

Supplementary file 1

Questionnaire

Dear students,

Hello! This questionnaire aims to understand the health of adolescents. All data will be kept confidential. Your honest answers are significant to our research, and we appreciate your cooperation!

1. Please tell us your age __ years; height __ cm; weight __ Kg;
2. How old were you when you had your first menstrual period?
A ≤ 11 years old B 12-16 years old C > 16 years old
3. How often do you have your menstrual period (i.e., the interval from the start date of this period to the start date of the next period)?
A < 21 days B 21-26 days C 27-35 days D > 35 days
4. How long does your period last each time (i.e., the time from when it starts to when it ends)?
A ≤ 2 days B 3-4 days C 5-8 days D > 8 days
5. How many sanitary pads do you use during your entire menstrual period (assessed by the number of daily use sanitary pads)?
A < 10 pieces B 10-25 pieces C > 25 pieces
6. How frequently do you experience dysmenorrhea?
A Occasionally (< 6 times in 12 periods) B Often (≥ 6 times and < 12 times in 12 periods)
C Always (every period is accompanied by dysmenorrhea)
D Never had dysmenorrhea (please skip to question 14 on the second page)
7. How long does the dysmenorrhea last each menstrual period?
A 1-2 days B 3-5 days C The entire menstrual period
8. When did you first experience dysmenorrhea?
A Within 1 year after your first period B More than 1 year after your first period
9. What level of pain do you think you reach when your dysmenorrhea is at its worst? (0 for no symptoms, 10 for unbearable pain)
☐ None ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10
10. Do you have any of the following symptoms when you have dysmenorrhea? (multiple choices allowed)
A Nausea, vomiting, loss of appetite B Headache C Back pain, leg pain
D Dizziness, weakness, complexion change E Diarrhea F Stomach pain G Insomnia
H Cold hands and feet I Other, please specify: _____ J No accompanying symptoms
11. How do you "deal with" dysmenorrhea? (multiple choices allowed)
A Endure B Warm compresses on the lower abdomen/drink hot water
C Chinese medicine D Painkillers E Hormonal drugs (e.g., birth control pills)

F Other methods, please specify: _____

12. Do you have abdominal pain below the navel when you are not menstruating?

A Occasionally B Often C Never

13. Have you ever communicated or sought guidance and help about dysmenorrhea through the following ways?

A Family B Friends, classmates C Teacher D School doctor E Doctor

F Newspapers, books, online media, etc. G Never communicated or looked up information about dysmenorrhea (For those who jump from question 6)

14. Do you have any of the following emotional changes during your period? (multiple choices allowed)

A Feeling down/depressed B Tense/anxious C Irritable/easily angered

D Dissatisfied with oneself or others around E Thoughts of self-harm

F Other, please specify _____ G No emotional changes

15. Have you ever been diagnosed with a mental illness?

A Yes, please select ①Depression ②Anxiety ③Bipolar disorder

④Other, please specify _____ B No

16. Have you ever hurt yourself on purpose in any way (e.g. by taking an overdose of pills or by cutting yourself)?

A Yes B No

17. In the past year, when you experienced stress, how did you cope? Please rate the difficulty of managing your stress.

A No difficulty B Mild difficulty C Moderate difficulty D Severe difficulty

18. What are your views on dysmenorrhea?

A A normal physiological phenomenon, accept and adapt

B Troublesome and annoying, hope to improve C Don't care much

19. Which of your female relatives have dysmenorrhea? (multiple choices allowed)

A Peers (biological sisters/cousins) B Previous generation (mother, aunts)

C Generational gap (grandmother) D Above relatives don't have dysmenorrhea

E Don't know, not sure

20. What are your needs for current menstrual health management education? (multiple choices allowed)

A Appearance and symptoms of normal and abnormal menstruation

B Methods to alleviate dysmenorrhea C Mental health

D Other, please specify: _____

21. Do you agree with their inclusion in menstrual health management? (multiple choices allowed)

A Family B School C Medical institutions D Unsure

22. What type of menstrual health promotion activities would you like to participate in? (multiple choices allowed)

A School health education class B Online learning C Providing one-on-one consultation services D Menstrual-themed popular science activities

E Other, please specify: _____

23. Do you eat cold food during your period?

A Often B Occasionally C Never D Avoid during period but occasionally eat

E Avoid during period but often eat

24. What is the main structure of your diet?

A Mainly red meat (pork, beef, lamb, etc.)

B Mainly white meat (chicken, duck, fish, etc.) C Mainly vegetarian

25. How many servings of dairy products do you consume daily (including milk, yogurt, ice cream, cheese, milkshake, butter, etc.)?

