



# Psychometric Testing of the Premenstrual Symptoms Questionnaire and the Association Between Perceived Injustice and Premenstrual Symptoms: A Cross-Sectional Study Among Japanese High School Students

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**Purpose:** Premenstrual symptoms comprise a wide range of mood, behavioral, and physical symptoms occurring during the luteal phase. Perceived injustice is a belief linked to unfairness (ie, unnecessary suffering caused by illness). This study aimed to assess the validity and reliability of the Premenstrual Symptoms Questionnaire (PSQ), a patient-reported outcome measurement tool, and to examine the association between perceived injustice/perception of menstruation and premenstrual symptoms, as measured by the PSQ.

**Materials and Methods:** Of 1388 female students, we analyzed 879 students with regular menstrual cycles who completed the PSQ, the premenstrual dysphoric disorder (PMDD) scale, the Somatic Symptom Scale-8 (SSS-8), and the Injustice Experience Questionnaire-chronic (IEQ-chr). First, the PSQ was examined for evidence of reliability and validity. Next, we used multiple regression and multivariate logistic regression to investigate the association between perceived injustice and premenstrual symptoms, using PSQ score as both a continuous variable and a dichotomous variable (premenstrual disorders or not). Moreover, the association between PSQ score and perceived menstruation was tested using student's *t*-test and analysis of variance.

**Results:** In terms of reliability, Cronbach's  $\alpha$  for PSQ score was 0.93. To assess structural validity, we used confirmatory factor analysis, which showed that the one-factor model and the two-factor model were a good fit. The PSQ showed good agreement with the PMDD scale. In terms of concurrent validity, PSQ total score correlated strongly with PMDD scale score, SSS-8 score, and IEQ-chr score ( $r = 0.88, 0.69, 0.57$ , respectively). IEQ-chr score predicted PSQ score (standardized regression coefficient = 0.53;  $P < 0.0001$ ) and higher prevalence of premenstrual disorders (odds ratio: 1.15; 95% confidence interval: 1.12–1.19). Negative perception of menstruation was associated with premenstrual symptoms.

**Conclusion:** The PSQ showed sound psychometric properties among the adolescents in our sample. Perceived injustice and negative perception of menstruation were associated with premenstrual symptoms.

**Keywords:** premenstrual syndrome, premenstrual disorders, injustice experience questionnaire-chronic, psychometric testing, validity

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## Introduction

Premenstrual symptoms comprise of a wide range of mood, behavioral, and physical symptoms that are limited to the luteal phase.<sup>1</sup> Premenstrual disorders (PMDs) include premenstrual syndrome (PMS) and premenstrual dysphoric disorder (PMDD).<sup>2</sup> Epidemiologic surveys have shown that the prevalence of premenstrual symptoms is high (8090%).<sup>3</sup> PMDD is a severe form of PMS defined mainly by its psychiatric symptoms, according to the Diagnostic and Statistical Manual of Mental Disorders (DSM).<sup>4</sup> The burden of PMDs is high among women between menarche and menopause. We have previously reported that PMDs are common menstrual problems among adolescents and that one in nine Japanese female high school students had absences from school because of PMD symptoms.<sup>5</sup>

Although the precise pathophysiology of PMDs remains unknown, various causes have been suggested, including hormonal changes, serotonergic dysfunction, stress, and poor lifestyle habits.<sup>6</sup> Previous studies have examined the relationships between PMDs and psychological factors.<sup>7–9</sup> Perceived stress, neuroticism, and coping strategies have been reported to be strongly related to PMDs.<sup>10</sup>

Perceived injustice is a belief linked to unfair treatment and unnecessary suffering caused by illness.<sup>11</sup> Perceived injustice has been extensively analyzed among people with chronic pain, including those with whiplash, fibromyalgia, and osteoarthritis.<sup>12</sup> In a recent study, we explored the association between perceived injustice and severity of menstrual pain.<sup>13</sup> Many women with premenstrual symptoms also suffer from related pain symptoms such as breast tenderness and abdominal pain.<sup>14</sup> However, an association between perceived injustice and premenstrual symptoms has not yet been reported. A previous study on chronic pain treatment showed that cognitive behavioral therapy could be used to target perceived injustice.<sup>15</sup> Cognitive behavioral therapy might be recommended as non-pharmacological medical approach to treat premenstrual symptoms without serious adverse effects.<sup>16</sup> Accordingly, it may be fruitful to view perceived injustice as a new therapeutic target in the treatment of premenstrual symptoms.

