The Association Between Alcohol Consumption and Dysmenorrhea in University Students in North China

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Research article

Abstract

Background: Dysmenorrhea is a condition frequently affecting menstruating women worldwide. Unfortunately, only a few studies have estimated the relationship between alcohol consumption and dysmenorrhea among women. In particular, there are fewer studies to explore the association between alcohol consumption, dysmenorrhea, and age at menarche.

Objective: This study aimed to evaluate whether and to what extent alcohol consumption is related to dysmenorrhea and age at menarche.

Methods: This was a cross-sectional, observational study conducted among college students. A total of 3,837 participants (age ≥18 years) volunteered to participate in the study and completed the questionnaire. Moreover, 145 were excluded from the study owing to exclusion criteria. We divided female college students into two groups stratified by age at menarche (AAM) 13 years. Logistic regression models were performed to estimate odds ratios (OR) and 95% confidence intervals (CI) for the association of alcohol consumption with dysmenorrhea, adjusting for confounding factors.

Results: A total of 3692 female college students completed the survey, including 409 (11.08%) who reported alcohol use. We found that alcohol consumption was not related to dysmenorrhea. However, stratified by age at menarche, we found that a positive association between alcohol consumption and dysmenorrhea among participants with AAM ≥13 years (OR,1.41; 95% CI, 1.06, 1.88). Compared with participants who reported no alcohol consumption, participants who reported consuming alcohol at least once a month (OR,1.29; 95% CI, 0.94, 1.78) and alcohol consumption at least once a week (OR,1.92; 95% CI, 1.07, 3.45) were more likely to have dysmenorrhea adjusting for other confounding factors.

Conclusion: Our findings showed overall no association of alcohol consumption with dysmenorrhea but a statistically significant positive association for those whose AAM was >13 years.

Introduction

Dysmenorrhea is a condition frequently affecting menstruating women worldwide, which is characterized by cramping pain in the lower abdomen [1]. Over the last few decades, the incidence of dysmenorrhea among women has increased year by year around the world. Also, the prevalence of primary dysmenorrhea was 41.7% among Chinese female university students[2]. Compared with their pain-free follicular peers, women with primary dysmenorrhea have a significantly reduced quality of life, poorer mood, and poorer sleep quality during menstruation[3].The reasons for the increased prevalence of dysmenorrhea in women are not fully understood. Identification of risk factors, particularly those that are modifiable is urgently needed.

Many potential factorsmay be associated with dysmenorrhea, including a family history of dysmenorrhea, body mass index (BMI), annual household income, and environmental tobacco smoke[2, 4]. However, it is necessary to pay more attention to alcohol consumption. A 36% increase in per capita

alcohol consumption in liters of alcohol consumed in China according to the World Health Organization[5, 6]. Some studies found that a positive relationship between dysmenorrhea and drinking consumption.One study found that Dysmenorrhea, heavy menstrual flow, and premenstrual discomfort increased with drinking level and were particularly strongly associated with reported consumption of 6 or more drinks a day at least once a week. [7].Another study has reported that one dose of alcohol affected the serum concentrations of allopregnanolone throughout the menstrual cycle, which might affect the occurrence of severe premenstrual syndrome and dysmenorrhea[8]. However, there is no a significant relationship between alcohol use and dysmenorrhea[9, 10].The association between alcohol and dysmenorrhea remains a controversial issue. Therefore, it is necessary to evaluate whether and to what extent alcohol consumption is related to dysmenorrhea.Moreover, it has been reported that the age of menarche was significantly associated with dysmenorrhea among high-school students in Kuwait[11].Also, age at menarche (AAM) younger than 12 years was associated with risk factors of primary dysmenorrhea[2]. Unfortunately, only a few studies have estimated the relationship between alcohol consumption, dysmenorrhea, and age at menarche.

Thus, the purpose of our research is to investigate the association between alcohol use and dysmenorrhea in female college students. Also, we further evaluated whether and what extent of alcohol assumption related to dysmenorrhea is stratified by AAM.

Methods

Study population

This study was based on a large-scale cross-sectional epidemiological study conducted in North China from May 2016 to Aug 2016. In the study, a total of 3,837 college students(age ≥18 years) volunteered to participate.1444 (37.63%) participants were from Shenyang, 1918 (49.99%) were from Liaocheng and 475 (12.38%) were from Jilin. All of the information was collected by questionnaire.

