

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

**Zhuo Yang**

Liaoning Cancer Institute and Hospital

**Jia Guo**

China Medical University

**Ming-li Sun**

China Medical University

**Qin-cheng He**

China Medical University

**Ya-Nan Ma** (✉ [ynma@cmu.edu.cn](mailto:ynma@cmu.edu.cn))

China Medical University <https://orcid.org/0000-0003-0385-8929>

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## Research article

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# Abstract

**Background** Evidence supporting the definitive effect of alcohol consumption on dysmenorrhea has been sparse. The current study was aim to evaluate the relationship between alcohol consumption and dysmenorrhea among age-stratified female college students in northern China.

**Methods** A total of 3692 female college students were included in this cross-sectional study. The logical regression model was performed to evaluate the association between alcohol consumption and primary dysmenorrhea. The model adjusted for confounding factors such as age and body mass index, and estimated the odds ratio (ORs) and 95% confidence interval (CIs).

**Results** Multivariable-adjusted models showed the analysis stratified by age at menarche (AAM) revealed that the prevalence of dysmenorrhea in participants with AAM < 13 years old (67.2%) was significantly higher than that in participants with AAM ≥13 years old (61.3%) ( $P = 0.003$ ). Alcohol consumption showed a dose-response relationship with dysmenorrhea in participants with AAM ≥13 years old.

**Conclusion** Our findings showed AAM modified the association of alcohol consumption with primary dysmenorrhea among female university students in North China.

# Introduction

Dysmenorrhea is a gynecological disorder that affects nearly half of women of reproductive age[1, 2] and is characterized by cramping pain in the lower abdomen that lasts for 1–3 days before or at the onset of menstruation[3]. Dysmenorrhea has important physical, behavioral, psychological and social repercussions, and is often accompanied by fatigue, headache, sweating, dizziness, diarrhea, nausea and vomiting[4]. It is worth noting that dysmenorrhea is a common gynecological disease among female college students. It is reported that the prevalence rate of dysmenorrhea among university students ranges from 46 to 93% in many countries [5–11] and from 44 to 56% in China [12]. This leads to poor performance in activities, and even reduce the quality of life. [13, 14]. Dysmenorrhea is a gynecological disorder that affects 40–70% of women of reproductive age. The prevalence of dysmenorrhea is related to many factors, such as young AAM [11, 15–17], long menstrual cycle and amount of menstrual bleeding[11, 15, 16], active or passive smoking and alcohol use [5, 16], stress [18], family history of dysmenorrhea [5, 16, 19], eating regularity[5, 20], sleep hygiene[10], and body mass index[16].

Current health trends are stressing the importance of appropriate alcohol use among female university students.

To date, no studies have reported a conclusive effect of alcohol use on dysmenorrhea. The aim of the present study was to determine the prevalence of dysmenorrhea in university students, and to evaluate whether alcohol use (scored as “yes” or “no”) and alcohol consumption (scored as “no”, “at least once a month”, or “at least once a week”) was associated with dysmenorrhea in an AAM-stratified population of university students in North China.

# Methods

## Study population

This study was based on a large-scale epidemiological study conducted in North China from May 2016 to Aug 2016. The study evaluated whether alcohol use (scored as “yes” or “no”) and alcohol consumption (scored as “no”, “at least once a month”, or “at least once a week”) were associated with dysmenorrhea in female undergraduate students after AAM-stratified.

A total of 3,837 subjects (age  $\geq 18$ ) volunteered to participate in the study and completed the questionnaire and examination. Subsequently, 20 participants were removed from statistical analysis due to incomplete data, especially incomplete data regarding dysmenorrhea. Moreover, 125 were excluded from the study owing to exclusion criteria. Finally, a total of 3692 female college students were enrolled into this study using the following criteria.

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, and (3) oral contraceptive user.