The aims of this study were to assess the validity and reliability of a patient-reported outcome measurement (PROM) tool for premenstrual symptoms, the Premenstrual Symptoms Questionnaire (PSQ),<sup>17</sup> and

to examine the association between perceived injustice/perception of menstruation and premenstrual symptoms.

## Materials and Methods

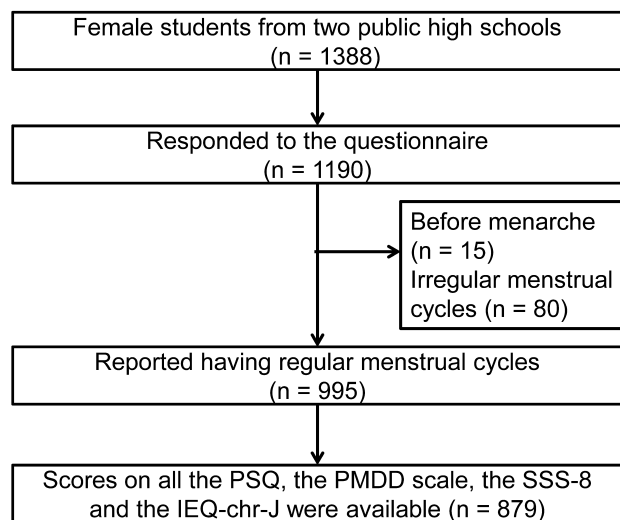
### Settings and Participants

A school-based survey was conducted in December 2019 with a sample of 1388 Japanese female students from two public high schools in Sendai, the largest city in north-eastern Japan. The study questionnaire was distributed to all female students at each school by their homeroom teachers. The questionnaires were completed, sealed in envelopes, and collected in the class. In total, 1190 students responded the questionnaire, including 995 who had regular menstrual cycles (25–38 days) (Figure 1). For this study, we selected the 879 students who completed all items on the PSQ, the PMDD scale, the Somatic Symptom Scale-8 (SSS-8), and the Japanese version of the Injustice Experience Questionnaire-chronic (IEQ-chr-J).

### Questionnaire

#### The Premenstrual Symptoms Questionnaire and the Premenstrual Dysphoric Disorder Scale

In this study, we used the PSQ, which was developed in our previous study,<sup>17</sup> and the PMDD scale, which was developed by Miyaoka et al to screen for premenstrual symptoms.<sup>18,19</sup> In both PROM tools, the PMDD criteria



**Figure 1** Flow chart of the study.

**Abbreviations:** PSQ, Premenstrual Symptoms Questionnaire; PMDD, premenstrual dysphoric disorder; SSS-8, Somatic Symptom Scale-8; IEQ-chr-J, Japanese version of the Injustice Experience Questionnaire-chronic.

from the DSM are translated into a rating scale with degrees of severity described in Japanese. The PSQ and the PMDD scale are therefore essentially identical to the Premenstrual Symptoms Screening Tool (PSST).<sup>20</sup> The PSQ has been found to be useful in our previous studies,<sup>5,17</sup> but its reliability and validity have not been systematically evaluated. The PMDD scale, in contrast, has been found to have high reliability and validity. Therefore, we selected the PMDD scale to study the concurrent validity of the PSQ.

The PSQ asks, Within the last 3 months, have you experienced the following premenstrual symptoms starting during the week before menses and stopping a few days after the onset of menses?

The premenstrual symptoms listed are (i) depressed mood, (ii) anxiety or tension, (iii) tearfulness, (iv) anger or irritability, (v) decreased interest in work, home, or social activities, (vi) difficulty concentrating, (vii) fatigue or lack of energy, (viii) overeating or food cravings, (ix) insomnia or hypersomnia, (x) feeling overwhelmed, and (xi) physical symptoms such as tender breasts, feeling of bloating, headache, joint or muscle pain, or weight gain.

These 11 symptoms are listed in the DSM criteria for PMDD. The PMDD scale consists of 12 symptoms, with “Insomnia or hypersomnia” divided into “Insomnia” and “Hypersomnia” as separate symptoms.

