

BMJ Open 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

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ABSTRACT

Objective To assess the magnitude of premenstrual dysphoric disorder (PMDD) and associated factors among female students of the College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, 2019.

Design Institution-based cross-sectional study design.

Setting College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

Participants 386 participants were recruited for self-administered interview using the stratified followed by simple random sampling technique.

Measurement Data were collected by self-administered interview. Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5) was used to measure PMDD. The Perceived Stress Scale (PSS) and the Oslo-3 social support are used to assess the factors. The data were checked, cleaned and entered into EpiData V.3.1 and exported to Statistical Package for Social Science (SPSS) V.21.0 for analysis. Bivariate and multivariable binary logistic regressions were used. OR with 95% CI was employed to see the strength of associations between dependent and independent variables. Variables with a *p* value <0.05 in multivariable logistic regression were declared as significantly associated.

Result 386 participants were involved in the study, with a response rate of 84.6%. The overall magnitude of PMDD in this study was 34.7% (30.3 to 39.1). Severe menstrual pain (adjusted OR (AOR)=2.82, 95% CI: 1.83 to 4.23), perception of an impact on academic performance due to menstrual pain (AOR=2.31, 95% CI: 1.23 to 4.32), and high perceived stress (AOR=3.52, 95% CI: 2.58 to 5.60) were significantly associated with PMDD disorder among female medical and health sciences students.

Conclusion PMDD is high among female medical and health sciences students. Thus, it needs early screening and intervention especially for those who have severe menstrual pain, perceived to have an impact on academic performance and high perceived stress.

INTRODUCTION

Menstruation is the reproductive process whereby the upper two-thirds of the

Strengths and limitations of this study

- We used an adequate sample for the study using appropriate sampling technique and data collection procedure.
- Since the study design was cross-sectional, it could not establish the temporal association between premenstrual dysphoric disorder and identified risk factors.
- The severity of pain was retrospective self-reported and therefore it may be subjected to social desirability and recall bias which is common to all questionnaires-based studies as to what one regards as moderate might be regarded as mild or severe by another.
- Comorbid mental illness was not assessed so that students with mental health problem might present symptoms overlapping with the symptoms of premenstrual syndrome.

endometrium is shed and regenerated on a repetitive basis.¹ Physical or emotional symptoms are experienced by a majority of women of reproductive age group before the onset of menstruation.²

More than 200 premenstrual symptoms have been known over the last 50 years, which include three main emotional, behavioural and physical domains.³ It is indicated that three out of every four women may experience slight physical and mental disorders before menstruation. Seventy-five per cent of women with regular menstrual cycles experience symptoms of premenstrual syndrome (PMS), while premenstrual dysphoric disorder (PMDD) affects only 3% to 8% of women in this group.⁴

Among women samples, up to 85% have reported one or more premenstrual



symptoms.⁵ Worldwide prevalence shows that 5% to 20% of women of reproductive age have moderate-to-severe premenstrual complaints and up to 75% of all women of reproductive age may experience symptoms of PMS. PMS, which is characterised by one or more physical, emotional or behavioural symptoms during the days before menstruation, was found in 94.8% of women of reproductive age (15 to 49 years).⁶ In India, it was shown that 12.2% had PMDD and 67% were not interested in going to school during menstruation, and 71% reported lack of concentration during study hours.⁷ Different community-based surveys showed that the point prevalence of PMDD among women across the globe ranged from 1.2% to 6.4%.⁸⁻¹⁰ A Nigerian study also stated that PMDD prevalence in the country was 36.1%.¹¹ The studies conducted in other universities of Ethiopia showed that the prevalence of PMDD ranged from 13.8% to 66.9% among medical and health science students.¹²⁻¹⁴

PMS can harm the interpersonal relationship, daily activity, work productivity and the overall physical health of a woman.¹⁵ Even though most women with PMS are able to perform their day-to-day activities; in its severe form, this disorder has been associated with increased absenteeism from school and work, poor academic performance, high suicidal ideation and attempt, and acute mental health problems.¹⁶⁻¹⁸ Some students find it difficult to get out of bed and attend class on time, sudden mood swings also make it difficult to cope with the consequences that come after that. If PMS is left untreated, and when women face other environmental or personal stress, the symptoms increase and the severity worsens, forming a mental disorder called PMDD.¹⁹⁻²¹ PMDD is the severest form of PMS spectrum where physical and emotional symptoms are more common.⁷