The inclusion criteria for the study were: (1) full-time female university student, and (2) nulliparous. Exclusion criteria were: (1) diagnosis of gynecological or endocrine disease, (2) current active smokers or active smoker history, because of only 19 (0.50%) smokers in our study (3) oral contraceptive user, (4) participants without complete data, especially incomplete data regarding dysmenorrhea.

A total of 3,837 participants volunteered to participate in the study and completed the questionnaire. Moreover, 145 were excluded from the study owing to exclusion criteria. Finally, a total of 3692 female college students were enrolled in this study using the above criteria.

Ethics approval and consent to participate

The Ethics Committee of China Medical University approved the protocols of this study, and the study procedures were under ethical standards. Written informed consent was obtained from each participant before data collection.

Questionnaire design

Each participant was asked to learn detailed information about the questionnaire before completing it. The information included the objective of the study and instructions on filling out the questionnaire. A standard anonymous questionnaire was used for this study. The questionnaire was designed to obtain information about participant-reported dysmenorrhea, demographic characteristics, and environmental exposures. Inour study, dysmenorrhea is defined as pain or discomfort in the lower abdomen during menstruation. Dysmenorrhea is defined as the occurrence of a lower abdomen pain during menstruation[12]. Passive smoking and alcohol consumption were assessed through self-reporting. Passive smoking was defined as the inhalation of second-hand smoke, which was queried as "Were you exposed to someone smoking indoors in your presence?" Alcohol use was queried as "Did you drink beer, white wine, or red wine?", and was scored as "Yes" or "No". Alcohol consumption was queried on three levels and scored as follows: "No", "At least once a month", or "At least once a week".

Statistical analysis

The distributions of BMI, age, and age at menarche (AAM) were examined using the Kolmogorov-Smirnov test and found to be normally distributed. Continuous variables were assessed using mean ± standard deviation (SD), whereas categorical variables were assessed using percentages. The chi-square test or t-test was used to test for differences between those who reported and those who did not report dysmenorrhea. We divided female college students into two groups stratified by AAM <13 or AAM ≥13 years based on a priori hypotheses[13].The logistic regression modelwas used to estimate odds ratios (ORs) and 95% confidence intervals (CIs) adjusting for confounding factors including age, body mass index, household income, mother's education, mother's history of dysmenorrhea, passive smoking, area of residence, and AAM. We selected these confounders on the basis of their associations with the outcomes of interest or a change in effect estimate of more than 10%.All statistical analyses were performed using Empower (www.empowerstats.com; X&Y Solutions, Inc., Boston, MA) and R (http://www.R-project.org). *P* values less than 0.05 were considered statistically significant.

Results

Data description

A total of 3692 female college students completed the survey. The average age of menarcheal in our study was 13.42 ± 1.30 years. Participants with dysmenorrhea tended to have lower menarche age (Table 1). A total of 409 (11.08%) of participants reported using alcohol and 3283 (88.92%) participants without alcohol assumption. Alcohol use and alcohol consumption were significantly associated with dysmenorrhea in unadjusted analyses (Table 2).

Logistic regression models

In models adjusted for confounding factors, we found that alcohol use and alcohol consumption were not related to dysmenorrhea (Table 3). However, stratified by AAM we found that a positive association between alcohol consumption and dysmenorrhea only among participants with AAM ≥13 years (OR,1.41; 95% CI, 1.06, 1.88). Compared to participants who reported no alcohol use, participants who reported consuming alcohol at least once per month (OR,1.29; 95% CI, 0.94, 1.78) and alcohol use at least once a week (OR,1.92; 95% CI, 1.07, 3.45) were more likely to have dysmenorrhea adjusted for confounding factors. Also, there is an interaction between alcohol use and AAM (Table 4).

Discussion

The results of this study can be divided into two levels. Firstly, without stratification, we founded no association between alcohol consumption and dysmenorrhea among university students in North China. However, our findings showed a positive association between alcohol consumption and dysmenorrhea among those whose AAM was≥13 years.

Few studies explored that explore the relationship between alcohol consumption, dysmenorrhea and AAM.In our study, alcohol consumption was not related to dysmenorrhea without stratification on AAM. Interestingly, we found that there is a significant relationship between alcohol consumption and dysmenorrhea among participants with AAM ≥13 years. It has been reported that alcohol use was not associated with any type of gynecological pain[10], which aligns with our findings.
Another study identified that dysmenorrhea was not significantly associated with consumption of salt, tea, coffee, or alcohol use among 488 health school students[9]. Alcohol consumption did not influence the prevalence of dysmenorrhea[14]. However, the findings of relationship between alcohol consumption and dysmenorrhea among students have been inconsistent. Dysmenorrhea, heavy menstrual flow, and premenstrual discomfort increased with drinking level and were particularly strongly associated with reported consumption of 6 or more drinks a day at least once a week in another study. Also, there was a positive correlation between alcohol consumption dysmenorrhea[7].