The PSQ also asks whether the premenstrual symptoms experienced interfere with (a) work efficiency or productivity, or home responsibilities; (b) social activities; or (c) relationships with coworkers or family. These three items measuring functional impairment of social and life activities were same as items in the Daily Record of Severity of Problems,<sup>21,22</sup> the diary chart for PMDs with the strongest evidence of validity and reliability.<sup>23</sup> The PMDD scale also included five items on functional impairment that were same as items in the PSST. In the present study, in both the PSQ and the PMDD scale, students were asked to rate the severity of premenstrual symptoms and these symptoms’ interference with activities as 1 – Not at all, 2 – Mild, 3 – Moderate, or 4 – Severe. The total scores on the PSQ and the PMDD scale were calculated as the sum of 14 items and 17 items, respectively. PSQ total score ranges from 14 to 56, and PMDD scale total score ranges from 17 to 68.

We divided the students into three groups on the basis of their premenstrual symptoms: PMDD, moderate-to-severe PMS, and no/mild PMS, according to the criteria reported by Steiner et al in 2003.<sup>20</sup> We further divided the

students into two groups: the PMDs group, who had moderate-to-severe PMS or PMDD, and the no PMDs group, who had no PMS or mild PMS, according to the PSQ criteria.

### Menstrual Pain Intensity

Menstrual pain intensity was evaluated using a numerical rating scale. On numerical rating scales, respondents rate their severity of menstrual pain from 0 (no pain) to 10 (the worst pain imaginable).

### Injustice Experience Questionnaire-Chronic

To study perceived injustice, we used the IEQ-chr-J.<sup>13</sup> The original version of the Injustice Experience Questionnaire was developed to assess perceived injustice among injured persons.<sup>11,24</sup> This questionnaire was modified to measure chronic symptoms in the IEQ-chr.<sup>25</sup> The IEQ-chr-J has been found to have high reliability and validity. The IEQ-chr-J comprises 12 items, with a five-point response format (0–4) for each item. Therefore, IEQ-chr-J score can range from 0 to 48.

### Somatic Symptom Scale-8

We used the SSS-8 to further assess the concurrent validity of the PSQ.<sup>26</sup> Somatic symptoms are common to many diseases and are present in psychiatric conditions such as depressive disorders and anxiety disorders.<sup>27,28</sup> The Japanese version of the SSS-8 has been found to have high reliability and validity.<sup>29</sup> The SSS-8 consists of eight items, each with a five-point response format (0–4). Therefore, SSS-8 score can range from 0 to 32.

### Perception of Menstruation

We used two original questions to assess participants’ perceptions of menstruation. The first of these questions was “Do you agree with the statement that it is unjust that only women menstruate?” and the second question was “Do your male friends or family members feel empathy regarding the difficulty you experience related to menstruation?” The response options for the first question were “Yes” or “No,” and the response options for the second question were “Yes,” “No,” or “Other.” For each participant, we also collected information about age, school grade level, body weight, height, age at menarche, sleep latency time, and sleep duration. Body mass index ( $\text{kg}/\text{m}^2$ ) was calculated by dividing weight by height squared. We defined participants with sleep-onset insomnia as those who needed more than 15 minutes to fall

asleep, in line with the criteria listed in the Japanese version of the Pittsburgh Sleep Quality Index.<sup>30</sup>

## Statistical Analysis

Means and standard deviations were calculated for continuous variables, and proportions were calculated for categorical variables. To confirm the factorial validity, we performed a confirmatory factor analysis (CFA) with a one-factor structure and a two-factor structure. The second model was based on the PMDD criteria from the DSM, which consisted of premenstrual symptoms and impairment. In the CFA, model fit was evaluated using fit indices: the chi-square ( $\chi^2$ ) statistic, the goodness-of-fit index (GFI), the adjusted GFI (AGFI), the Tucker–Lewis Index (TLI), the comparative fit index (CFI), the root mean square residual error of approximation (RMSEA), and the standardized root mean square residual (SRMR). GFI and AGFI values >0.90 indicate a good fit.<sup>31</sup> TLI and CFI values close to 0.95 indicate a relatively good fit.<sup>32</sup> RMSEA values <0.08 and SRMR values <0.09 suggest a good fit.<sup>31</sup>

Correlations were analyzed using Spearman's rank correlation coefficient. The agreement between the PSQ and the PMDD scale was evaluated by the weighted kappa. Kappa values of 0.81–1.00 suggest almost perfect agreement, and kappa values of 0.61–0.80 suggest substantial agreement.<sup>33</sup>

Multiple regression analysis was used to explore the association between IEQ-chr-J total score and PSQ total score. The included covariates were school grade level, body mass index, age at menarche, menstrual pain intensity, and sleep-onset insomnia.