Chronic stress is known to be a prominent factor in the prevalence and severity of premenstrual symptoms. Stress has been associated with a significant amount of variation in psychological, emotional and physical well-being.²² Different studies have indicated that PMS is more common and more severe among well-educated women than uneducated women with a possible association of PMS with stress.^{23,24} Severe PMS/PMD is said to be more common in the late twenties and mid-thirties.^{25,26} Two hundred and twenty-nine (68.8%) respondents with mild/moderate symptoms were less than 25 years old, and so were 68.0% of those with severe/extreme symptoms.⁶ Dysmenorrhoea had statistically significant association with PMDD.^{14,27-29} Older age groups, average length of one cycle of menstruation and academic performance impairment, rural residence, lower age at menarche, regularity of menses and family history of menstrual related problem were associated with PMDD in other studies.³⁰⁻³²

Even though PMDD has a high impact on academic performance, special attention still is not given for premenstrual-related problems in Ethiopia. Female university students are highly vulnerable to stress and impairments including social, occupational or other important areas of functioning, and this also affects their

academic performance, especially prior to their menstruation. If these premenstrual related problems are left untreated, they increase in number and severity, and then can form a mental disorder called PMDD which is a severe form of PMS. Therefore, the result of this study was intended for alarming concerned bodies to develop appropriate policies, strategic plans and intervention programmes to screen and treat such premenstrual-related problems early. This also aids to minimise or eliminate its negative effect on academic achievement.

Objective

The aim of this study was to assess the magnitude of PMDD and associated factors among medical and health science students at the College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia.

METHODS AND MATERIALS

Study design and period

An institution-based cross-sectional study was conducted among female undergraduate students at the University of Gondar, College of Medicine and Health Sciences from May to June, 2019.

Study participants and sampling procedure

We used stratified, by considering years of study as strata, followed by simple random sampling technique to recruit 456 female undergraduates. Sample frame was prepared by using their identification numbers taking from registrar office. All female undergraduate students were our source populations, and students who were sampled were the study populations. Female undergraduates who were enrolled in the first semester of 2018/2019 academic year and attending their education were included in the study. Students who were using hormonal contraceptive, pregnant and had follow-up treatment for known physical and mental disorder were excluded.

Sample size determination

The sample size of this study was determined by using the single population proportion formula by assuming 66.9% prevalence of PMDD among female health science students from the study conducted at Wollo University, Ethiopia,¹⁴ 1.96 Z (standard normal distribution), 4% tolerable margin of error, 95% CI of certainty ($\alpha=0.05$) and 10% non-response rate.

$$n = (z\alpha/2)^2 \cdot p(1-p)/d^2$$

n=minimum sample size required

p=proportion of PMDD in previous study (66.9%)

d=tolerable margin of error (4%)

$\frac{z\alpha}{2}$ = standard normal distribution, 1.96 and, commonly $\alpha=5\%$ with 95% CI

$$n = (1.92)^2 \cdot 0.669(1 - 0.669)/0.04^2 \\ =532$$

But the number of female students in the University of Gondar, College of Medicine and Health Sciences was 1879, which is less than 10 000, during the study year; so, we have used correction formula to calculate the final sample size (nf).

$$\begin{aligned} nf &= \frac{n}{1+n/N} \\ nf &= \frac{532}{1+532/1879} \\ &= 414 \end{aligned}$$

By adding 10% non-response, the final sample size was 456.

Study variables

Outcome variable was PMDD which was assessed by Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5). PMDD was treated as categorical variable (Yes/No). Independent variables included socio-demographic factors (age, religion, ethnicity, marital status, residence and mothers' educational level), obstetric and gynaecologic factors (menstrual duration in one cycle and its regularity, premenstrual pain and its level, age at menarche, family history of menstrual-related problem and impact on academic performance), psychosocial factors such as social support and academic stress were assessed, and substance-related factors (alcohol, khat and cigarette).