## 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 outcome for dysmenorrhea, demographic characteristics, and environmental exposures. A brief definition of primary dysmenorrhea was attached to the questionnaire, which was explained as “two or more days of menstrual pain during menstrual bleeding (with respect to the baseline)”. Pain was defined as abdominal or low back pain. A positive dysmenorrheal history was identified as “any menstrual pain during the previous 12 months” [21]. Participants should not have a medical history of other gynecological or endocrine disease, or oral contraceptives within the previous 12 months [22]. 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 characteristics of the study participants with respect to the primary dysmenorrheal status, which is coded as Yes or No, are presented in Table 1. Continuous variables are reported as mean  $\pm$  standard deviation (SD), whereas categorical variables are reported as percentages. The chi-square test or *t*-test was used to test for differences between the two dysmenorrheal groups. Differences in the prevalence of primary dysmenorrhea with respect to alcohol consumption are presented in Table 2. The effects of

alcohol consumption on primary dysmenorrhea are presented in Table 3. The effects of alcohol consumption on primary dysmenorrhea after AAM-stratified are presented in Table 4. We assessed the association of alcohol consumption with primary dysmenorrhea using logistic regression models. The logistic regression model to estimate odds ratios (ORs) and 95% confidence intervals (CIs) was adjusted 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. All statistical analyses were performed using Empower ([www.empowerstats.com](http://www.empowerstats.com); X&Y Solutions, Inc., Boston, MA) and R (<http://www.R-project.org>). *P* values less than 0.05 were considered as statistically significant.

## Results

### Data description

The average age of menarche in our study was  $13.42 \pm 1.30$  years old. Participants with dysmenorrhea tended to have lower menarche age (Table 1). Alcohol use ("Yes" or "No") and alcohol consumption ("No", "At least once a month", or "At least once a week") were significantly associated with dysmenorrhea (Table 2).

### Logistic regression models

However, these differences were not significant after adjusting for confounding variables (Table 3). The association between alcohol use and the prevalence of dysmenorrhea was consistently stronger among participants with AAM  $\geq 13$  years old than among participants with AAM  $< 13$  years old, with point estimates of 1.06-1.88 and 0.55-1.42, respectively. Alcohol consumption had a dose-response relationship with dysmenorrhea. The adjusted ORs for participants with AAM  $\geq 13$  years who consumed alcohol at least once a month and at least once a week were 1.29 (CIs, 0.94-1.78) and 1.92 (CIs, 1.07-3.45), respectively, compared with those who did not consume alcohol. AAM modified the associations of alcohol use and alcohol consumption with primary dysmenorrhea (*P* value for interaction = 0.017) (Table 4).

## Discussion

The results of this study can be divided into two levels. First, without sample stratification, we founded that there was no association between alcohol consumption and dysmenorrhea among university students in North China. However, when the samples are stratified based on the AAM, we founded that participants with AAM  $\geq 13$  years old had higher prevalence of dysmenorrhea, and the prevalence rate of dysmenorrhea showed a dose-response association with alcohol consumption.

Our study is one of the few efforts to investigate the association between alcohol consumption and dysmenorrhea risk among female college students. Dysmenorrhea was reported to be associated with a variety of factors, such as mother's history of passive smoking[5] and dysmenorrhea[19]. Nevertheless, few studies have explored the relationship between alcohol consumption and dysmenorrhea. The results

of the unstratified multivariate analyses we studied were consistent with previous reports by several scholars, Sznajder et al.[12] reported that alcohol use was not associated with any type of gynecological pain, including dysmenorrhea. Potur et al. [23] identified the prevalence and symptoms of dysmenorrhea in Turkish students and reported that alcohol consumption did not influence the prevalence of dysmenorrhea. Midilli et al.[24] assessed the characteristics of menstruation, dysmenorrhea and factors affecting dysmenorrhea among 488 health school students at the Celal Bayar University Manisa Health School in 2014, and reported that there was no significant association between dysmenorrhea and consumption of salt, tea, coffee, or alcohol.

However, studies on the relationship between alcohol and dysmenorrhea have been inconsistent. Some have shown that alcohol consumption increases the incidence and severity of PMS and dysmenorrhea[25–28]. At present, the study of Nybergetal et al.[29] may explain the relationship between the two in terms of hormones, they found that a dose of alcohol affected the serum concentrations of allopregnanolone throughout the menstrual cycle, which might affect the occurrence of severe premenstrual syndrome and dysmenorrhea. Our data provided new evidence in support of the relationship between alcohol consumption and the risk of dysmenorrhea.