We examined the association between perceived injustice and PMDs. Odds ratios (ORs) of the prevalence of PMDs and covariates were calculated using multivariate logistic regression analysis. Here, the included covariates were school grade level, body mass index, age at menarche, menstrual pain, and sleep-onset insomnia.

Differences in PSQ total score were assessed using Student's *t*-test or one-way analysis of variance followed by Dunnett's test, as appropriate.

Statistical analyses except for the CFA and weighted kappa were performed using JMP Pro 15.1.0 (SAS, Cary, NC, USA). The CFA was performed using IBM SPSS Amos 26 (IBM Corp., New York, USA). Weighted kappa was calculated using the Excel add-in software BellCurve for Excel 3.2.0 (Social Survey Research Information Co.,

Ltd., Tokyo, Japan). Statistical significance was set at  $P < 0.05$  (two-tailed tests).

## Results

The characteristics of the study population are presented in Table 1. Cronbach's  $\alpha$  coefficient was calculated to assess reliability. The Cronbach's  $\alpha$  for PSQ was 0.93, indicating very good internal consistency.

To analyze the factorial validity of the PSQ, first, we performed a CFA with a one-factor structure including the six error covariance terms (Supplemental Material 1). Second, we performed a CFA with a two-factor structure including the five error covariance terms (Supplemental Material 2). These two models of the PSQ showed similarly good fit (Table 2).

Next, we analyzed the consistency of the evaluation of premenstrual symptoms between the PSQ and the PMDD scale. PSQ total score was found to be very highly correlated with PMDD scale total score (Spearman's  $r = 0.88$ ,  $P < 0.0001$ ). Severity of PMDs as evaluated by the PSQ and the PMDD scale is shown in Table 3. In terms of the measure of agreement between the two scales, weighted kappa was 0.65 (95% confidence interval: 0.58–0.72). This means that the strength of agreement between the PSQ and the PMDD scale was substantial. We further analyzed the correlation coefficients and the agreement for individual premenstrual symptoms (Table 4). The strongest correlation was for "anger or irritability" and "overeating or food cravings" ( $r = 0.80$ ), and the weakest correlation was for "Insomnia" ( $r = 0.44$ ). In terms of agreement, the highest value was for "overeating or food cravings" (kappa = 0.81), and the lowest value was for "Insomnia" (kappa = 0.36).

**Table 1** Characteristics of the Study Participants (n = 879)

Characteristic	
Age (years), mean (SD)	16.7 (0.9)
School year, number (%)	
First year	290 (33.0)
Second year	283 (32.2)
Third year	303 (34.5)
Missing	3 (0.3)
Age at menarche (years), mean (SD)	12.0 (1.4)
BMI (kg/m <sup>2</sup> ), mean (SD)	19.6 (5.0)
Menstrual pain intensity, mean (SD)	4.6 (2.7)
Sleep-onset insomnia, n (%)	291 (33.1)
Total sleep duration (minutes), mean (SD)	368.7 (56.1)

**Abbreviations:** BMI, body mass index; SD, standard deviation.

**Table 2** Goodness-of-Fit Summary of the PSQ (One-Factor Model and Two-Factor Model)

Model	$\chi^2$ (df)	GFI	AGFI	TLI	CFI	RMSEA (90% CI)	SRMR
One-factor (14 items + six error covariance)	425.1 (71)	0.93	0.90	0.94	0.95	0.08 (0.07–0.08)	0.04
Two-factor (11 items + 3 items + five error covariance)	403.7 (71)	0.94	0.91	0.94	0.96	0.07 (0.07–0.08)	0.04

**Abbreviations:** PSQ, Premenstrual Symptoms Questionnaire;  $\chi^2$ , chi-square; df, degrees of freedom; GFI, goodness-of-fit index; AGFI, adjusted GFI; TLI, Tucker–Lewis Index; CFI, comparative fit index; RMSEA, root mean square residual error of approximation; CI, confidence interval; SRMR, standardized root mean square residual.