Measurement

Data were collected from female medical and health science students using self-administered and semi-structured questionnaire by psychiatric nurses using the Amharic version of the tool for 10 days. The questionnaire was translated from English to local language (Amharic) before data collection and back to English to maintain its consistency. Training was given for data collectors on how to approach and explain unclear questions, and the purpose of the study. The questionnaire was tested on 5% of the total sample before the actual data collection was started and its finding was not included in the main research report. Data collectors were made aware of ethical principles like confidentiality and security of informed consent.

PMDD was measured by DSM-5. DSM-5 was developed by the American Psychiatric Association and currently is used to diagnose clinical PMDD in Ethiopia. Those women experiencing at least five symptoms from diagnostic criteria of DSM-5 in the majority of menstrual cycles were considered as having PMDD. It was must for these symptoms to be present in the final week before the onset of menses, start to improve within a few days after the onset of menses, and become minimal or absent in the week of post menses.³³

Social support

Social support was assessed by using the Oslo 3-item social support scale which had a sum score range from 3 to 14 and had three broad categories. According to this category, respondents who scored between 3 and 8, 9 and 11,

and 12 and 14 were considered as having poor, moderate and strong social support, respectively.³⁴ In the current study, its Cronbach's alpha was 0.79, refers good reliability.

Perceived stress

In order to measure individual stress levels, Perceived Stress Scale-10 item (PSS-10) was used, which was found to be very reliable for determining the role of stress in the aetiology of psychological and behavioural disorders. Based on PSS-10, scores ranging from 0 to 13 were considered to indicate low perceived stress; 14 to 26 moderate perceived stress, and 27 to 40 high perceived stress.³⁵ Its reliability was tested with a Cronbach's alpha of 0.88.

Data processing and analysis

Data were coded and entered in the computer using EpiData V.3.1, and exported to the Statistical Package for Social Science (SPSS) V. 21 for analysis. After data cleaning, bivariate analysis was used to assess the associations between dependent and predictive variables. Adjusted OR (AOR) with 95% CI was used to estimate the strength of the association. AOR is the statistical value that is found during multivariate analysis (after controlling the confounding effects). All variables associated with PMDD, at a p value <0.05 in the bivariate logistic regression, were further analysed using multivariate logistic regression analyses to control confounding effects. Variables with a p value <0.05 in the multivariable binary logistic regression were declared to be significantly associated with PMDD.

Patient and public involvement

Participants in the current study were medical and health science students at the College of Medicine and Health Sciences, University of Gondar, Ethiopia. Patients were already excluded in our methods. Respondents were not involved in the design of the study and recruitment. The result of this study will be disseminated to the University of Gondar, College of Medicine and Health Sciences, gender office and psychiatry department for timely intervention.

RESULT

Socio-demographic characteristics of the study participants

A total of 456 students were invited to participate in the study. Of those, 386 filled completely and turned back the questionnaire that yielded a response rate of 84.6%. The reason for this low response rate was lack of interest and limited time. The age of participants ranged from 18 to 26 years with a mean age of 20.9±1.66 (SD) years. Majority 284 (73.6%) of the participants were orthodox Christian religion followers. Most of the respondents 317 (82.1%) were single in marital status. Of the total participants, 333 (86.3%) came from urban areas before they joined the university. (table 1)

Gynaecological and obstetric-related characteristics

Of the total respondents, 284 (73.6%) complained of menstrual pain. Of those having menstrual pain, 137 (35.5%) perceived that the menstrual pain has an

Table 1 Socio-demographic characteristics and their associations with PMDD among female students at the College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, 2019. (n=386)