We observed that alcohol use was not related to the prevalence of dysmenorrhea among participants with AAM before age 13. Several studies can explain the possible mechanisms responsible for this phenomenon. Among female university students withAAM before age 13, dysmenorrhea may be due to higher levels of estrogen caused by hormone patterns in the early stages of sexual maturity[15]. Furthermore, a longitudinal study reported that women with an earlier age at menarche were more likely to have longer and more painful menses. Also, frequent alcohol consumption increased duration and severity of menstrual pain among women with menstrual pain[16]. Thus, participants with AAM before age 13 might consider reducing alcohol use and alcohol consumption to reduce menstrual pain.

The average age of menarcheis 12.27 years (95% CI, 12.16-12.39) in China[17], and the average age of menarche in this study was 13.42 ±1.30 years, so we divided female college students into two groups stratified by AAM 13 years based on a priori hypotheses[13]. Interestingly, we found a significant relationship between alcohol consumption and dysmenorrhea among participants with AAM ≥13

years. One study has reported that one dose of alcohol affected the serum concentrations of allopregnanolone throughout the menstrual cycle, which might affect the occurrence of severe premenstrual syndrome and dysmenorrhea[8]. Also, for participants older than 13 years of AAM, the function of the adrenal and hypothalamic pituitary-gonadal axis (HPG) may mature later. Alcohol consumption might disrupt the unstable maturation process, which may lead to many of the physical and hormonal changes and even dysmenorrhea.

Our study still had several limitations. The main limitation of our study was its cross-sectional design so that statistical associations can be determined, but no causal inferences can be made. In the future, it is necessary to conduct a longitudinal study. Also, we collected the questionnaire information from a large government-owned and operated public university located in North China. We cannot generalize the results to the all female college students because of the potential for selection bias. Our research only showed that the association between alcohol use and the prevalence of dysmenorrhea was consistently stronger among participants with AAM ≥13 years than among participants with AAM <13 years. However, it does not explain the underlying mechanism. Further research is needed to confirm our findings and clarify the potential specific mechanisms. In our study, alcohol consumption and dysmenorrhea were evaluated through a retrospective questionnaire, which might be subject to recall bias. Accurate responses from the study participants were crucial for the study validity. Several underlying factors that could affect the magnitude of dysmenorrhea were not sufficiently investigated, including age at first alcohol use,diseases which could cause dysmenorrhea, lifestyle, drug abuse, exercise, and genotypic variation which may have resulted in residual confounding. Future studies including these additional factors are needed. One additional limitation should be noted is that non-standard questions were used for assessing passive smoke exposure and alcohol use and consumption, which may make the results not comparable to those of prior studies that have used standardized instruments. Another limitation is that all of the information was collected by questionnaire without standardized instruments. Also, we will use standardized instruments to get the information in future research. Finally, the questionnaire did not query about the occurrence of dysmenorrhea before the start of alcohol use, which may have a confounding effect on the association of alcohol consumption with dysmenorrhea, due to the participants with dysmenorrhea tending to avoid using alcohol or reducing alcohol consumption. It is important to use standard questions and reduce information bias in further research.

Conclusion

Our findings showed a positive association between alcohol consumption and dysmenorrhea stratified by AAM. Future research is needed to confirm our findings and to elucidate the underlying mechanisms.

Declarations

Consent to publish

We have obtained consent to publish from the participant to report individual patient data.

Availability of data and material

Not applicable

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable

Author Contributions:

Conceptualization: YM, ZY

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Formal analysis: YM, ZY

Investigation: YM, ZY

Methodology: YM

Project administration: YM

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All authors read and approved the final manuscript.

Abbreviations

SD: standard deviation

ORs: odds ratios

95%CIs: 95%confidence intervals

AAM: age at menarche

References

1. De Sanctis V, Soliman A, Bernasconi S, Bianchin L, Bona G, Bozzola M, Buzi F, De Sanctis C, Tonini G, Rigon F*et al*:**Primary Dysmenorrhea in Adolescents: Prevalence, Impact and Recent Knowledge**. *Pediatr Endocrinol Rev* 2015, **13**(2):512-520.

