Research Article

Factors Associated with Premenstrual Syndrome among Nursing Students Based on the Theory of Unpleasant Symptoms

Hyun Yi Kook*

College of Nursing, Chonnam National University, Gwangju, Republic of Korea.

*Corresponding author: Hyun Yi Kook, College of Nursing, Chonnam National University, Gwangju, Republic of Korea.

Abstract

Background: This study aimed to explain premenstrual syndrome (PMS) in nursing students based on the Theory of Unpleasant Symptoms (TOUS). PMS includes physiological factors (pain intensity during clinical practice, sleep quality), psychological factors (neuroticism, stress), situational factors (attitudes toward menstruation, sex role stereotypes) that influence symptoms. Therefore, thoroughly investigating the correlates of PMS among nursing students is necessary.

Method: Data were collected from March 2022 to May 2022 through a cross-sectional study of female students using a self-reported questionnaire. A total of 330 female students (in the fourth grade) enrolled in the nursing department of a college in G city were recruited via convenience sampling. Independent t-test and one-way ANOVA were used to explore differences in PMS, with Scheffe's test performed post hoc. We analyzed correlations using Pearson's correlation and performed multiple regression analyses to investigate the factors influencing PMS.

Results: PMS was positively significantly correlated with menstrual pain intensity during clinical practice (r = 0.51, $p < 0.01$), attitudes toward menstruation (r = 0.15, $p < 0.01$), neuroticism (r = 0.37, $p < 0.01$) and stress (r = 0.39, $p < 0.01$), but negatively correlated with sleep quality (r = −0.38, $p < 0.01$). The results of multiple regression analysis showed that menstrual pain intensity during clinical practice ($\beta = 0.42$), sleep quality ($\beta = -0.23$), neuroticism ($\beta = 0.17$) and stress ($\beta = 0.21$) affected PMS. The regression model was significant (F = 44.64, $p < 0.001$) and explanatory power was 44%.

Conclusion: The findings of this study identified physiological and psychological factors influencing PMS. Developing an appropriate understanding of these influencing factors and customized interventions may be associated with the improvement of PMS in female college students enrolled in the Department of Nursing

Introduction

Many women experience menstruation, which is a reproductive function, a symbol of sexual identity, and an important indicator of a woman's health [1]. However, various symptoms that occur before and during menstruation periodically cause discomfort in women's daily activities, with some individuals experiencing serious physical and psychological symptoms [2,3]. Because of this, many women have a negative perception of menstruation. Premenstrual syndrome (PMS) is a mixed set of symptoms that may occur between 2 and 14 days before the onset of menstruation and usually ends shortly after menstruation begins [4]. PMS includes physical, behavioral, and emotional clinical symptoms that vary in severity and timing between individuals. Symptoms can include breast tenderness, abdominal bloating, back pain, irritability, anxiety, tension, depression, difficulty controlling emotions, sleep disturbance, poor concentration, and social withdrawal [1,5,6].

Epidemiological studies indicate that there are between 12% and 81.3% cases of PMS worldwide [6-9]. In Korea, the prevalence of PMS is 36.1% and 38.1% in adolescents and women of childbearing age, respectively, and among them, 12.3% and 8.8% of women report experiencing severe symptoms [10]. Other studies found that 100% of nursing students and 98.1% of general female college students reported experiencing premenstrual syndrome, with various prevalence rates depending on the diagnostic method or population [11,12]

Female college students, who have a relatively high prevalence compared to other age groups, have reported that PMS is associated with poor academic accomplishment, low quality of life, difficulty in maintaining social activities, a higher level of daily stress, and even criminal behavior and suicidality [13-17]. Previous research suggests that 11.8% of female students and 1.7% of those with moderate PMS showed symptoms of significant depression, respectively [18]. Also, university students are often in early adulthood and may need to adjust to university life, with its attendant autonomy and independent lifestyle are preferred; this may not have been experienced previously in the controlled, passive form of education in Korea [19]. As a consequence, university students may disrupt previously healthy lifestyles with irregular sleeping pattern and poor strategies for coping with stress, making them vulnerable to health conditions and negative health behaviors [20, 21]. A high proportion of nursing students are women of reproductive age who are then subjected to various stressors, such as intensive learning, clinical practice and the national nursing examination [20, 22].

Although the etiology of PMS has not yet been fully identified, it seems that physiological, psychological and situational factors are interrelated, and that changes in neurotransmitters [23, 24], psychological factors [25], stress, and hormones [26, 27] are probably the primary contributors to the symptoms [28, 29]. Nevertheless, few studies have been conducted to comprehensively explain PMS in nursing students based on a theoretical model. Independent and partially investigated studies have been able to explain isolated relationships between factors, but it has been difficult to determine the total influence of physiological, psychological, and situational factors that are specific to nursing students and are often interrelated.

Considering the multidimensional aspect of PMS, applying an integrated evaluation to investigations on the syndrome is necessary. The Theory of Unpleasant Symptoms (TOUS) [30] suggests that, in many conditions related to illness or stress, an individual's physiological, psychological, and situational factors may affect symptoms simultaneously and in complex ways. The physiological factors include body systems that normally regulate an individual's energy level; psychological factors include an individual's state of mental or mood and their emotional responses to an illness; and situational factors include how an individual's social and physical experiences may affect their symptoms [30]. This theory was initially developed to explain the symptoms of dyspnea and fatigue, but it has progressed to provide a conceptual framework for understanding symptoms in a variety of contexts and to help manage, improve, and prevent unpleasant symptoms [31]. Previous studies have used the TOUS to examine experiences of symptoms have focused on patients with serious illnesses, such as breast cancer and colorectal cancer with non-recurrent, non-periodic symptoms [32-34], but few research has used the TOUS framework to explain PMS in nursing students, who repeatedly and regularly experience unpleasant symptoms that can affect their daily lives and lead to declines in their health-related quality of life [35,36].