Menarche is a milestone event in the growth and development of women and a sign of sexual maturity. Several surveys have found that in recent decades, girls of different races, countries and regions have experienced the phenomenon that the AAM continues to advance[30, 31]. The average age of menarche in China[19] is 12.27 years old (95% CI, 12.16–12.39), and the average age of menarche in this study is  $13.42 \pm 1.30$  years, so we chose AAM 13 to differentiate all students into two groups for further analysis. AAM may be a possible risk factor for obesity[32], breast cancer[33], mental illness[34] and dysmenorrhea[11, 15–17]. Our results showed that the age among participants with dysmenorrhea was significantly younger than that of participants without dysmenorrhea ( $P < 0.001$ ). It is suggested that the younger the AAM, the greater the risk of dysmenorrhea, which is consistent with the results of Harlow et al.[35] Their study found that the earlier the AAM, the higher the incidence, duration and severity of dysmenorrhea. Their study found that the earlier the AAM, the higher the incidence and the longer the duration, and the more severe the pain.

According to studies, the effect of stratification of AAM on the association between alcohol consumption and dysmenorrhea may due to the following reasons. First, the association between younger than 13 years old of AAM and dysmenorrhea may be due to higher levels of estrogen caused by hormone patterns in the early stages of sexual maturity[36]. Second, Participants with AAM < 13 years old might reduce their alcohol use and consumption, or avoid alcohol use, due to their higher frequency of dysmenorrhea. Third, for participants older than 13 years old of AAM, the function of the adrenal and hypothalamic-pituitary-gonadal axis (HPG) may mature later. In this case, alcohol consumption might disrupt the unstable maturation process, which may lead to many of the physical and hormonal changes and even dysmenorrhea.

The study had some limitations. First, the study was based on a cross-sectional sample that lacked a longitudinal trace, which might lead to selection bias. Second, alcohol use, alcohol consumption, and dysmenorrhea were evaluated by means of a retrospective questionnaire, which might be subject to recall bias. Accurate responses from the study participants were crucial for the study validity. Third, we do not have enough samples to examine the effects of alcohol consumption and alcohol consumption on dysmenorrhea in female college students younger than 13 years of age. Fourth, several underlying factors that could affect the magnitude of dysmenorrhea were not sufficiently investigated, including age at first alcohol use, disease which could cause dysmenorrhea, lifestyle, drug abuse, exercise, and genotypic variation. Future studies including these additional factors are needed. Finally, the questionnaire did not query about the occurrence of dysmenorrhea before the start of alcohol use, which may possibly have a confounding effect on the association of alcohol use and alcohol consumption with dysmenorrhea, due to the participants with dysmenorrhea may tend to avoid using alcohol or reduce alcohol consumption.

## Conclusion

In summary, our study revealed that alcohol consumption showed a dose-response relationship with dysmenorrhea in participants with AAM  $\geq 13$  years old. AAM-stratified clearly shows for the first time that there is a significant association between alcohol consumption and dysmenorrhea. Therefore, AAM may be a critical factor for modifying alcohol consumption and dysmenorrhea in university students in North China. Future research is needed to confirm our findings and to elucidate the underlying mechanisms.

## Abbreviations

SD  
standard deviation  
ORs  
odds ratios  
95%CIs  
95%confidence intervals  
AAM  
age at menarche

## Declarations

### Ethics approval and consent to participate

The procedures of this survey were conducted in accordance with the World Medical Association Declaration of Helsinki-Ethical Principles for Medical Research involving Human Subjects. This study was

approved by the Responsible Committee on Human Experimentation of China Medical University. Written informed consent was obtained from each participant before data collection. No children enrolled in this study.

### **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.

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Not applicable

### **Author Contributions:**

Concepualizaton: YM, ZY

Data curation: YM, QH

Formal analysis: YM, ZY

Investigation: YM, ZY

Methodology: YM

Project administration: YM

Resources: YM, ZY, QH

Supervision: YM

Validation: ZY

Writing-original draft: ZY

Writing-review and editing: YM, ZY, JG, MS

All authors read and approved the final manuscript.