Variables	Category	PMDD		Bivariate		Multivariate	
		Yes % (n)	No % (n)	OR with 95% CI	P value	OR with 95% CI	P value
Age (in years)	18 to 20	42.5 (57)	46.4 (117)	0.85 (0.56 to 1.30)	0.465	0.45 (0.24 to 1.26)	0.728
	>20	57.5 (77)	53.6 (135)	1		1	
Religion	Orthodox	69.4 (93)	75.7 (191)	1		1	
	Protestant	23.1 (31)	18.7 (47)	1.36 (0.81 to 2.27)	0.25	1.12 (0.63 to 1.24)	0.258
	Others	7.5 (10)	5.6 (14)	1.47 (0.63 to 3.43)	0.376	1.02 (0.34 to 2.98)	0.275
Marital status	Married	21.6 (29)	15.9 (40)	1		1	
	Single	78.4 (105)	84.1 (212)	1.68 (2.40 to 4.16)	0.015	1.68 (2.40 to 4.16)	0.015
Area they came from	Urban	88.1 (118)	85.3 (215)	1		1	
	Rural	11.9 (16)	14.7 (37)	0.79 (0.42 to 1.48)	0.457	0.59 (0.27 to 1.17)	0.274
Academic year	First	20.1 (27)	18.3 (46)	1.17 (0.36 to 3.80)	0.789	1.08 (0.15 to 2.56)	0.687
	Second	26.9 (36)	25.4 (64)	1.13 (0.36 to 3.55)	0.841	1.03 (0.24 to 2.65)	0.631
	Third	25.4 (34)	29.8 (75)	0.91 (0.29 to 2.86)	0.867	0.57 (0.11 to 1.84)	0.565
	Fourth	23.9 (32)	22.6 (57)	1.12 (0.35 to 3.57)	0.845	0.86 (0.18 to 3.57)	0.744
	Fifth	3.7 (5)	3.9 (10)	1		1	
Mothers' education	Illiterate	13.4 (18)	13.5 (34)	1.05 (0.54 to 2.02)	0.886	0.92 (0.45 to 1.84)	0.786
	Primary school	17.2 (23)	16.3 (41)	1.11 (0.61 to 2.04)	0.731	1.04 (0.47 to 1.95)	0.726
	Secondary school	28.4 (38)	26.9 (68)	1.11 (0.66 to 1.85)	0.696	1.02 (0.57 to 1.41)	0.572
	College and above	41.0 (55)	43.3 (109)	1		1	

PMDD, premenstrual dysphoric disorder.

impact on their academic performance, and 99 (72.3%) missed their class at least once in their campus stay. One hundred sixty-six (43%) respondents had a family history of menstrual-related problems. Of the total respondents, 223 (57.8%) had 4 to 5 days of menstrual bleeding per cycle. Students who had menstrual pain used different pain management techniques; painkillers like paracetamol and ibuprofen 37%, hot drinks such as tea and coffee 51%, and only 7.1% consulted healthcare providers. (table 2)

Psychosocial and substance-related characteristics

Regarding psychosocial factors, among the total respondents, 246 (63.7%) had poor social support and 174 (45.1%) didn't perceive stress. Of the total respondents, 97 (25.1%), eight (2.1%) and four (1%) used alcohol, khat and cigarette, respectively, within the last 3 months. (table 3)

Prevalence of PMDD

In the current study, the magnitude of PMDD among undergraduate students in the University of Gondar, College of Medicine and Health Sciences was 34.7% with 95% CI (30.3 to 39.1). The most commonly reported symptom were lethargy, easily fatigability or marked lack of energy (63.5%), followed by decreased interest in usual activities (58.5%) (table 4).

Factors associated with PMDD

In the crude logistic regression analysis, being single, family history of menstrual-related problem, severe menstrual pain, perceiving an impact of menstrual pain on academic performance, high amount of menstrual bleeding per day, moderate-to-high perceived stress, 6 days and above of menstrual bleeding in one cycle, and current use of khat and cigarette were associated with PMDD at a p value <0.05. These factors were fitted with adjusted logistic regression for further analysis. In the overall adjusted logistic regression analysis, severe menstrual pain, perceiving an impact on academic performance due to menstrual pain and high perceived stress were significantly associated with PMDD.

The odds of developing PMDD was 2.31 times higher among female students who perceived an impact of menstrual pain on their academic performance than those who did not perceive (AOR=2.31, 95% CI: 1.23 to 4.32). The odds of developing PMDD was 2.82 times higher among students having severe menstrual pain compared with those who had no menstrual pain (AOR=2.82, 95% CI: 1.83 to 4.23). The odds of developing PMDD was also 3.52 times higher among students who had high perceived stress (AOR=3.52, 95% CI: 2.58 to 5.60) compared with those who had no such stress (table 5).