A ≤ 1 serving B 2-4 servings C > 4 servings

26. How many hours do you sleep each night?

A < 4 hours B 5 hours C 6 hours D 7 hours E 8 hours F 9 hours G > 10 hours

Thank you for participating in the questionnaire!

Table Supplementary 1 Correlation Analysis between the PSS Questionnaire and the Single-Item Measure

	single-item measure	PSS-1	PSS-2	PSS-3	PSS-4
single-item measure	1				
PSS-1	0.762***	1			
PSS-2	0.777***	0.776 ***	1		
PSS-3	0.728***	0.728 ***	0.777 ***	1	
PSS-4	0.822***	0.677***	0.678***	0.731**	1

Table Supplementary 2 Reliability Analysis of the PSS-4 Questionnaire

Measurement Item	CITC Value	Cronbach's α if Item Deleted	Cronbach's α
PSS-1	0.806	0.905	0.923
PSS-2	0.783	0.913	
PSS-3	0.883	0.878	
PSS-4	0.815	0.902	

Table Supplementary 3 Validity Analysis of the PSS-4 Questionnaire

Measurement Item	Factor loading	KMO
PSS-1	0.892	0.829
PSS-2	0.877	
PSS-3	0.938	
PSS-4	0.897	

Table Supplementary 4. Univariate regression analysis.

Variables	OR (95CI)	P-value
Age(years)	1.33 (1.23~1.44)	<0.001
BMI(kg/m ²)	1 (0.96~1.04)	0.914
Age of menarche: ref. = ≤ 11 or > 16		
12 - 16	0.77 (0.6~1)	0.047
Menstrual cycle(days): ref. = < 21		
21 - 26	0.59 (0.37~0.94)	0.025
27 - 35	0.58 (0.36~0.92)	0.021
> 35	0.32 (0.18~0.58)	<0.001
Duration of menstruation(days): ref. = < 5		
5 - 8	1.26 (0.97~1.64)	0.078
> 8	1.1 (0.49~2.47)	0.826
Sanitary napkin usage during menstruation: ref. = < 10		
10 - 25	0.91 (0.68~1.22)	0.529
> 25	1.34 (0.82~2.19)	0.243
Family history of dysmenorrhea: ref. = No or don't know		
yes	2.03 (1.6~2.59)	<0.001
Mental disease self-report: ref. = No		
Yes	1.49 (1~2.22)	0.049
Self-harm: ref. = No		
Yes	1.2 (0.91~1.57)	0.194
Stress: ref. = No difficulty		
Mild difficulty	1.24 (0.87~1.77)	0.234
Moderate difficulty	1.8 (1.25~2.6)	0.002
Severe difficulty	1.84 (1.1~3.07)	0.02
Diet structure: ref. = Vegetarian diet		
Red meat diet	0.62 (0.44~0.87)	0.006
White meat diet	0.62 (0.43~0.89)	0.01
Daily milk intake per day: ref. = ≤ 1		
> 1	0.7 (0.55~0.88)	0.002
Sleep duration: ref. = < 8		
≥ 8	0.72 (0.54~0.94)	0.018

Table Supplementary 5. Characteristics of Chinese adolescents surveyed about dysmenorrhea(n =1383).

Variable	Overall, N = 1,383	Dysmenorrhoea		<i>p</i> -value
		no N = 411 (29.72%)	yes N = 972 (70.28%)	
Age(years), Mean $\pm$ SD	14.8 $\pm$ 1.5	14. 3 $\pm$ 1. 4	14. 9 $\pm$ 1. 6	<0. 001
BMI(kg/m ²), Mean $\pm$ SD	19.6 $\pm$ 2.9	19. 6 $\pm$ 3. 1	19. 6 $\pm$ 2. 9	0.904
Diet structure, n (%)				0.014
Vegetarian diet	238 (17.2)	52 (12. 7)	186 (19.1)	
Red diet	666 (48.2)	210 (51. 1)	456 (46.9)	
White diet	479 (34.6)	149 (36. 3)	330 (34)	
Daily milk intake per day, n (%)				0. 001
$\leq$ 1	653 (47.2)	167 (40. 6)	486 (50)	
$>$ 1	730 (52.8)	244 (59. 4)	486 (50)	
Sleep duration, n (%)				0. 024
$<$ 8	1105 (79.9)	313 (76. 2)	792 (81.5)	
$\geq$ 8	278 (20.1)	98 (23. 8)	180 (18.5)	
Mental disease self-report, n (%)				0.124
No	1242 (89.8)	377 (91.7)	865 (89)	
Yes	141 (10.2)	34 (8.3)	107 (11)	
Self-harm, n (%)				0. 32
No	1056 (76.4)	321 (78. 1)	735 (75.6)	
Yes	327 (23.6)	90 (21. 9)	237 (24.4)	
Stress, n (%)				0. 009
No difficulty	170 (12.3)	63 (15. 3)	107 (11)	
Mild difficulty	564 (40.8)	182 (44. 3)	382 (39.3)	
Moderate difficulty	536 (38.8)	136 (33. 1)	400 (41.2)	
Severe difficulty	113 (8.2)	30 (7. 3)	83 (8.5)	
Age of menarche(years)				0. 069
$\leq$ 11 or $>$ 16	411 (29.7)	108 (26.3)	303 (31.2)	
12-16	972 (70.3)	303 (73.7)	669 (68.8)	
Menstrual cycle (days)				0. 002
$<$ 21	126 (9.1)	26 (6.3)	100 (10.3)	
21-26	634 (45.8)	185 (45)	449 (46.2)	
27-35	536 (38.8)	161 (39.2)	375 (38.6)	
$>$ 35	87 (6.3)	39 (9.5)	48 (4.9)	
Duration of menstruation(days)				0. 187
$<$ 5	343 (24.8)	115 (28)	228 (23.5)	
5-8	1012 (73.2)	287 (69.8)	725 (74.6)	
$>$ 8	28 (2.0)	9 (2.2)	19 (2)	