Even with the high prevalence and negative impacts of PMS, these symptoms have been inadequately treated in female university students [37,38]. The primary barriers to effective administration may be associated with a lack of accurate understanding about the factors related to PMS. Consequently, recognizing and understanding factors associated with PMS are critical to establishing a customized management strategy that can alleviate its symptoms. This study was therefore designed to explain PMS in nursing students based on TOUS theory [30,39], which attributes symptom experience to various factors that influence symptoms, and to provide a comprehensive understanding of how physiological factors (i.e., menstrual pain intensity during clinical practice [28,40,41] and sleep quality [36,42]), psychological factors (i.e., neuroticism [43] and stress [44-46]), and situational factors (i.e., attitudes towards menstruation [47–49] and sex role stereotypes [50,51]) influence PMS in female college nursing students.

Therefore, in this study, we constructed a theoretical model with preliminary hypotheses based on TOUS (Figure 1) and examined the correlates of PMS among female college students in the Nursing Department at X University using the physiologic, psychological and situational factors. Specifically, we aimed to examine the effects of these factors on PMS, help design a foundation for developing nursing intervention programs that can create health coping strategies for women in this population who are experiencing PMS.
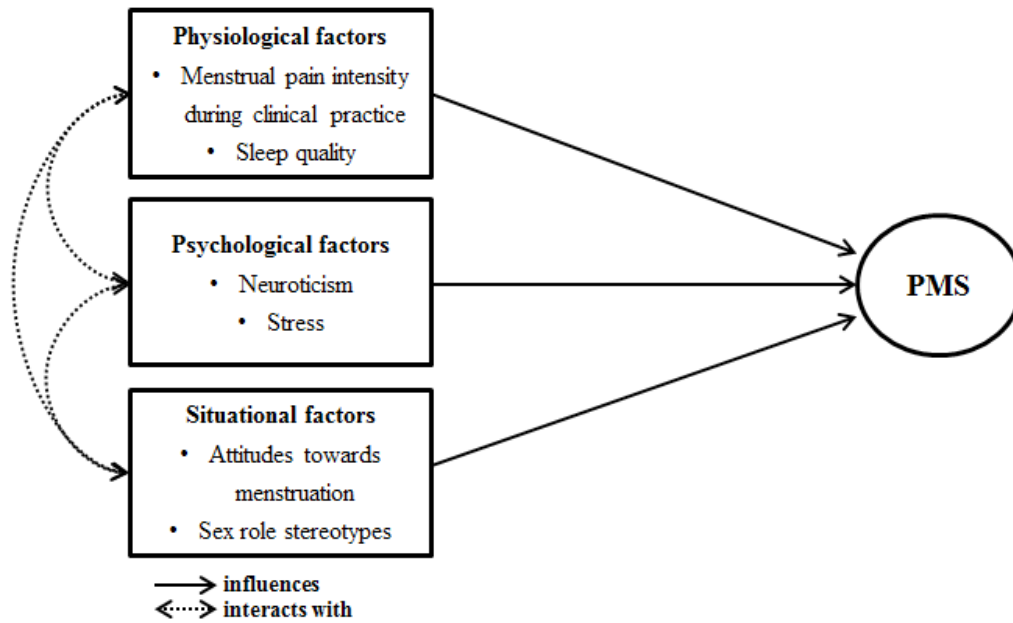
Figure 1: The hypothesized model on influencing factors of PMS in female nursing students.

Methods

Ethical Approval

Ethical approval was granted by the Ethics Committee at the author's university [blinded for review]. All participants were provided with relevant information, including study design, objectives, and the data collection process prior to data collection. In addition, we assured participants that their responses were confidential, that no private identifying information would be exposed, that the data would be used for the state research purpose only, and that participants could withdraw their consent to be involved in the study from any time.

Study Design

A cross-sectional study using a self-reported questionnaire was used to collect the data among female students between Mar 2022 and May 2022.

Participants

We recruited a convenience sample of 4th grade students in the nursing department at X university in G city, Republic of Korea. The inclusion criteria were having experienced menstruation regularly for at least the previous six consecutive months, not having any medical disease, including pelvic disorders, understanding the purpose of this study, and voluntarily agreeing to participate. Those who had a history of childbirth or miscarriage were excluded. The required sample size for this study, estimated using the G*Power 3.1 program, was 328 participants (power .80, effect size .15 and significance level .05). Accounting for the dropout rate, 340 questionnaires were distributed, of which 337 were returned. However, seven questionnaires included invalid responses. Therefore, 330 questionnaires were ultimately used for analysis.

Data Collection

Data were collected from March 2022 to May 2022. A total of 330 female students (grade 4th) enrolled in the nursing departments of the four nursing colleges in G city were recruited via convenience sampling. The investigator described the objectives of the study and requested the students' cooperation. Questionnaires were provided only to those who voluntarily agreed in writing to be involved in the study. The self-reported questionnaire was completed in about 20 minutes, and was returned from participants in packs shortly after completion.

Research Instruments

1. PMS

PMS was measured using the Korean Menstrual Symptom Scale (KMSS) for university developed by Lee et al. [52]. In the 37 items scale, items were measured using a 5-point Likert scale (1 = not at all, 5= very severe), whrere a higher score indicates more severe PMS symptoms. It includes 8-items on negative emotions, 7 items on changes in activity levels, 9 items on physical symptoms, 4 items on mood changes, 4 items on changes in concentration, and 5 items on water retention. We assessed the reliability using Cronbach's α, which was .96 when the instrument was developed and .97 in this study

2. Physiological Factors

2.1. Menstrual pain intensity during clinical practice

Menstrual pain intensity was measured using a 10 point Numeric Rating Scale (NRS), with 0 being no menstrual pain and 10 being the most severe.

2.2. Sleep Quality

Sleep quality was measured using the Korean Sleep Scale A by Oh et al. [53]. This scale consist of 15 items in total, including 8 items on sleep pattern, 4 items on sleep assessment, 1-item on sleep outcome, 2 items on sleep disruptors. Each item is rated on a 4 point Likert scale (1 = always true, 4= not at all). A higher total score indicates a higher sleep quality. We assessed the reliability using Cronbach's α, which was .75 when the instrument was developed and .88 in this study.