Table 2 PMDD associated with gynaecological and obstetric-related characteristics of students at the College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, 2019. (n=386)

Characteristics	Category	PMDD		Bivariate		Multivariate	
		Yes % (n)	No % (n)	OR with 95% CI	P value	OR with 95% CI	P value
Age at menarche	<13	18.7 (25)	17.5 (44)	1		1	
	13 to 16	68.6 (92)	70.2 (177)	0.92 (0.53 to 1.59)	0.752	0.76 (0.55 to 1.42)	0.275
	>16	12.7 (17)	12.3 (31)	0.97 (0.45 to 2.08)	0.928	0.74 (0.24 to 1.56)	0.369
Menstrual cycle	Regular	35.1 (47)	25 (63)	1		1	
	Irregular	64.9 (87)	75 (189)	0.68 (0.41 to 1.13)	0.139	0.52 (0.35 to 1.12)	0.023
Menstrual pain	No	16.4 (22)	31.7 (80)	1		1	
	Mild	6.0 (8)	10.3 (26)	1.02 (0.23 to 2.45)	0.131	1.31 (0.53 to 3.22)	0.56
	Moderate	36.6 (49)	35.4 (89)	1.44 (0.67 to 3.10)	0.188	1.72 (0.62 to 4.78)	0.301
	Severe	30.6 (41)	15.9 (40)	4.93 (2.09 to 11.60)	0.009	1.34 (0.69 to 2.59)	0.389
	Very severe	10.4 (14)	6.7 (17)	3.95 (1.40 to 11.16)	0.069	1.76 (0.84 to 3.69)	0.132
Actions they took	Painkiller	42 (47)	33.7 (58)	1		1	
	Hot drinks	44.6 (50)	55.2 (95)	0.65 (0.39 to 1.09)	0.101	0.36 (0.23 to 1.43)	0.034
	Massage	6.3 (7)	4.1 (7)	1.23 (0.40 to 3.76)	0.712	0.45 (0.36 to 1.24)	0.875
	Consultation	7.1 (8)	7.0 (12)	1.23 (0.29 to 5.20)	0.774	1.35 (0.43 to 4.87)	0.341
Perception of impact on academic performance	No	36.6 (41)	61.6 (106)	1		1	
	Yes	63.4 (71)	38.4 (66)	4.07 (2.46 to 6.73)	0.001	2.42 (1.31 to 4.46)	0.005
Impact of pain	Class missing	72.4 (55)	69.9 (51)	0.46 (0.16 to 1.33)	0.152	0.65 (0.46 to 1.78)	0.025
	Test missing	7.9 (6)	16.4 (12)	1.55 (0.52 to 4.56)	0.43	1.34 (0.78 to 1.04)	0.145
	Decrease result	13.2 (10)	8.2 (6)	1.16 (0.30 to 4.56)	0.833	1.02 (0.36 to 3.56)	0.237
	Dropout	6.5 (5)	5.5 (4)	1		1	
Duration of menstrual bleeding	1 to 3 days	20.9 (28)	28.6 (72)	1		1	
	4 to 5 days	59.7 (80)	56.7 (143)	1.46 (0.91 to 2.36)	0.167	0.80 (0.42 to 1.50)	0.479
	≥6 days	19.4 (26)	14.7 (37)	2.92 (1.48 to 5.78)	0.041	0.97 (0.41 to 2.27)	0.941
Amount of menstrual bleeding	Too little	20.9 (28)	27.8 (70)	1		1	
	Moderate	70.1 (94)	69.8 (176)	1.46 (0.91 to 2.36)	0.262	1.22 (0.65 to 2.29)	0.545
	Too much	9.0 (12)	2.4 (6)	2.92 (1.48 to 5.78)	0.003	2.18 (0.65 to 7.34)	0.21
Family history of menstrual-related problems	No	46.3 (62)	62.7 (158)	1		1	
	Yes	53.7 (72)	37.3 (94)	1.95 (1.28 to 2.99)	0.002	1.76 (1.05 to 2.92)	0.031

PMDD, premenstrual dysphoric disorder.

DISCUSSION

Symptoms of PMDD have a negative impact on academic performance of female students.³⁶⁻³⁷ Therefore, there is a need to determine the prevalence of PMDD and identify the predictors associated with it. This would also help prevent the problem and prepare treatment strategies that promote the academic performance of female university students.