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## References

1. Zondervan KT, Yudkin PL, Vessey MP, Jenkinson CP, Dawes MG, Barlow DH, Kennedy SH: **The community prevalence of chronic pelvic pain in women and associated illness behaviour.** *The British journal of general practice : the journal of the Royal College of General Practitioners* 2001, **51**(468):541-547.
2. Westling AM, Tu FF, Griffith JW, Hellman KM: **The association of dysmenorrhea with noncyclic pelvic pain accounting for psychological factors.** *American journal of obstetrics and gynecology* 2013, **209**(5):422.e421-422.e410.
3. Durain D: **Primary dysmenorrhea: assessment and management update.** *Journal of midwifery & women's health* 2004, **49**(6):520-528.
4. Lentz G LR, Gershenson D, et al.: **Comprehensive Gynecology.** Philadelphia: PA: Mosby Elsevier; 2012.
5. Gagua T, Tkeshelashvili B, Gagua D: **Primary dysmenorrhea: prevalence in adolescent population of Tbilisi, Georgia and risk factors.** *J Turk Ger Gynecol Assoc* 2012, **13**(3):162-168.
6. Cheng H-F, Lin Y-H: **Selection and efficacy of self-management strategies for dysmenorrhea in young Taiwanese women.** *J Clin Nurs* 2011, **20**(7-8):1018-1025.
7. Titilayo A, Agunbiade OM, Banjo O, Lawani A: **Menstrual discomfort and its influence on daily academic activities and psychosocial relationship among undergraduate female students in Nigeria.** *Tanzan J Health Res* 2009, **11**(4):181-188.
8. Ortiz MI: **Primary dysmenorrhea among Mexican university students: prevalence, impact and treatment.** *Eur J Obstet Gynecol Reprod Biol* 2010, **152**(1):73-77.
9. Tangchai K, Titapant V, Boriboonhirunsarn D: **Dysmenorrhea in Thai adolescents: prevalence, impact and knowledge of treatment.** *J Med Assoc Thai* 2004, **87** Suppl 3:S69-S73.
10. Chaudhuri A, Singh A, Dhaliwal L: **A randomised controlled trial of exercise and hot water bottle in the management of dysmenorrhoea in school girls of Chandigarh, India.** *Indian J Physiol Pharmacol* 2013, **57**(2):114-122.
11. Bjelland EK, Eberhard-Gran M, Nielsen CS, Eskild A: **Age at menarche and pelvic girdle syndrome in pregnancy: a population study of 74 973 women.** *BJOG* 2011, **118**(13):1646-1652.
12. 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.
13. Geneen LJ, Moore RA, Clarke C, Martin D, Colvin LA, Smith BH: **Physical activity and exercise for chronic pain in adults: an overview of Cochrane Reviews.** *Cochrane Database Syst Rev* 2017,

4(4):CD011279-CD011279.

14. Aykut M, Günay O, Gün I, Tuna R, Balcı E, Özdemir M, Öztürk Y: **The impact of some biological, socio-demographic and nutritional factors on the prevalence of dysmenorrhoea.** *Erciyes Med J* 2007, **29**:393-402.
15. Kannan P, Claydon LS, Miller D, Chapple CM: **Vigorous exercises in the management of primary dysmenorrhea: a feasibility study.** *Disabil Rehabil* 2015, **37**(15):1334-1339.
16. Seven M, Güvenç G, Akyüz A, Eski F: **Evaluating dysmenorrhea in a sample of Turkish nursing students.** *Pain Manag Nurs* 2014, **15**(3):664-671.
17. Eryilmaz G, Ozdemir F: **Evaluation of menstrual pain management approaches by Northeastern Anatolian adolescents.** *Pain Manag Nurs* 2009, **10**(1):40-47.
18. Jun E-M, Chang S, Kang D-H, Kim S: **Effects of acupressure on dysmenorrhea and skin temperature changes in college students: a non-randomized controlled trial.** *Int J Nurs Stud* 2007, **44**(6):973-981.
19. Ju H, Jones M, Mishra G: **The prevalence and risk factors of dysmenorrhea.** *Epidemiol Rev* 2014, **36**:104-113.
20. Oral E, Kirkan T, Yazici E, Cansever MGZ, Aydin N: **Premenstrual symptom severity, dysmenorrhea, and school performance in medical students.** *Journal of Mood disorders* 2012, **2**(4):143.
21. Chen C, Cho SI, Damokosh AI, Chen D, Li G, Wang X, Xu X: **Prospective study of exposure to environmental tobacco smoke and dysmenorrhea.** *Environmental health perspectives* 2000, **108**(11):1019-1022.
22. Li N, Liu H, Chen C, Yang F, Li Z, Fang Z, Wang L, Hu Y, Chen D: **CYP1A1 gene polymorphisms in modifying the association between passive smoking and primary dysmenorrhea.** *Annals of epidemiology* 2007, **17**(11):882-888.
23. 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.
24. 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.
25. Song JE, Chae HJ, Jang WH, Park YH, Lee KE, Lee SH, Jang HA, Jeon JH, Jung MS: **The relationship between life style, menstrual attitude and premenstrual syndrome in nursing students.** *Korean Journal of Women Health Nursing* 2013, **19**(2):119-128.
26. Ju H, Jones M, Mishra GD: **Smoking and trajectories of dysmenorrhoea among young Australian women.** *Tobacco control* 2016, **25**(2):195-202.
27. Iacovides S, Avidon I, Baker FC: **What we know about primary dysmenorrhea today: a critical review.** *Hum Reprod Update* 2015, **21**(6):762-778.
28. Pinar G, Colak M, Oksuz E: **Premenstrual Syndrome in Turkish college students and its effects on life quality.** *Sex Reprod Healthc* 2011, **2**(1):21-27.