3. Psychological Factors

3.1. Neuroticism

Neuroticism was measured using the International Personality Item Pool (IPIP) developed by Goldberg [54], translated by Yu and Lee [55]. Among the five personality traits, only the 10 items for neuroticism scale was adopted in this study. Each item is rated on 5 point Likert scale (1 = not at all, 4 = always true). A higher total score indicates a higher level of neuroticism. We assessed the reliability using Cronbach's α that were .90 at the time of instrument development, .82 in this study

3.2. Stress

Stress was measured using the Stress Scale for Korean Nursing Students developed by Yoo et al. [56]. This scale consists of 59 items in total, including 39 items on college-based stress and 20 items on clinical-based stress. Each item is rated on a 5 point Likert scale (0 = not at all, 4 = always true). A higher total score indicates a higher level of perceived stress. We assessed the reliability using Cronbach's α, which was .94 and .92 for college-based and clinical-based stress, respectively, when the instrument was developed and.96 for both college-based and clinical-based stress in this study

4. Situational Factors

4.1. Attitudes toward Menstruation

Attitudes toward menstruation was measured using the Menstrual Attitude Questionnaire developed by Yang et al. [57]. This scale consist of 21 items in total, including 8 items on women's secret, 5 items on women's burden, 5-items on traditional feminity, 3 items on women's symbol. Each item is rated on 7 point Likert scale (1 = very positive, 7 = very negative). A higher total score indicates more negative attitudes toward menstruation. . We assessed the reliability using Cronbach's α, which was 0.82 at the time of the instrument's development and 0.85 in this study.

4.2. Sex Role Stereotype

Sex role stereotype was measured using the self-reported questionnaire developed by Kim and Kim [58], modified by Koh et al [59]. This scale consist of 27 items in total, including 7 items on family-oriented sex role, 6 items on social psychology, 6 items on intellectual characteristics, 4 items on social activity, 4 items on appearance. Each item is rated on 5 point Likert scale (1 = strongly agree, 5 = strongly disagree). A higher total score indicates more conservative sex role stereotypes based on biological sex. We assessed the reliability using Cronbach's α, which was 0.83 at the time of the instrument's development, 0.88 in a modified study and 0.87 in this study.

5. General and menstruation related information questionnaire

General and menstruation related information include age, body mass index (BMI), menarche age, family history of PMS, regularity of menstrual cycle, average menstrual period, average menstrual cycle, volume of menstruation, the degree of difficulty in daily life, menstrual pain intensity during usual day and clinical practice.

Statistical Analysis

Data analysis was performed using SPSS ver. 27.0. General and menstruation-related characteristics, sleep quality, attitudes toward menstruation, sex role stereotypes, neuroticism, stress, and PMS were analyzed using descriptive statistics. We analyzed the differences in PMS according to general and menstruation-related characteristics by independent t-test and one-way ANOVA, with Scheffe's test post hoc. We examined the correlates between menstruation pain intensity during clinical practice, sleep quality, attitudes toward menstruation, sex role stereotypes, neuroticism, stress, and PMS using Pearson's correlation coefficients. Multiple linear stepwise regression analysis was performed to identify the correlates of PMS. Variables that were statistically significant in the univariate analysis were included in the multivariate analysis. A variance inflation factor (VIF) value of 10 or less indicates that there is no problem with multicollinearity, and the VIF of this study ranged from 1.02 to 1.51. For all of the above statistical analyses, the significance level and confidence interval were $p<$ .05 and 95%, respectively.

Results

A total of 337 nursing students experiencing PMS were initially enrolled in the study. A total of 7 cases were excluded due to missing responses; therefore 330 responses were included for data analyses.

1. The Characteristics related General and Menstruation

Table 1 shows the general and menstruation-related characteristics of the participants. The highest proportion of participants were between 12 and 13 years old at the onset of menarche (n=164, 49.7%) and had regular menstrual cycles (n=212, 64.2%). Of these, 152 (46.1%) participants answered that their average menstrual cycle length was between 26 and 30 days, with 60.3% reporting that their average menstrual period was 6 days or less in length. Of the participants, 231 (70%) of them stated that their menstruation was of average volume. The degree of menstrual pain was assessed by Numeric Rating Scale (NRS), which resulted in a mean pain level of 5.28±2.54 and 5.38±2.57 in usual day and clinical practice, respectively. The level of pain experienced by individuals in decreasing sequence was 7-10 points (severe; n=132,

40%), 4-6 points (moderate; n=113, 34.2%), and 1-3points (mild; n=85, 25.8% on clinical practice.

By measuring and analyzing the variables for the characteristics, we obtained the following results: Significant differences in PMS were demonstrated in family history (F = 3.068, p = 0.002) and regularity of menstrual cycle (F = −2.26, p = 0.024). In the post hoc testing, volume of menstruation, the degree of difficulty in daily life and menstrual pain intensity during a normal day and clinical practice showed significant differences. Large volumes of menstruation, the highest degree of difficulty in daily life and a menstrual pain intensity of 7–10 points (severe) on a normal day and clinical practice were found to have a significantly higher PMS score than small volumes of menstruation, low degrees of difficulty and 1–3-point pain intensity (mild) (Table 1).

Variables	Categories	Mean ± SD	n (%)	PMS	
				Mean ± SD	t/F (p)
Age (year)		22.14 ± 1.32			
BMI (kg/m²)	Underweight	21.60 ± 3.55	46 (13.9)	2.57 ± .99	1.058 (.367)
	Normal		208 (63.0)	2.71 ± .93	
	Overweight		34 (10.3)	2.86 ± .84	
	Obese		42 (12.7)	2.54 ± .85	
Menarche age (year)	≤ 11 years	12.48 ± 1.61	89 (27.0)	2.73 ± .95	.309 (.819)
	12~13 years		164 (49.7)	2.66 ± .93	
	14~15 years		63 (19.1)	2.73 ± .88	
	≥ 16 years		14 (4.2)	2.51 ± .84	
Family history of PMS	Yes		165 (50.0)	2.84 ± .90	3.068 (.002)
	No		165 (50.0)	2.53 ± .92	
Regularity of menstrual cycle	Yes		212 (64.2)	2.60 ± .92	-2.26 (.024)
	No		118 (35.8)	2.84 ± .90	
Average menstrual period	≤ 6 days		199 (60.3)	2.74 ± .95	1.005 (.367)
	7~9 days		126 (38.2)	2.60 ± .88	
	≥ 10 days		5 (1.5)	2.48 ± .41	
Average menstrual cycle	≤ 20		8 (2.4)	2.55 ± .89	.748 (.560)
	21~25days		34 (10.3)	2.89 ± .79	
	26~30 days		152 (46.1)	2.61 ± .93	
	31~34 days		77 (23.3)	2.72 ± .98	
	≥ 35 days		59 (17.9)	2.74 ± .91	