In the current study, the magnitude of PMDD was marginally similar with studies conducted in another area of Ethiopia at 30.9%,³⁸ Egypt 40.5%,³⁹ Nigeria 36.1%,¹¹ Korea 34.8%,⁴⁰ Nepal 38.9% of medical students⁴¹ and Iran 36.3%.⁴² However, the magnitude of PMDD in this study was lower than the studies conducted among female students in other parts of Ethiopia at 66.9%,¹⁴ Nepal 39.6% nursing students⁴¹ and Iran 59%.⁴³ The possible

explanation for this difference might be: smaller sample size (254), socio-demographic characteristics, time of data collection (1 to 15 February 2017) and curriculum difference. In Wollo University, Ethiopia, medical students joined the University by losing their work, salary and spousal affiliation, which increases premenstrual-related dysphoric symptoms. The proportion of PMDD in female medical and health science students of University of Gondar was lower than the nursing students of a tertiary care teaching hospital in Nepal. The other probable reason might also be differences in socio-demographic characteristics, level of academic stress, course load and study setting. The prevalence of PMDD in Iranian adolescent schoolgirls was high compared with the current study finding. The possible variation for this difference could be due to tool difference (Premenstrual Assessment Scale

Table 3 Associations between PMDD and psychosocial and substance-related characteristics among female students at the College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, 2019. (n=386)

Variables	Category	PMDD		Bivariate		Multivariate	
		Yes % (n)	No % (n)	OR with 95% CI	P value	OR with 95% CI	P value
Social support	Poor	63.4 (85)	63.9 (161)	0.66 (0.17 to 2.52)	0.543	1.53 (0.98 to 1.23)	0.568
	Moderate	33.6 (45)	34.1 (86)	0.65 (0.17 to 2.56)	0.542	0.54 (0.37 to 1.02)	0.351
	Strong	3.0 (4)	2.0 (5)	1		1	
Perceived stress	No stress	38.8 (52)	48.4 (122)	1		1	
	Low stress	23.9 (32)	23.0 (58)	1.29 (0.75 to 2.22)	0.349	1.13 (0.45 to 2.02)	0.229
	Moderate stress	22.4 (30)	15.1 (38)	1.85 (1.04 to 3.30)	0.037	1.65 (1.01 to 3.30)	0.027
	High stress	14.9 (20)	13.5 (34)	1.38 (0.73 to 2.62)	0.024	1.28 (0.43 to 1.62)	0.324
Current use of khat	No	96.3 (129)	98.8 (249)	1			
	Yes	3.7 (5)	1.2 (3)	3.22 (0.76 to 13.67)	0.014	2.86 (0.65 to 12.49)	0.163
Current use of alcohol	No	71.6 (96)	76.6 (193)	1		1	
	Yes	28.4 (38)	23.4 (59)	1.29 (0.81 to 2.08)	0.287	0.25 (0.15 to 0.97)	0.765
Current use of cigarette	No	98.5 (132)	99.2 (250)	1			
	Yes	1.5 (2)	0.8 (2)	1.89 (0.26 to 13.60)	0.025	1.61 (0.21 to 12.36)	0.646

PMDD, premenstrual dysphoric disorder.

(PAS)), sample size (1379), socio-cultural, sampling technique and being young, as the contribution of mixed psychobiological signs and symptoms of premenstrual

problem in Iran. On the other hand, the magnitude of PMDD in this study was higher than the studies conducted in other areas of Ethiopia at 13.8%,¹² 26.8%¹³ and 27%;⁴⁴

Table 4 Proportions of premenstrual dysphoric symptoms among students at the College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, 2019. (n=386) (DSM-5)

Item	Category	Frequency (N)	Percentage (%)
Marked affective lability	No	201	52.1
	Yes	185	47.9
Marked irritability or anger or increased interpersonal conflicts	No	251	65
	Yes	135	35
Marked depressed mood, feelings of hopelessness or self-deprecating thoughts	No	281	72.8
	Yes	105	27.2
Marked anxiety, tension, feelings of being 'keyed up' or 'on edge'	No	250	64.8
	Yes	136	35.2
Decreased interest in usual activities (eg, work, school, friends and hobbies)	No	160	41.5
	Yes	226	58.5
Subjective difficulty in concentration	No	247	64
	Yes	139	36
Lethargy, easy fatigability or marked lack of energy	No	141	36.5
	Yes	245	63.5
Marked change in appetite, overeating or specific food cravings	No	260	67.4
	Yes	126	32.6
Hypersomnia or insomnia	No	203	52.6
	Yes	183	47.4
Sense of being overwhelmed or out of control	No	320	82.9
	Yes	66	17.1
Physical symptoms such as breast tenderness or swelling, joint or muscle pain, a sensation of 'bloating,' weight gain	No	168	43.5
	Yes	218	56.5

DSM-5, Diagnostic and Statistical Manual of Mental Disorders, fifth edition.