2. Hu Z, Tang L, Chen L, Kaminga AC, Xu H:**Prevalence and Risk Factors Associated with Primary Dysmenorrhea among Chinese Female University Students: A Cross-sectional Study**.*J Pediatr Adolesc Gynecol* 2020, **33**(1):15-22.

3. Iacovides S, Avidon I, Baker FC:**What we know about primary dysmenorrhea today: a critical review**.*Hum Reprod Update* 2015, **21**(6):762-778.

4. Chauhan M, Kala J:**Relation between dysmenorrhea and body mass index in adolescents with rural versus urban variation**.*J Obstet Gynaecol India* 2012, **62**(4):442-445.

5. Newman I, Ding L, Feng Y:**Estimate of undergraduate university student alcohol use in China: a systematic review and meta-analysis**.*Arch Public Health* 2017, **75**:52.

6. **World Health Organization. Global Status Report on Alcohol and Health 2014. Geneva: WHO; 2014.** [http://apps.who.int/iris/bitstream/10665/112736/1/9789240692763_eng.pdf.]

7. Wilsnack SC, Klassen AD, Wilsnack RW:**Drinking and reproductive dysfunction among women in a 1981 national survey**.*Alcohol Clin Exp Res* 1984, **8**(5):451-458.

8. Nyberg S, Andersson A, Zingmark E, Wahlstrom G, Backstrom T, Sundstrom-Poromaa I:**The effect of a low dose of alcohol on allopregnanolone serum concentrations across the menstrual cycle in women with severe premenstrual syndrome and controls**.*Psychoneuroendocrinology* 2005, **30**(9):892-901.

9. Midilli TS, Yasar E, Baysal E:**Dysmenorrhea Characteristics of Female Students of Health School and Affecting Factors and Their Knowledge and Use of Complementary and Alternative Medicine Methods**.*Holist Nurs Pract* 2015, **29**(4):194-204.

10. Sznajder KK, Harlow SD, Burgard SA, Wang Y, Han C, Liu J:**Gynecologic pain related to occupational stress among female factory workers in Tianjin, China**.*Int J Occup Environ Health* 2014, **20**(1):33-45.

11. Al-Matouq S, Al-Mutairi H, Al-Mutairi O, Abdulaziz F, Al-Basri D, Al-Enzi M, Al-Taiar A:**Dysmenorrhea among high-school students and its associated factors in Kuwait**.*BMC Pediatr* 2019, **19**(1):80.

12. Chen C, Cho SI, Damokosh AI, Chen D, Li G, Wang X, Xu X:**Prospective study of exposure to environmental tobacco smoke and dysmenorrhea**.*Environ Health Perspect* 2000, **108**(11):1019-1022.

13. Marcellin L, Santulli P, Pinzauti S, Bourdon M, Lamau MC, Borghese B, Petraglia F, Chapron C:**Age at menarche does not correlate with the endometriosis phenotype**.*PLoS One* 2019, **14**(7):e0219497.

14. Potur DC, Bilgin NC, Komurcu N:**Prevalence of dysmenorrhea in university students in Turkey: effect on daily activities and evaluation of different pain management methods.***Pain Manag Nurs* 2014, **15**(4):768-777.

15. Tsang BK, Domingo MT, Spence JE, Garner PR, Dudley DK, Oxorn H:**Endometrial prostaglandins and menorrhagia: influence of a prostaglandin synthetase inhibitor in vivo.***Can J Physiol Pharmacol* 1987, **65**(10):2081-2084.

16. Harlow SD, Park M:**A longitudinal study of risk factors for the occurrence, duration and severity of menstrual cramps in a cohort of college women.***Br J Obstet Gynaecol* 1996, **103**(11):1134-1142.

17. Ma HM, Du ML, Luo XP, Chen SK, Liu L, Chen RM, Zhu C, Xiong F, Li T, Wang W*et al*:**Onset of breast and pubic hair development and menses in urban chinese girls**. *Pediatrics* 2009, **124**(2):e269-277.

Tables

Table 1. Characteristics of study participants with respect to dysmenorrhea.