Volume of Menstruation	Small[a]		40 (12.1)	2.28 ± .79	10.394 (.000†) a<b
	Average[a]		231 (70.0)	2.65 ± .93	
	Large[b]		59 (17.9)	3.10 ± .83	
The degree of difficulty in daily life	Almost no disturbance and no discomfort[a]		58 (17.6)	1.98 ± .76	34.102 (.000†) a<b<c
	Normal life is possible but discomfort[b]		244 (73.9)	2.76 ± .87	
	Normal life is difficult and a lot of discomfort[c]		28 (8.5)	3.49 ± .68	
Menstrual pain intensity (NRS) during usual day	0-3[a]	5.28 ± 2.54	95 (28.8)	2.10 ± .74	41.888 (.000†) a<b<c
	4-6[b]		104 (31.5)	2.68 ± .81	
	7-10c		131 (39.7)	3.12 ± .89	
Menstrual pain intensity (NRS) during clinical practice	0-3[a]	5.38 ± 2.57	85 (25.8)	2.08 ± .72	45.598 (.000†) a<b<c
	4-6[b]		113 (34.2)	2.60 ± .77	
	7-10[c]		132 (40.0)	3.15 ± .91	

Table 1: The general and menstruation-related characteristics compared with PMS among different groups (N=330)

2. Correlations between physiological factors (menstrual pain intensity during clinical practice, sleep quality), psychological factors (neuroticism, stress), situational factors (attitude toward menstruation, sex role stereotype) and PMS. (N=330)

Table 2 shows the analysis results for the relationship between the participant's PMS and major variables. . PMS was significantly positively correlated with menstrual pain intensity during clinical practice ($r = 0.51$, $p < 0.01$), neuroticism ($r = 0.37$, $p < 0.001$), stress ($r = 0.39$, $p < 0.001$) and attitudes toward menstruation ($r = 0.15$, $p = 0.008$). In contrast, PMS was negatively correlated with sleep quality ($r = -0.38$, $p < 0.001$) (Table 2). Thus, participants with poor sleep quality, negative attitudes towards menstruation, severe menstrual pain intensity and high levels of neuroticism and stress experienced more severe PMS.

Variables		Menstrual pain intensity during clinical practice	Sleep quality	Neuroticism	Stress	Attitudes toward menstruation	Sex role stereotype	PMS
		r (*p*)	r (*p*)	r (*p*)	r (*p*)	r (*p*)	r (*p*)	r (*p*)
Physiological Factor	Menstrual pain intensity during clinical practice	1						
	Sleep quality	−0.19 (0.000)	1					
Psychological Factor	Neuroticism	0.13 (0.020)	−0.22 (0.000)	1				
	Stress	0.16 (0.003)	−0.11 (0.041)	0.41 (0.000)	1			
Situational Factor	Attitudes toward menstruation	−0.02 (0.074)	−0.16 (0.003)	0.09 (0.120)	0.21 (0.000)	1		
	Sex role stereotype	0.11 (0.045)	0.07 (0.226)	−0.01 (0.897)	−0.08 (0.126)	−0.36 (0.000)	1	

PMS	0.51 (0.000)	−0.38 (0.000)	0.37 (0.000)	0.39 (0.000)	0.15 (0.008)	−0.02 (0.712)	1
TOUS = Theory of unpleasant symptoms, PMS = Premenstrual syndrome							

Table 2: Corrleations between Variabled based on TOUS (N=330)

3. Influencing factors for PMS (N=330)

In order to identify the relevant factors affecting PMS, the multiple regression model of the independent variables (menstrual pain intensity during clinical practice, sleep quality, neuroticism, stress, attitudes toward menstruation and sex role stereotypes) was analyzed. The tolerance limits were all above 0.1, and the variance inflation factors (VIF) ranged from 1.02 to 1.51, which did not exceed 10, confirming that there was no evidence of multicollinearity. The Durbin–Watson statistic was 1.824, which is close to the criterion value of 2, indicating that there was no correlation between the independent variables, so the regression model is reasonable.

The regression model of the independent variables (menstrual pain intensity during clinical practice, sleep quality, attitudes toward menstruation, sex role stereotypes, neuroticism and stress) was significant (F = 44.64, $p < 0.001$), and its explanatory power was 44%. The independent variable of sleep quality (t = −5.37, $p < 0.001$) was found to have an inverse effect on PMS, while menstrual pain intensity during clinical practice (t = 9.69, $p < 0.001$), neuroticism (t = 3.70, $p < 0.001$) and stress (t = 4.50, $p < 0.001$) were found to have a positive effect on PMS. As a result of multiple regression analysis, menstrual pain intensity during clinical practice ($\beta = 0.42$), sleep quality ($\beta = −0.23$), stress ($\beta = 0.21$) and neuroticism ($\beta = 0.17$) were shown to affect PMS (Table 3).

In other words, when levels of menstrual pain intensity during clinical practice, stress, and neuroticism were higher and sleep quality was lower, PMS symptoms were higher.

Variables		B	SE	β	t(p)	R²	Adj R²	F(p)
	(Constant)	1.78	0.40	-	4.44(.000)			
Physiological Factor	Menstrual pain intensity during clinical practice	0.15	0.02	0.42	9.69(0.000)			
	Sleep quality	−0.31	0.06	−0.23	−5.37(0.000)			
Psychological Factor	Neuroticism	0.16	0.04	0.17	3.70(0.000)	0.45	0.44	44.64 (<.001)
	Stress	0.24	0.05	0.21	4.50(0.000)			
Situational Factor	Attitudes toward menstruation	0.05	0.04	0.05	1.19(0.234)			
	Sex role stereotype	−0.02	0.06	−0.01	−0.28(0.779)			
B : non-standardized coefficient, SE : standard error, β : standardized coefficient; PMS = Premenstrual syndrome								

Table 3: Influencing factors on PMS (N=330)

Discussion

Attempts to evaluate PMS among female college students in the department of nursing are worthwhile, and we investigated the relationship between physiological, psychological, and situational factors based on TOUS. The results showed that psychophysiological factors, such as menstrual pain intensity during clinical practice, sleep quality, neuroticism, and stress were significant independent determinants of PMS in the studied population with combined explanatory power of 44%.