Table 5 Overall crude and adjusted logistic regression analysis of factors associated with premenstrual dysphoric disorder among female medical and health science students at College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, 2019. (n = 386)

Variables	Category	PMDD		Bivariate		Multivariate	
		Yes % (n)	No % (n)	COR (95% CI)	P value	AOR (95% CI)	P value
Marital status	Married	21.6 (29)	15.9 (40)	1		1	
	Single	78.4 (105)	84.1 (212)	1.68 (2.40,4.16)	0.015	0.72 (0.35 to 1.50)	0.382
Menstrual pain	No	16.4 (22)	31.7 (80)	1		1	
	Mild	6.0 (8)	10.3 (26)	1.02 (0.23 to 2.45)	0.131	1.36 (0.54 to 3.45)	0.517
	Moderate	36.6 (49)	35.4 (89)	1.44 (0.67 to 3.10)	0.188	1.82 (0.630,5.24)	0.269
	Severe	30.6 (41)	15.9 (40)	4.93 (2.09 to 11.60)	0.009	2.82 (1.83,4.23)	0.023
	Very severe	10.4 (14)	6.7 (17)	3.95 (1.40 to 11.16)	0.069	3.02 (0.84,2.56)	0.137
Perception of impact of menstrual pain	No	36.6 (41)	61.6 (106)	1		1	
	Yes	63.4 (71)	38.4 (66)	4.07 (2.46 to 6.73)	0.001	2.31 (1.23 to 4.32)	0.009
Duration of menstrual bleeding	1–3 days	20.9 (28)	28.6 (72)	1		1	
	4–5 days	59.7 (80)	56.7 (143)	1.78 (0.82 to 2.57)	0.167	0.79 (0.42,1.51)	0.475
	>=6 days	19.4 (26)	14.7 (37)	2.73 (1.05 to 4.56)	0.041	0.98 (0.41,2.34)	0.969
Amount of menstrual bleeding per day	Too little	20.9 (28)	27.8 (70)	1		1	
	Moderate	70.1 (94)	69.8 (176)	1.45 (0.91 to 2.32)	0.262	1.24 (0.64 to 2.39)	0.521
	Too much	9.0 (12)	2.4 (6)	11.60 (2.53 to 53.26)	0.003	2.50 (0.59,10.50)	0.212
Family history of menstrual related problems	No	46.3 (62)	62.7 (158)	1		1	
	Yes	53.7 (72)	37.3 (94)	1.88 (1.25,2.2.83)	0.002	1.85 (0.69,3.14)	0.122
Current use of khat	No	96.3 (129)	98.8 (249)	1		1	
	Yes	3.7 (5)	1.2 (3)	3.68 (1.45,9.39)	0.014	0.84 (0.14,5.05)	0.845
Current use of cigarette	No	98.5 (132)	99.2 (250)	1		1	
	Yes	1.5 (2)	0.8 (2)	3.20 (1.01,10.11)	0.025	1.17 (0.25 to 5.61)	
Perceived stress	No stress	38.8 (52)	48.4 (122)	1		1	
	Low stress	23.9 (32)	23.0 (58)	1.29 (0.75,2.22)	0.349	1.44 (0.74,2.81)	0.286
	Moderate stress	22.4 (30)	15.1 (38)	1.85 (1.04,3.30)	0.037	1.70 (0.84,3.42)	0.14
	High stress	14.9 (20)	13.5 (34)	1.38 (0.73,2.62)	0.024	3.52 (2.58,5.60)	0.001

Jordan 7.7%;³⁶ and India 3.7% and 12.22%.^{45 46} In the studies conducted in the other areas of Ethiopia, the prevalence of PMDD was lower than the current study. The possible reason for this difference might be variations in course load, study setting, study subject, diagnostic tool and sample size. The magnitude of PMDD in this study was higher than a prospective study done in Jordan among female university students. The possible reason for this variation might be study design, socio-demographic characteristics, data collection period (at the beginning of a semester in Jordan) and study participants. Different studies showed that the prevalence of PMDD among female students in India was lower than our study finding. The differences could be due to sample size, cross-cultural variation and academic stress (striving for higher academic achievements).

