevalence of hazardous drinkers in different grades.

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