Sanitary napkin usage during menstruation				0.186
< 10	274 (19.8)	80 (19.5)	194 (20)	
10-25	986 (71.3)	303 (73.7)	683 (70.3)	
> 25	123 (8.9)	28 (6.8)	95 (9.8)	
Family history of dysmenorrhea, n (%)				< 0. 001
No or don' t know	778 (56.3)	279 (67.9)	499 (51.3)	
Yes	605 (43.7)	132 (32.1)	473 (48.7)	

Sixty-six participants who had abdominal pain even during the non-menstrual period were excluded. BMI: body mass index, p values were calculated by comparing characteristics between two groups.

Table Supplementary 6. Univariate regression analysis(n =1383).

Variables	OR (95CI)	P-value
Age(years)	1.32 (1.22~1.44)	<0.001
BMI(kg/m ²)	1 (0.96~1.04)	0.904
Family history of dysmenorrhea: ref. = No or don' t know		
yes	2 (1.57~2.55)	<0.001
Age of menarche: ref. = ≤ 11 or > 16		
12 - 16	0.79 (0.61~1.02)	0.069
Menstrual cycle(days): ref. = < 21		
21 - 26	0.63 (0.4~1)	0.052
27 - 35	0.61 (0.38~0.97)	0.036
> 35	0.32 (0.17~0.59)	<0.001
Duration of menstruation(days): ref. = < 5		
5 - 8	1.27 (0.98~1.66)	0.071
>8	1.06 (0.47~2.43)	0.881
Sanitary napkin usage during menstruation: ref. = < 10		
10 - 25	0.93 (0.69~1.25)	0.626
> 25	1.4 (0.85~2.3)	0.184
Mental disease self-report: ref. = No		
Yes	1.37 (0.92~2.06)	0.126
Self-harm: ref. = No		
Yes	1.15 (0.87~1.52)	0.32
Stress: ref. = No difficulty		
Mild difficulty	1.24 (0.86~1.77)	0.246
Moderate difficulty	1.73 (1.2~2.5)	0.003
Severe difficulty	1.63 (0.97~2.74)	0.066
Diet structure: ref. = Vegetarian diet		
Red meat diet	0.61 (0.43~0.86)	0.005
White meat diet	0.62 (0.43~0.89)	0.01
Daily milk intake per day: ref. = ≤ 1		
> 1	0.68 (0.54~0.86)	0.001
Sleep duration: ref. = < 8		
≥ 8	0.73 (0.55~0.96)	0.024

Table Supplementary 7. Association between stress and dysmenorrhea in the database.

Stress	n. total	n. event %	Crude crude. OR 95CI	P-value	Model 1 adj. OR 95CI	P-value	Model 2 adj. OR 95CI	P-value	Model 3 adj. OR 95CI	P-value
No difficulty	170	107 (62.9)	1(Ref)		1(Ref)		1(Ref)		1(Ref)	
Mild difficulty	564	382 (67.7)	1.24 (0.86~1.77)	0.246	1.29 (0.89~1.86)	0.172	1.29 (0.89~1.87)	0.175	1.24 (0.84~1.81)	0.275
Moderate difficulty	536	400 (74.6)	1.73 (1.2~2.5)	0.003	1.78 (1.23~2.6)	0.002	1.74 (1.18~2.56)	0.005	1.61 (1.08~2.39)	0.02
Severe difficulty	113	83 (73.5)	1.63 (0.97~2.74)	0.066	1.77 (1.04~3.01)	0.035	1.65 (0.93~2.9)	0.085	1.66 (0.93~2.97)	0.087
P for trend	1383	972 (70.3)		0.002		0.001		0.005		0.012

OR, odds ratio.CI, confidence interval.Ref: reference.