Studies have shown that PMS is a common symptom in menstrual disorders and has a relatively high proportion of prevalence. In this study, the mean age of participants was 22.14 ± 1.32 years, and their mean age at menarche was 12.48 ± 1.61 years, which was lower than in a previous study [44]. Those with a family history of PMS were significantly more likely to have severe PMS, consistent with previous research [60]. Approximately 70.0% of subjects were shown to have average volume of menstruation, while 17.9% was shown to have large volume of menstruation, and subjects with heavier bleeding had tendency to have statistically significant more severe PMS. In addition, between PMS and regularity of menstrual cycle had significant association. Also, more than 70% of the subjects were complained that over 4-point menstrual pain during usual day and clinical practice. These results were in alignment with previous research [60, 61]. This was significantly higher than the proportion of middle school girls who reported moderate to severe pain in one recent study (59.9%) [62], but similar to the proportion of college students reporting this level of pain in another study (78.5%) [45].

Physiological factors as menstrual pain intensity during clinical practice, sleep quality were related to PMS based on the results of multivariable analysis, which is consistent with previous study [63]. The mean menstrual pain intensity of nursing students was 5.38/10 and 2.3 points higher than that of the perimenopausal women (43 to 53 years), while 0.84 points lower than that of the adolescent girls [64, 65]. Menstrual pain is a subjectively perceived health condition, and the level of pain was shown to be higher among adolescents, college students, and postmenopausal women who had relatively high physical health. The mechanism of the relationship between menstrual pain and PMS is not yet fully understood, but it is likely that when the duration of exposure to previously unexperienced pain is shorter, a higher level of pain intensity is perceived. In this study, menstrual pain intensity during clinical practice was particularly identified as the major determinant affecting PMS, which can be suggested as meaning that the complex symptoms of PMS are highly related to pain. In nursing students in particular, research is needed to expose another unfamiliar environment due to the nature of nursing education; clinical practice is reported to be a stressful situation that causes high anxiety and tension, leading to difficulties in coping with stress [66, 67]. Stressful situation elevates the level of cortisol, and stress has been shown to be higher during clinical practice than during typical days in nursing students. This high level of stress makes it easier to feel pain at a higher level, which has been found to be one of the factors that exacerbates PMS. Also, similar to the findings of an earlier study examining nursing students [68], sleep quality was also identified as having a statistically significant negative effect on PMS, with higher sleep quality being associated with lower PMS severity. This supports previous research that suggests that worse sleep quality can alter estrogen and progesterone concentrations, leading to PMS [40]. In another study, sleep quality was decreased in 71.6% of general university students and 89% of nursing students, and nursing students in particular had lower sleep quality than general university students due to stress caused by the heavy learning load involving theory, practice, and responsibility for patient care [68]. Therefore, intervention strategies to alleviate PMS through satisfied sleep needs are crucial for nursing students.

The results of regression analysis showed that neuroticism and stress were positively correlated with PMS, which corresponded with prior research [54, 69-71]. The more neurotic an individual is, the more likely they are to experience PMS. Neuroticism is the personality trait that refers to the tendency to be emotionally sensitive, moody, easily anxious, depressed, overly worried, and susceptible to negative emotions [54, 69,70]. Higher levels of neuroticism are associated with more negative moods in daily life and more life stress [70], which may lead to more negative responses to premenstrual physical symptoms and attitudes toward menstruation, higher perceived depression and stress, and more PMS. In addition, the higher stress, the more PMS were experienced. This is supported by several previous studies which have reported that increasing or chronic stress can lead to hormonal imbalance and contribute to PMS [6,20,46,72,73]. Furthermore, a similar study reported that stress was the most important predictor of PMS in female college students [74], and another study reported that women were more vulnerable to stress, indicating that they suffered more severe PMS, such as recurrent physical symptoms and difficulty concentrating before menstruation. Therefore, daily stress can be considered as a factor that aggravates the severity of PMS in female college students, and practical intervention programs should be developed to improve the ability to cope with life stress appropriately. In terms of stress, we found that nursing students in their fourth year, when the burden of clinical practice, employment, and national examinations was increased, had a higher level of stress than in the first and second years (before clinical practice begins), which was also higher than that of general university students [20,75,76]. These findings suggest that nursing students' stress related to clinical practice was mostly above average and can have a negative impact on their health. As a result, intervention strategies are needed to help nursing students alleviate PMS through proper stress control.

Although attitudes toward menstruation were positively correlated with PMS, it was not identified as a significant determinant of PMS. Previous studies have shown that negative attitudes toward menstruation lead to excessive perception of premenstrual bodily changes, which exacerbate the physical, cognitive, behavioral and social symptoms of PMS, supporting the present findings [37,51,68,77]. In addition, high-stress environments result in negative attitudes toward menstruation, and female college students with negative attitudes toward menstruation had a 6.25-fold increased risk of clustering into the premenstrual dysphoric disorder group compared to female college students with normal and mild PMS [78], suggesting that PMS and menstrual attitudes are closely related. The more women experience pain, negative emotions, and daily restrictions associated with each recurrent menstrual period, the more negative their attitudes toward menstruation become, which in turn exacerbates PMS.

Sex role stereotypes were not significantly associated with PMS and were not an influencing factor. In Korea, there was less interest in women's unique experiences, such as menstruation, due to the traditional culture of masculinity and patriarchy. Studies in Western cultures, however, have shown that menstruation has been considered an important indicator of women's health throughout Western history, and various studies have been conducted on the phenomenon [51,79-82]. In particular, these studies suggested that PMS is more likely to be experienced in the context of low acceptance of women's roles related to sex role stereotypes or negative attitudes towards menstruation [51, 80, 83]. In addition, the distinction between sex roles has been blurred and sex role stereotypes are disappearing in the current society. Thus, sex role may not be a situational factor that has a significant effect on PMS.