**Table 3** Cross-Tabulation of Severity of Premenstrual Disorders Assessed by the PSQ and the PMDD Scale (n = 879 Students)

		PMDD Scale			
		No/Mild PMS	Moderate to Severe PMS	PMDD	Total
PSQ	No/mild PMS	694	64	5	763
	Moderate-to-severe PMS	19	58	8	85
	PMDD	3	13	15	31
	Total	716	135	28	879

**Note:** The relevant number of students in each table cell are presented here.

Weighted kappa (95% confidence interval): 0.65 (0.58–0.72),  $P < 0.001$

**Abbreviations:** PSQ, Premenstrual Symptoms Questionnaire; PMDD, premenstrual dysphoric disorder; PMS, premenstrual syndrome.

Table 5 shows the correlation coefficients for the PSQ, the SSS-8, and the IEQ-chr-J. PSQ total score was correlated with SSS-8 total score ( $r = 0.69$ ) and with IEQ-chr-J score ( $r = 0.57$ ). Severity of PMDs evaluated by the PSQ was modestly correlated with SSS-8 total score ( $r = 0.46$ ) and with IEQ-chr-J score ( $r = 0.46$ ). In terms of the individual items in the PSQ, the correlation coefficients ranged from 0.38 to 0.60 for SSS-8 total score and from 0.28 to 0.54 for the IEQ-chr-J score.

To analyze the association between premenstrual symptom severity and perceived injustice in more detail, multiple regression analysis was performed (Table 6). Menstrual pain and IEQ-chr-J score were associated with PSQ total score. The results of the variance inflation factor showed that there was no multicollinearity problem in this analysis (1.01 to 1.13). The multivariate logistic analysis revealed that the risk factors for PMDs were menstrual pain (OR = 1.16; 95% confidence interval [CI]: 1.06–1.27) and IEQ-chr-J score (OR = 1.15; 95% CI: 1.12–1.19) (Table 7). Late age at menarche was associated with lower risk of PMDs (OR = 0.81; 95% CI: 0.69–0.94).

We then analyzed how many students felt a sense of injustice regarding their menstruation (Table 8). A total of 40.4% students answered “Yes” to the question of whether it is unjust that only women menstruate. PSQ total score was significantly higher among students who perceived injustice than among those who did not. When asked

whether they felt that their male friends or family members felt empathy regarding the difficulty they experienced related to menstruation, 17.7% of the students responded “No” (Table 8). PSQ total score was significantly higher among the students who did not think that their male friends or family members felt empathy about this than among those who felt that their male friends or family did feel this kind of empathy.

## Discussion

The present study evaluated the PSQ, a PROM tool for premenstrual symptoms. We found strong evidence of validity and reliability for the questionnaire. Additionally, our findings show a correlation between premenstrual symptoms and perceived injustice.

CFA demonstrated that the PSQ fit a one-factor model and two-factor model well. The PMDD scale has been reported to fit a three-factor model identified by CFA.<sup>18</sup> One previous report on the results of a CFA of another PMDD questionnaire based on the DSM showed that both a one-factor model and a two-factor model produced a good fit to the data for several indicators.<sup>34</sup> This discrepancy with our findings may be because of differences in the questionnaires used to record premenstrual symptoms and in the studies’ recruitment methods.

The Cronbach’s  $\alpha$  for PSQ (0.93) showed a high degree of internal consistency. This value was as high as that reported previously for the PMDD scale (0.91).<sup>18</sup>

**Table 4** Correlation Coefficients and Agreement Between the PSQ and the PMDD Scale

	Depressed Mood	Anxiety or Tension	Tearful	Anger or Irritability	Decreased Interest	Difficulty Concentrating	Fatigue or Lack of Energy	Overeating or Food Cravings	Insomnia or Hypersomnia (PSQ)		Feeling Overwhelmed	Physical Symptoms
									Hypersomnia (PMDD scale)	Insomnia (PMDD scale)		
Spearman's <i>r</i>	0.72*	0.63*	0.77*	0.80*	0.71*	0.70*	0.71*	0.80*	0.53*	0.44*	0.67*	0.70*
Weighted kappa	0.72*	0.57*	0.80*	0.79*	0.70*	0.70*	0.71*	0.81*	0.51*	0.36*	0.72*	0.68*

Note: \*P < 0.0001

Abbreviations: PSQ, Premenstrual Symptoms Questionnaire; PMDD, premenstrual dysphoric disorder.