Model 1 was adjusted for age, and BMI.

Model 2 was adjusted for Model1, diet structure, daily milk intake, and sleep time, mental disease, and self-harm.

Model 3 was adjusted for Model1, Model2, age of menarche, menstrual cycle, duration of menstruation, sanitary napkin usage during menstruation, and family history.

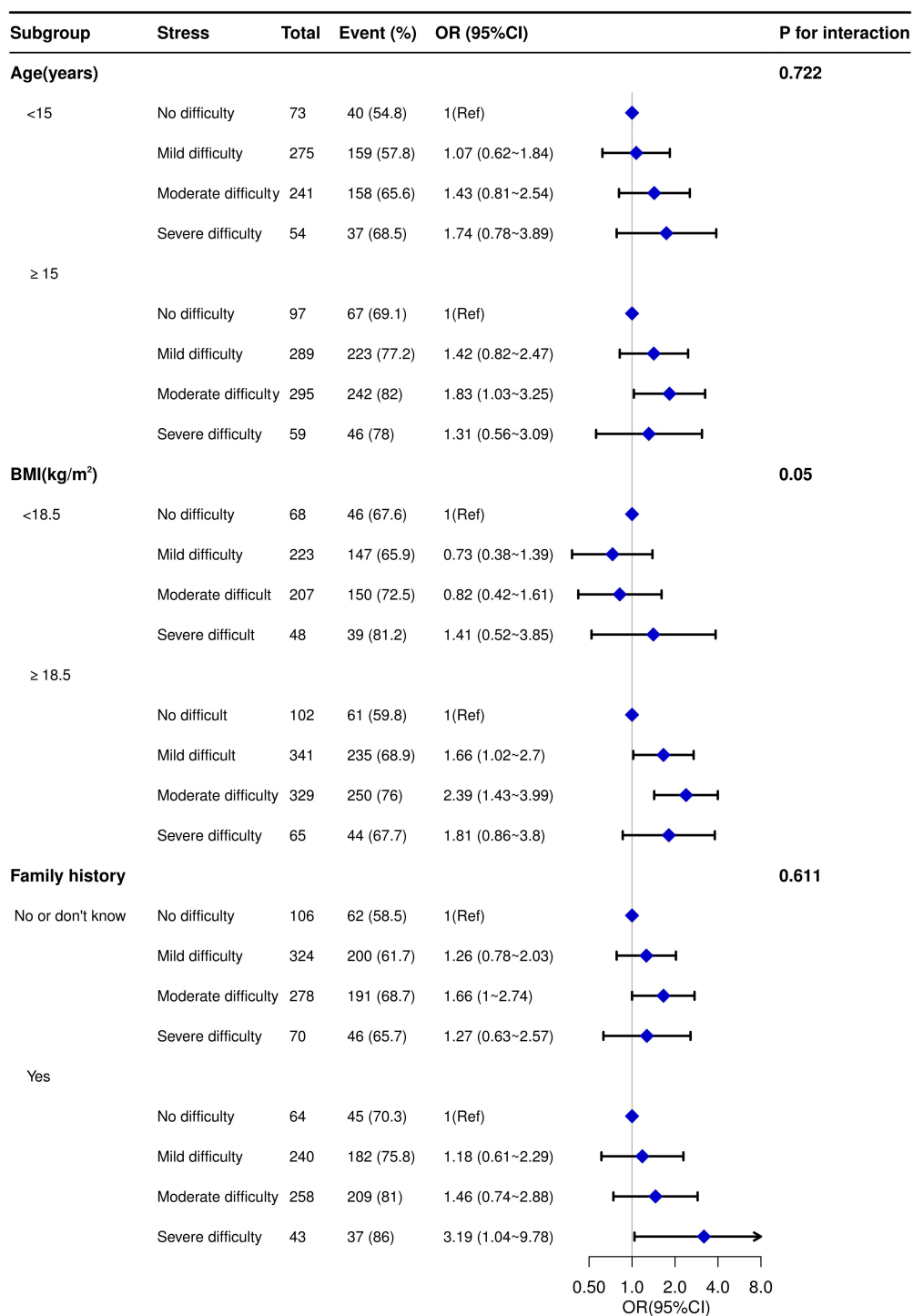


Figure Supplementary 1. Association between stress and dysmenorrhea.

Notes: Adjusted for age, BMI, family history.

OR, Odds Ratio. CI, Confidence Interval. BMI, body mass index.