However, there are some limitations of this study. First, this was a cross-sectional study performed only in a single location and restricted population as nursing students, which may have reduced the representativeness of the sample. Thus, generalizing the findings of this study to all college students in Korea should be approached with caution. Second, the inherent potential biases of a self-reported questionnaire include inevitable recall bias. Third, the design of this study as a cross-sectional study may be inadequate for establishing a clear causal relationship. Despite these limitations, the study specifically measured the extent of PMS experienced by female nursing students and investigated the predictors of PMS, including four major factors (menstrual pain intensity during clinical practice, sleep quality, neuroticism and stress).

As nursing students are future healthcare providers, they may benefit from under-standing the physiological and psychological factors of PMS and acquiring accurate knowledge to form a positive coping strategies for PMS it rather than focusing on the negative aspects of menstruation.

Conclusions

This study was designed to investigate the correlates of premenstrual syndrome between the variables suggested by the TOUS (menstrual pain intensity during clinical practice, sleep quality, attitudes towards menstruation, sex role stereotypes, neuroticism and stress) among female university students enrolled in the Department of Nursing, and identified menstrual pain intensity during clinical practice, sleep quality, neuroticism and stress as influencing factors of PMS. These findings suggest that healthcare providers could alleviate PMS through physiopsychological interventions such as relieving men-strual pain, enhancing sleep quality, converting the personal trait of neuroticism and controlling stress levels. By doing so, this study on the correlates of PMS can contribute the crucial evidence with the management of and interventions for PMS in nursing students with PMS.

References

1. Critchley HOD, Maybin JA, Armstrong GM, Williams ARW (2020) Physiology of the Endometrium and Regulation of Menstruation. Physiol Rev 100:1149-1179.

2. Mondragon NI, Txertudi MB (2019) Understanding menstruation: Influence of gender and ideological factors. A study of young people's social representations. Feminism & Psychology 29: 357-373.

3. Biggs WS, Demuth RH (2011) Premenstrual syndrome and premenstrual dysphoric disorder. Am Fam Physician 84: 918-924.

4. Dönmez S, Gümüşsoy S (2019) Premenstrual syndrome in nursing students and the affecting factors. Kocaeli Medical Journal 8: 38-45.

5. Gollenberg AL, Hediger ML, Mumford SL, Whitcomb BW, Hovey KM, et al. (2010) Perceived stress and severity of perimenstrual symptoms: the BioCycle Study. J Womens Health (Larchmt) 19: 959-967.

6. Direkvand-Moghadam A, Sayehmiri K, Delpisheh A, Kaikhavandi S (2014) Epidemiology of premenstrual syndrome (PMS)-a systematic review and meta-analysis study. J Clin Diagn Res 8: 106-109.

7. Potter J, Bouyer J, Trussell J, Moreau C (2009) Premenstrual syndrome prevalence and fluctuation over time: results from a French population-based survey. J Womens Health (Larchmt) 18: 31-39.

8. Bakhshani NM, Mousavi MN, Khodabandeh G (2009) Prevalence and severity of premenstrual symptoms among Iranian female university students. J Pak Med Assoc 59: 205-8.

9. Geta TG, Woldeamanuel GG, Dassa TT (2020) Prevalence and associated factors of premenstrual syndrome among women of the reproductive age group in Ethiopia: Systematic review and meta-analysis. PLoS One 15: e0241702.

10. Song JE, Chae HJ, Jang WH, Park YH, Lee KELee SH, et al. (2013) The relationship between life style, menstrual attitude and premenstrual syndrome in nursing students. Korean J Women Health Nurs 19: 119-128.

11. Kim EY, Bae JH (2014) The Effect of Female College Student's Stress Level on Premenstrual Syndrome. Journal of International Academy of Physical Therapy Research 5: 723-729.

12. Elgzar W, Sayed S (2017) Quality of life among girls with or without clinically significant premenstrual syndrome. American Journal of Nursing Science 6: 87-98.

13. Vasundhra V, Jayakumari S (2020) Pre-menstrual syndrome and its impact on adolescent women. Drug Invention Today 14: 5 776-779.

14. Sherehan RA, Galal AE, Soad AR, Eman MA (2018) Effect of Caffeinated Beverages Intake on Premenstrual Syndrome among Nursing Students. Egyptian Journal of Health Care 9: 61-74.

15. Maity S, Wray J, Coffin T, Nath R, Nauhria S, et al. (2022) Academic and Social Impact of Menstrual Disturbances in Female Medical Students: A Systematic Review and Meta-Analysis. Front Med (Lausanne) 9: 821908.

16. Osborn E, Brooks J, O'Brien PMS, Wittkowski A (2021) Suicidality in women with Premenstrual Dysphoric Disorder: a systematic literature review. Arch Womens Ment Health 24: 173-184.

17. Prasad D, Wollenhaupt-Aguiar B, Kidd KN, Cardoso TDA, Frey BN, et al. (2021) Suicidal risk in women with premenstrual syndrome and premenstrual dysphoric disorder: a systematic review and meta-analysis. J Womens Health (Larchmt) 30: 1693-1707.

18. Jang, H (2009) The Mediating Effect of Dysfunctional Beliefs on the Relationship between College Student's Stress and Their Maladjustment. Unpublished master's thesis. Keimyung University.

19. Yang NY, Moon SY (2013) The impact of health status, health promoting behaviors, and social problem ability on college adjustment among nursing students. The Journal of Korean academic society of nursing education 19: 33-42.

20. YeonSuk P, Chang-geum L, Chang-keum G (2017) The Study of Evaluation of University Students' Health Behaviors. 15: 517-529.

21. Pulido□Martos M, Augusto□Landa JM, Lopez□Zafra E (2012) Sources of stress in nursing students: a systematic review of quantitative studies. International Nursing Review 59: 15-25.