29. Nyberg S, Andersson A, Zingmark E, Wahlström G, Bäckström T, Sundström-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.
30. Tomova A, Genov N, Kumanov F, Robeva R: **Menarche in Bulgarian—secular trend in twenty century.** *Akush Ginekol (Sofia)* 2009, **48**(3):10-14.
31. Rubin C, Maisonet M, Kieszak S, Monteilh C, Holmes A, Flanders D, Heron J, Golding J, McGeehin M, Marcus M: **Timing of maturation and predictors of menarche in girls enrolled in a contemporary British cohort.** *Paediatr Perinat Epidemiol* 2009, **23**(5):492-504.
32. Kaplowitz PB, Slora EJ, Wasserman RC, Pedlow SE, Herman-Giddens ME: **Earlier onset of puberty in girls: relation to increased body mass index and race.** *Pediatrics* 2001, **108**(2):347-353.
33. Kotsopoulos J, Lubinski J, Lynch HT, Neuhausen SL, Ghadirian P, Isaacs C, Weber B, Kim-Sing C, Foulkes WD, Gershoni-Baruch R *et al*: **Age at menarche and the risk of breast cancer in BRCA1 and BRCA2 mutation carriers.** *Cancer Causes Control* 2005, **16**(6):667-674.
34. Copeland W, Shanahan L, Miller S, Costello EJ, Angold A, Maughan B: **Outcomes of early pubertal timing in young women: a prospective population-based study.** *Am J Psychiatry* 2010, **167**(10):1218-1225.
35. 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.
36. 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.

## Tables

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

	Dysmenorrhea status		P value
	No	Yes	
<i>N</i>	1425	2267	
BMI (kg/m <sup>2</sup> )	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.

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

	Dysmenorrhea status		P value <sup>a</sup>
	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%)	

<sup>a</sup>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 <sup>a</sup>
Alcohol use	OR (95% CI) <i>P</i> value	
No	1.00	1.00
Yes	1.38 (1.11, 1.72) 0.004	1.24 (0.97, 1.58) 0.083
Alcohol consumption		
No	1.00	1.00
At least once a month	1.31 (1.02, 1.67) 0.034	1.22 (0.93, 1.61) 0.150
At least once a week	1.64 (1.06, 2.53) 0.027	1.29 (0.81, 2.07) 0.288

<sup>a</sup>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) <i>P</i> value)	
	< 13	≥ 13
Unadjusted model		
Alcohol use		
No	1.00	1.00
Yes	0.85 (0.56, 1.31) 0.472	1.48 (1.14, 1.93) 0.004
Alcohol consumption		
No	1.00	1.00
At least once a month	0.94 (0.57, 1.54) 0.798	1.31 (0.97, 1.76) 0.078
At least once a week	0.68 (0.32, 1.44) 0.311	2.26 (1.29, 3.97) 0.005
Adjusted model <sup>a</sup>		
Alcohol use		
No	1.00	1.00
Yes	0.88 (0.55, 1.42) 0.607	1.41 (1.06, 1.88) 0.018
<i>P</i> value for interaction <sup>b</sup>	0.042	
Alcohol consumption		
No	1.00	1.00
At least once a month	1.06 (0.61, 1.83) 0.836	1.29 (0.94, 1.78) 0.118
At least once a week	0.53 (0.23, 1.25) 0.150	1.92 (1.07, 3.45) 0.029
<i>P</i> value for interaction <sup>b</sup>	0.017	

<sup>a</sup>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.

<sup>b</sup>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.

## Supplementary Files

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