	Dysmenorrhea status		
	No	Yes	*P* value
N	1425	2267	
BMI (kg/m^2)	20.41 ± 2.72	20.30 ± 2.56	0.244
Age (years)	20.13 ± 1.36	20.14 ± 1.40	0.752
Menarche age (years)	13.53 ± 1.33	13.35 ± 1.27	**<0.001**
Menarche age (years)			**0.003**
<13	262 (21.00%)	537(25.60%)	
≥13	986 (79.00%)	1562(74.40%)	
Current household income (per capita monthly RMB)			0.326
<1,000	390 (27.50%)	620 (27.60%)	
1,000-2,000	600 (42.30%)	903 (40.20%)	
>2,000	427 (30.10%)	725 (32.30%)	
Mother's history of dysmenorrhea			**<0.001**
No	754 (52.90%)	713 (31.50%)	
Yes	193 (13.50%)	717 (31.60%)	
Unknown	478 (33.50%)	837 (36.90%)	
Mother's education			0.115
Primary school or lower	274 (19.30%)	502 (22.20%)	
Middle school	614 (43.20%)	983 (43.50%)	
High school	382 (26.90%)	558 (24.70%)	
College or above	150 (10.60%)	218 (9.60%)	
Passive smoking			**<0.001**
No	972 (68.20%)	1235(54.50%)	
Yes	453 (31.80%)	1032(45.50%)	
Area of residence			0.550
Rural	603 (42.30%)	982 (43.30%)	

			Urban	821 (57.70%)	1284(56.70%)

All values are percent of total subjects; other values are mean ± SD

1$=6.83RMB

Table 2. prevalence of dysmenorrhea with respect to alcohol use and alcohol consumption.

	Dysmenorrhea status		P value[a]
	No	Yes	
Alcohol use			**0.004**
No	1294 (90.80%)	1989 (87.70%)	
Yes	131 (9.20%)	278 (12.30%)	
Alcohol consumption			**0.010**
No	1294 (90.80%)	1989 (87.70%)	
At least once a month	102 (7.20%)	205 (9.00%)	
At least once a week	29 (2.00%)	73 (3.20%)	

[a]P values for physical characteristics were derived from t-test; all others were derived from chi-square test.

Table 3. Crude and adjusted odds ratio (OR) and 95% confidence interval (CI) of dysmenorrhea association with alcohol use and alcohol consumption.

	Unadjusted model	Adjusted model[a]
	OR (95% CI) P value	OR (95% CI) P value
Alcohol use		
No (n=3283)	1.0 (Reference)	1.0 (Reference)
Yes (n=409)	**1.38 (1.11, 1.72) 0.004**	1.24 (0.97, 1.58) 0.083
Alcohol consumption		
No (n=3283)	1.0 (Reference)	1.0 (Reference)
At least once a month (n=307)	**1.31 (1.02, 1.67) 0.034**	1.22 (0.93, 1.61) 0.150
At least once a week (n=102)	**1.64 (1.06, 2.53) 0.027**	1.29 (0.81, 2.07) 0.288

[a]Logistic regression model was adjusted for age, body mass index, household income, mother's education, mother's history of dysmenorrhea, passive smoking, area of residence, and age at menarche.

Table 4. Crude and adjusted odds ratio (OR) and 95% confidence interval (CI) of dysmenorrhea association with alcohol use and alcohol consumption stratified by menarche age

	Menarche age (OR (95% CI) P value)	
	< 13	≥ 13
Unadjusted model		
Alcohol use		
No (n=3283)	1.0 (Reference)	1.0 (Reference)
Yes (n=409)	0.85 (0.56, 1.31) 0.472	**1.48 (1.14, 1.93) 0.004**
Alcohol consumption		
No (n=3283)	1.0 (Reference)	1.0 (Reference)
At least once a month (n=307)	0.94 (0.57, 1.54) 0.798	1.31 (0.97, 1.76) 0.078
At least once a week (n=102)	0.68 (0.32, 1.44) 0.311	**2.26 (1.29, 3.97) 0.005**
Adjusted model[a]		
Alcohol use		
No (n=3283)	1.0 (Reference)	1.0 (Reference)
Yes (409)	0.88 (0.55, 1.42) 0.607	**1.41 (1.06, 1.88) 0.018**
P value for interaction[b]	**0.042**	
Alcohol consumption		
No (n=3283)	1.0 (Reference)	1.0 (Reference)
At least once a month (n=307)	1.06 (0.61, 1.83) 0.836	1.29 (0.94, 1.78) 0.118
At least once a week (n=102)	0.53 (0.23, 1.25) 0.150	**1.92 (1.07, 3.45) 0.029**
P value for interaction[b]	**0.017**	

[a]Logistic regression model was adjusted for age, body mass index, household income, mother's education, mother's history of dysmenorrhea, passive smoking, and area of residence.

[b]Interaction effect analysis was adjusted for age, body mass index, household income, mother's education, mother's history of dysmenorrhea, passive smoking, and area of residence.

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