22. Liu B, Wang G, Gao D, Gao F, Zhao B, et al. (2015) Alterations of GABA and glutamate–glutamine levels in premenstrual dysphoric disorder: a 3T proton magnetic resonance spectroscopy study. Psychiatry Res 231: 64-70.

23. Pang Y, Liao H, Duan G, Feng Z, Liu H, et al. (2021) Regulated aberrant amygdala functional connectivity in premenstrual syndrome via electro-acupuncture stimulation at sanyinjiao acupoint⊡ SP6⊡. Gynecol Endocrinol 37: 315-319.

24. del Mar Fernández M, Regueira-Méndez C, Takkouche B (2019) Psychological factors and premenstrual syndrome: A Spanish case-control study. PLoS One 14: e0212557.

25. Huang Y, Zhou R, Wu M, Wang Q, Zhao Y, et al. (2015) Premenstrual syndrome is associated with blunted cortisol reactivity to the TSST. Stress 18: 160-168.

26. Yen JY, Wang PW, Su CH, Liu TL, Long CY, et al. (2018) Estrogen levels, emotion regulation, and emotional symptoms of women with premenstrual dysphoric disorder: The moderating effect of estrogen receptor 1α polymorphism. Prog Neuropsychopharmacol Biol Psychiatry 82: 216-223.

27. Stoner R, Camilleri V, Calleja-Agius J, Schembri-Wismayer P (2017) The cytokine-hormone axis–the link between premenstrual syndrome and postpartum depression. Gynecol Endocrinol 33: 588-592.

28. Gao M, Zhang H, Sun Y, Gao Z, Sun C, et al. (2022) Gabrb2 knock-out mice exhibit double-directed PMDD-like symptoms: GABAAR subunits, neurotransmitter metabolism disruption, and allopregnanolone binding. Aging (Albany NY) 14: 8437-8447.

29. Lenz ER, Suppe F, Gift AG, Pugh LC, Milligan RA, et al. (1995) Collaborative development of middle-range nursing theories: toward a theory of unpleasant symptoms. ANS Adv Nurs Sci 17: 1-13.

30. Lenz ER, Suppe F, Gift AG, Pugh LC, Milligan RA, et al. (1995) Collaborative development of middle-range nursing theories: toward a theory of unpleasant symptoms. ANS Adv Nurs Sci 17: 1-13.

31. Lenz ER, Pugh LC, Milligan RA, Gift A, Suppe F, et al. (1997) The middle-range theory of unpleasant symptoms: an update. ANS Adv Nurs Sci 19: 14-27.

32. Lopes-Júnior LC, Bomfim EDO, Nascimento LC, Pereira-da-Silva G, de Lima RAG et al. (2015) Theory of unpleasant symptoms: support for the management of symptoms in children and adolescents with cancer. Rev Gaucha Enferm 36: 109-112.

33. Kim M, Jung MS (2021) Effects of chemotherapy-induced peripheral neuropathy in women with breast cancer: A structural equation approach with the Theory of Unpleasant Symptoms. Cancer Nurs 44: 145-153.

34. Wang S, Jiang N, Song Y, Ma L, Niu Y, et al. (2022) Correlates of Cancer-Related Fatigue among Colorectal Cancer Patients Undergoing Postoperative Adjuvant Therapy Based on the Theory of Unpleasant Symptoms. Curr Oncol 29: 9199-9214.

35. Chekoudjian, CB (2009) The subjective experience of PMS: A sociological analysis of women's narratives.

36. Aşcı O, Gökdemir F, Süt HK, Payam F (2015)The relationship of premenstrual syndrome symptoms with menstrual attitude and sleep quality in Turkish nursing student. J Caring Sci 4:1 79-87.

37. Kennett DJ, Hagan FTO, Meyerhoff TJ (2016) Managing menstruation: Moderating role of symptom severity on active coping and acceptance. West J Nurs Res 38: 553-571.

38. Badkur D, Singh S, Arjaria V, Wanjpe A (2023) Study to assess the association of PMS with sociodemographic factors and various coping behaviors adopted for premenstrual symptoms. Asian Journal of Medical Sciences 14.

39. Lee SE, Vincent C, Finnegan L (2017) An analysis and evaluation of the theory of unpleasant symptoms. ANS Adv Nurs Sci 40: E16-E39.

40. Andersen ML, Araujo P, Frange C,Tufik S (2018) Sleep disturbance and pain: a tale of two common problems. Chest 154: 1249-1259.

41. Xing X, Xue P, Li SX, Zhou J, Tang X, et al. (2020) Sleep disturbance is associated with an increased risk of menstrual problems in female Chinese university students. Sleep Breath 24: 1719-1727.

42. Meers JM, Bower JL, Alfano CA (2020) Poor sleep and emotion dysregulation mediate the association between depressive and premenstrual symptoms in young adult women. Arch Womens Ment Health 23: 351-359.

43. Izadi M, Amiri S (2019) Personality characteristics in female students with premenstrual dysphoric disorder and premenstrual syndrome. Advances in Nursing and Midwifery 28: 40-45.

44. Da Hai Som, K (2017) Influencing Factors in Premenstrual Syndrome(PMS) among Nursing Students. Journal of Digital Convergence 15: 277-286.

45. Wang Hee J, Kang MS. Min OS (2018) Influential Factors on Premenstrual Syndrome in Female College Students Korean Parent Child Health J 21: 1-10.

46. Rafique N, Al-Sheikh, MH (2018) Prevalence of menstrual problems and their association with psychological stress in young female students studying health sciences. Saudi Med J 39: 67-73.

47. Chang HJ, Jeong HG, Ko YH, Han CS, Joe SH, et al. (2013) Frequency, clinical characteristics and correlates of premenstrual syndrome in high school students. Korean J Psychosom Med 21: 44-54.

48. Wong LP, Khoo, EM (2011) Menstrual-related attitudes and symptoms among multi-racial Asian adolescent females. Int J Behav Med 18: 246-253.

49. Jung GS, Oh HM, Choi, IR (2014) The Influential Factors on Premenstrual Syndrome College Female Students. Journal of the Korea Academia-Industrial cooperation Society 15: 3025-3036.