**Table 5** Correlation Coefficients for the PSQ, the SSS-8, and the IEQ-Chr-J

	SSS-8 Spearman's <i>r</i>	IEQ-chr-J Spearman's <i>r</i>
Total score	0.69*	0.57*
Severity of PMDs	0.46*	0.46*
Depressed mood	0.52*	0.54*
Anxiety or tension	0.57*	0.49*
Tearful	0.52*	0.46*
Anger or irritability	0.50*	0.43*
Decreased interest	0.45*	0.46*
Difficulty concentrating	0.56*	0.43*
Fatigue or lack of energy	0.60*	0.47*
Overeating or food cravings	0.40*	0.28*
Insomnia or hypersomnia	0.48*	0.34*
Feeling overwhelmed	0.47*	0.49*
Physical symptoms	0.52*	0.31*
Work efficiency or productivity	0.55*	0.47*
Social activities	0.43*	0.37*
Relationships with coworkers or family	0.38*	0.40*

Note: \*P < 0.0001

Abbreviations: PSQ, Premenstrual Symptoms Questionnaire; SSS-8, Somatic Symptom Scale-8; IEQ-chr-J, Japanese version of the Injustice Experience Questionnaire-chronic; PMDs, premenstrual disorders.

The PMDD scale and the PSST have the same structure, with 12 items on premenstrual symptoms and five items on functional impairment. The PSQ, which comprises 11 items on premenstrual symptoms and three items on functional impairment, could be considered the short forms of the other two scales. Although the PMDD scale has already been used as a PROM tool for premenstrual symptoms in Japan with strong evidence of reliability and validity, the PSQ would be more convenient because of its brevity.

We also showed the association of premenstrual symptoms and somatic symptoms for the first time. As mentioned above, somatic symptoms are present in psychiatric conditions such as depressive disorders and anxiety disorders<sup>27,28</sup> and are considered to be manifestations of underlying psychiatric disorders.<sup>35</sup> Because depressive mood and anxiety are also premenstrual symptoms, this association is reasonable.

Our data showed that both the severity of premenstrual symptoms as assessed by the PSQ total score and the risk of PMDs were positively associated with perceived injustice. A previous study in a chronic pain treatment setting found that cognitive behavioral therapy could be used to target perceived injustice.<sup>15</sup> Accordingly, perceived injustice may also be a therapeutic target among individuals experiencing premenstrual symptoms.

**Table 6** Multiple Regression Analysis Calculating the Associations Between Sample Characteristics and Severity of Premenstrual Symptoms

	$\beta$	95% CI	p	Standardized $\beta$	VIF
School grade level	1.10	-0.14 to 2.34	0.08	0.05	1.01
BMI (kg/m <sup>2</sup> )	0.03	-0.17 to 0.24	0.74	0.01	1.03
Age at menarche	-0.71	-1.45 to 0.03	0.06	-0.05	1.05
Menstrual pain	1.71	1.32 to 2.10	< 0.0001	0.24	1.13
Sleep-onset insomnia	0.90	-0.21 to 2.01	0.11	0.04	1.07
IEQ-chr-J	1.29	1.15 to 1.42	< 0.0001	0.53	1.12

**Abbreviations:**  $\beta$ , regression coefficient; CI, confidence interval; VIF, variance inflation factor; BMI, body mass index; IEQ-chr-J, Japanese version of the Injustice Experience Questionnaire-chronic.