In the current study, the most commonly reported symptoms were lethargy; easily fatigability or marked lack of energy (63.5%); decreased interest in usual activities

(58.5%); and physical symptoms such as breast tenderness or swelling, joint or muscle pain, and a sensation of ‘bloating’ and weight gain (56.5%). It was consistent with the study findings indicated in Mekelle University, Ethiopia,^{12 31 44} and in Iran⁴² and India.⁴⁵ Sense of being overwhelmed or out of control 17.1%, marked depressed mood, feeling of hopelessness or self-deprecating thoughts 27.2% were the least prevalent symptoms.

Students perceiving an impact of menstrual pain on academic performance were more likely to develop PMDD than those who didn’t perceive such impact. The possible reason might be due to the fact that participants with the perception of an impact on academic performance become more concerned and hypervigilant with the premenstrual symptoms that led to difficulty concentrating, missing class, dysmenorrhoea (menstrual pain) and dropout/failure in academics. This was supported by studies conducted in other areas of Ethiopia and the Kingdom of Saudi Arabia.^{30–32} Students with severe



menstrual pain were more at risk for the development of PMDD compared with those who had no menstrual pain. The possible explanations for this association might be menstrual pain or dysmenorrhoea that causes distress, and aggravates the emotional and behavioural responses to menstrual symptomatology and leads to the likelihood of PMDD. Menstrual pain may also increase anxiety, tension, sensitivity to rejection by others and irritability. This was supported by the studies conducted in Nigeria,^{11 47} Ethiopia,^{14 48} Pakistan,^{27 28 49} Egypt²⁹ and Iran.⁴² The odds of developing PMDD was higher among the students who had high academic stress compared with those who had no such stress. The possible reason might be that when individuals become more stressed, their concentration in studies and coping mechanism for life events decreases, and this leads to the development of anxiety and depressive symptoms like tension, sense of difficulty to control oneself, depressed mood and irritability. With stressful life events, the level of cortisol increases, which in turn worsens the premenstrual symptoms. Premenstrual symptoms like anger and irritability may be associated with stress-related premenstrual decline in brain serotonin function, resulting in the worsening of cardinal mood symptoms.⁵⁰ This was in agreement with other studies conducted in Spain,⁵¹ Iowa in the USA^{52 53} and India.⁵⁴

Strength and limitation of this study

We used adequate sample for the study using appropriate sampling technique and data collection procedure. Since the study design was cross-sectional, it could not establish the temporal association between PMDD and identified risk factors. The severity of pain was self-reported and therefore it was subjected to social desirability and recall bias which is common to all questionnaire-based studies, as what one regards as moderate might be regarded as mild or severe by another. Comorbid mental illness was not assessed, so students with mental health problem might present symptoms overlapping with the symptoms of PMS. Since the study was conducted in a single institution, it is difficult to generalise for other students.

CONCLUSION

The magnitude of PMDD was high compared with the general population. Severe level of menstrual pain, perception of an impact of menstrual pain on academic performance and perceived stress were factors significantly associated with PMDD. It needs early screening and intervention before menstrual symptoms affect students' academic performance. Stress reduction programmes may be an effective non-pharmaceutical treatment for physical and psychological symptom relief. Therefore, it is also recommended that medical and health science students should be provided with early psychological and gynaecological counselling to prevent future complications of PMDD.

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Patient consent for publication Not required.

Ethics approval Ethical clearance was obtained from the Ethical Review Board of College of Medicine and Health Sciences, University of Gondar. Written informed consent was obtained from each of the participants. Confidentiality was maintained throughout the study period. Respondents who had severe symptoms of menstrual disorders were referred to the nearby clinicians.

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Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. All data were included in the manuscript including in the table. No additional data available for this study.

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