50. Chrisler, JC (2013) Teaching taboo topics: Menstruation, menopause, and the psychology of women. Psychology of Women Quarterly 37: 128-132.

51. Temel S, Terzioglu F, Isik Koc, G (2018) Premenstrual syndrome in university students: its correlation with their attitudes toward gender roles. J Psychosom Obstet Gynaecol 39: 228-236.

52. Lee K, Cheon S, Kim M, Lee EH, Lee SB, et al. (2018) Development of Korean menstrual symptom scale for university students. Korean Journal of Women Health Nursing 24: 414-422.

53. Oh JJ, Song MS, Kim, SM (1998) Development and validation of Korea sleep scale A. Journal of korean Academy of Nursing 28: 563-572.

54. Goldberg, LR (1999) A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. Personality psychology in Europe 7: 7-28.

55. Lee K, Ashton, MC (2004) Psychometric properties of the HEXACO personality inventory. Multivariate Behav Res 39: 329-58.

56. Yoo JS, Chang SJ, Choi EK, Park JW (2008) Development of a stress scale for Korean nursing students. Taehan Kanho Hakhoe Chi 38: 410-419.

57. Yang DO (2022) The relationship between increased years after menarche and attitudes toward menstruation. 2002, Chonnam National University Graduate School: Gwangju.

58. Kim J, Kim, K (1999) College students' dating violence and coping behavior. Unpublished master's thesis, Chonnam National University Gwangju.

59. Ko HR (2007) An analysis of rape case perception difference: with special to sex-role stereotype, rape myths effects. Master's thesis, Chung-Ang University.

60. Talukdar P, Ahmed N, Sarkar S (2022) Premenstrual Syndrome among College Students and its Relation to their Study Activities. Journal of Mental Health and Human Behaviour 27: 24-28.

61. Yi SJ, Kim M, Park, I (2023) Levels and Factors of Premenstrual Syndrome (PMS) among Female College Students.

62. Kim HJ, Choi SY, Min, H (2019) Effects of sleep pattern, stress, menstrual attitude, and behavior that reduces exposure to endocrine disrupting chemicals on premenstrual syndrome in adolescents. Korean Journal of Women Health Nursing 25: 423-433.

63. Naeimi, N (2015) The prevalence and symptoms of premenstrual syndrome under examination. Journal of Biosciences and Medicines 3: 1.

64. Chung SH,Kim TH, Lee HH,Lee A,Jeon DS, et al. (2014) Premenstrual Syndrome and Premenstrual Dysphoric Disorder in Perimenopausal Women. J Menopausal Med 20: 69-74.

65. H. Kang Jeong and S. Hwang Eun (2019) Influencing Factors on Premenstrual Syndrome in Adolescent Girls. Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology 9: 541-552.

66. Tsegaye D, Getachew, Y (2019) Premenstrual dysphoric disorder and associated factors among female health science students in Wollo University, Ethiopia, 2017/18. Maternal health, neonatology and perinatology 5: 1-8.

67. Minichil W, Eskindir E, Demilew D, Mirkena Y (2020) Magnitude of premenstrual dysphoric disorder and its correlation with academic performance among female medical and health science students at University of Gondar, Ethiopia, 2019: a cross-sectional study. BMJ Open 10: e034166.

68. Kim GH, Yoon HS (2013) Factors influencing sleep quality in nursing students and non nursing students. Journal of Korean Academy of Psychiatric and Mental Health Nursing 22: 320-329.

69. Nosratabadi S, Ahmadi A, Ghazanfarpour M, Hosseinnataj A, Khorasani F (2021) The Association Between Neuroticism and Premenstrual Syndrome Symptoms.

70. Hamidovic A, Dang N, Khalil D, Sun J (2022) Association between Neuroticism and Premenstrual Affective/Psychological Symptomatology. Psychiatry international 3: 52-64.

71. Arslantaş, H, Abacigil F, Çinakli S (2018) Relationship between premenstrual syndrome and basic personality traits: a cross-sectional study. Sao Paulo Medical Journal 136: 339-345.

72. Read JR, Perz J, Usher JM (2014) Ways of coping with premenstrual change: development and validation of a premenstrual coping mea-

sure. BMC Women's Health 14: 9000.

73. Mitsuhashi R, Sawai A, Kiyohara K, Shiraki H, Nakata Y (2023) Factors Associated with the Prevalence and Severity of Menstrual-Related Symptoms: A Systematic Review and Meta-Analysis. International Journal of Environmental Research and Public Health 20: 569.

74. Kim SN, Kim HY (2018) Effects of life style and life stress on premenstrual syndrome among female university students. Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology 8: 791-802.

75. Yoo KH (2018) A Study on the Stress and Adjustment to College Life among Nursing Students. J Korean Acad Soc Nurs Educ 24: 269-278.

76. Park SJ, Park BJ (2013) Relationship of clinical practice stress to clinical competence among one college nursing students. The Korean journal of stress research 21: 313-322.

77. Guvenc G, Kilic A, Akyuz A, Ustunsoz A (2012) Premenstrual syndrome and attitudes toward menstruation in a sample of nursing students. J Psychosom Obstet Gynaecol 33: 106-111.

78. Lee MS, Yang J, Young-Hoon K, Seung-Duk K (2012) Characteristics of PMS and PMDD in female college students. Korean Journal of Psychosomatic Medicine 22-31.

79. Winterich JA (2003) Sex, menopause, and culture: Sexual orientation and the meaning of menopause for women's sex lives. Gender & Society 17: 627-642.

80. Kreyenbuhl-Gardner KM (2003) A sociological analysis of premenstrual syndrome. 2003: East Tennessee State University.

81. Lee S (2002) Health and sickness: The meaning of menstruation and premenstrual syndrome in women's lives. Sex roles 46: 25-35.

82. Johnson TM (1987) Premenstrual syndrome as a western culture-specific disorder. Culture, Medicine and psychiatry 11: 337-356.

83. Lee AM, So-Kum Tang C, Chong C (2009) A culturally sensitive study of premenstrual and menstrual symptoms among Chinese women. Journal of Psychosomatic Obstetrics & Gynecology 30: 105-114.