**Table 7** Multivariate Analyses of Risk Factors for Premenstrual Disorders

	Multivariate		
	OR	95% CI	P
School grade level	1.16	0.89–1.51	0.274
BMI (kg/m <sup>2</sup> )	1.00	0.96–1.04	0.834
Age at menarche	0.81	0.69–0.94	0.008
Menstrual pain	1.16	1.06–1.27	0.001
Sleep-onset insomnia	1.10	0.70–1.72	0.677
IEQ-chr-J	1.15	1.12–1.19	< 0.0001

**Abbreviations:** OR, odds ratio; CI, confidence interval; BMI, body mass index; IEQ-chr-J, Japanese version of the Injustice Experience Questionnaire-chronic.

Women's perceptions regarding menstruation have been shown to vary by age, with younger adolescents tending to show more negative attitudes.<sup>36,37</sup> Adolescence is a unique time in human development, both psychologically and physiologically. It is a vulnerable period between childhood and adulthood. Adolescents tend to have more negative attitudes toward menstruation. A previous study reported that more than

half of female adolescents had a negative attitude toward menstruation.<sup>36</sup> Our data showed that approximately 40% of the students perceived injustice regarding their menstruation and that about 18% felt that their male friends or family members lacked understanding of their menstruation difficulties. Those who had such opinions also had a higher severity of premenstrual symptoms. These students might feel injustice that only women menstruate and, consequently, have more premenstrual symptoms. However, the questions used to measure perception of menstruation in this study were potentially leading. Among adolescent girls, having a strongly negative perception of menstruation is generally associated with having insufficient information.<sup>38</sup> Health education programs for adolescent girls including psychological stress management during menstruation might be helpful to alleviate premenstrual symptoms in this population.

Our study had several limitations. The main limitation was that the study was cross-sectional in design. It was therefore impossible to determine causality between premenstrual

**Table 8** PSQ Total Score by Perception of Menstruation

	Mean PSQ Total Score (95% CI)	P
"Do you agree with the statement that it is unjust that only women menstruate?"		(Student's t-test)
Yes (n = 355, 40.4%)	39.7 (37.6–41.7)	0.030
No (n = 498, 56.7%)	36.7 (35.0–38.4)	
Missing (n = 26, 2.9%)		
"Do your male friends or family members feel empathy regarding the difficulty you experience related to menstruation?"		(one-way ANOVA followed by Dunnett's test)
Yes (n = 538, 61.2%)	35.8 (34.2–37.5)	I < 0.0001 0.802
No (n = 156, 17.7%)	45.6 (42.5–48.5)	
Other (n = 157, 17.9%)	36.8 (33.8–39.9)	
Missing (n = 28, 3.2%)		

**Abbreviations:** PSQ, Premenstrual Symptoms Questionnaire; CI, confidence interval; ANOVA, analysis of variance.

symptoms and perceived injustice. Second, we screened for PMDs by retrospective self-report, making the study susceptible to recall bias. The diagnosis of PMDs requires the prospective daily charting over a period of two consecutive symptomatic cycles.<sup>23</sup> However, prospective daily charting is difficult in large samples. Third, the study was conducted only in Sendai, the largest city in northeastern Japan, which might limit the generalization of the findings to the total population of adolescent girls in Japan. A related limitation was that the study participants were all high school students. Our results can thus be generalized only to adolescent girls with PMDs. Further research is necessary to determine whether similar results would be found among adult women.

## Conclusions

The present study presented evidence of the validity and acceptability of the PSQ as a measure of premenstrual symptoms in our study sample. We further found that premenstrual symptoms are associated with perceived injustice.

## Ethics Approval and Informed Consent

The study was carried out in accordance with the principles outlined in the Declaration of Helsinki. The trial protocol was approved by the Ethics Committee of Kindai University (approval number: 31-149). Participating students provided informed consent before completing the survey. The ethics committee approved a waiver of parental informed consent because the students' intention to participate could be confirmed, and the data were anonymized and contained no identifiable personal information about the respondents. The decision not to obtain parental informed consent was in accordance with the Ethical Guidelines for Medical and Health Research Involving Human Subjects enforced by Japan's Ministry of Education, Culture, Sports, Science and Technology and Japan's Ministry of Health, Labour and Welfare.

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## Author Contributions

All authors made substantial contributions to the conception and design, acquisition of data, or analysis and interpretation of the data; took part in drafting the article or revising it critically for important intellectual content;

agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors have no conflicts of interest to declare.

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