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Magnitude of premenstrual dysphoric disorder and its correlation with academic performance among female medical and health science students at University of Gondar, Ethiopia, 2019: Cross-sectional study

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Magnitude of premenstrual dysphoric disorder and its correlation with academic performance among female medical and health science students at University of Gondar, Ethiopia, 2019: 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 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 are recruited for self-administered interview using the stratified followed by simple random sampling technique.

Measurement: Data are collected by self-administered interview. Diagnostic and statistical manual of mental disorder-fifth edition (DSM-5) is used to measure premenstrual dysphoric disorder. The Perceived Stress Scale (PSS) and the Oslo-3 social support are used to assess the factors. The data are checked, cleaned, and entered in to EPI-data version 3.1 and exported to SPSS version 21.0 for analysis. Bivariate and multivariable binary logistic regressions are used. Odds ratio with 95% confidence interval is employed to see the strength of associations between dependent and independent variables. Variables with a P-value < 0.05 in multivariable logistic regression are declared as significantly associated.

Result: 386 participants are involved in the study; with a response rate of 84.6%. The overall prevalence of premenstrual dysphoric disorder (PMDD) in this study is 34.7% (30.3 to 39.1). Severe menstrual pain (AOR = 2.90 (1.02 to 8.26)), perception of an impact on academic performance due to menstrual pain (AOR = 2.30 (1.19 to 4.45)), and high perceived stress (AOR = 3.57 (1.31 to 9.69)) are significantly associated with premenstrual dysphoric disorder among female medical and health sciences students.

Conclusion: Premenstrual dysphoric disorder 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 an impact on academic performance, and high perceived stress.
Keywords: Premenstrual Dysphoric Disorder, Magnitude, University Students, Ethiopia.

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Strength and limitation of the 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 premenstrual dysphoric disorder and identified risk factors.

- The severity of pain was self-reported and therefore it may be 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 that students with mental health problem might present symptoms overlapping with the symptoms of PMS.

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Introduction

Menstruation is the reproductive process whereby the upper two thirds of the endometrium is shed and regenerated on a repetitive basis (1). Physical or emotional symptoms are experienced by the majority of women of reproductive age group before their onset of menstruation (2).

More than 200 premenstrual symptoms have been known over the last 50 years which include three main emotional, behavioral 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 percent of women with regular menstrual cycles experience symptoms premenstrual syndrome, and 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 5-20% of women at reproductive age have moderate to severe premenstrual complaints and up to 75% of all women of reproductive age may experience symptoms of PMS. Premenstrual syndrome, which is characterized by one or more physical, emotional or behavioral symptoms during the days before menstruation, was found in 94.8% of women at reproductive age (15-49 years old) (6). In India it was shown that 12.2% had PMDD and 67% were not having interest to go to school during menstruation, and 71% were reported about 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 there was 36.1% of PMDD in the country prevalence (11). The studies conducted in other universities of Ethiopia showed that the prevalence of premenstrual dysphoric disorder ranged from 13.8% to 66.9% among medical and health science students (12-14).

Premenstrual syndrome (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 left untreated and when women faced

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with other environmental or personal stressors, the symptoms increase and the severity worsens, forming a mental disorder called premenstrual dysphoric disorder (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 for 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). Dysmenorrhea 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 menstrual related problem were associated with PMDD in other studies (30-32).

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

Objective

The aim of this study was to assess the magnitude of premenstrual dysphoric disorder and associated factors among medical and health science students at college of medicine and health science, University of Gondar, Gondar, Ethiopia.

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METHODS AND MATERIALS

Study design and period

An institution-based cross-sectional study was conducted from May to June, 2019.

Study setting

The study was conducted in University of Gondar (UoG), College of Medicine and Health Sciences (CMHS). UoG is located in Gondar town, northwest of Ethiopia. It is about 728 km far from the capital city of Ethiopia, Addis Ababa. It has latitude of 12°36′N 37°28′E with an elevation of 2133 meters above sea level. CMHS is one of the oldest educational and health service institution in Ethiopia. It was established in 1954 as public health college and training center. It is currently offering about 11 undergraduate degree and 34 postgraduate programs. In 2018/19 academic year, 1849 female students were enrolled and attended their education in CMHS.

Study participants and sampling procedure

We have 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 2018/19 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 premenstrual dysphoric disorder among female health science students from the study conducted in Wollo University, Ethiopia (14), 1.96 Z (standard normal distribution), 4% tolerable margin of error, 95% CI of certainty (alpha = 0.05), 10% non-response rate. Accordingly, the sample size was determined to be 532. But, since the number of students in college of medicine and health sciences was less than 10,000 during the study year, i.e., 1879, so we have used correction formula. So by adding 10% none response, the final sample was 456.

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Study variables

Outcome variable was premenstrual dysphoric disorder which was assessed by diagnostic and statistical manual of mental disorder-fifth edition (DSM-V). 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 gynecologic 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 by using the Amharic version of the tool for ten 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 become aware about 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 it is used to diagnose clinical PMDD in Ethiopia. Those women experiencing at least five symptoms from diagnostic criteria of DSM-V in the majority of menstrual cycles were considered as having PMDD. Those symptoms must 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 ranges from 3 to 14 and had three broad categories. According to this category, respondents who scored 3–8, 9–11 and 12-14 were considered as having poor, moderate and strong social support respectively (34). In the current study, its chrombach's alpha was 0.79, refers good reliability..

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Perceived stress

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

Data processing and analysis

Data were coded and entered in the computer using Epi-data version 3.1, and exported to Statistical Package for Social Science (SPSS) version 21 for analysis. After data cleaning, bivariate analysis was used to assess the associations between dependent and predictive variables. Adjusted odds ratio (AOR) with 95% CI was used to estimate the strength of the association. All variables associated with premenstrual dysphoric disorder, at a p-value of less than 0.2 in bivariate logistic regression, were further analyzed 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 premenstrual dysphoric disorder.

Ethical consideration

Ethical clearance was obtained from the Ethical Review Board (ERB) of UoG, CMHS. Written informed consent was obtained from each of the participants. Confidentiality of the information was kept and will be maintained for the future. During the data collection, participants were informed as they have the right to withdraw from the study at any time. Participants having severe form of premenstrual syndrome were consulted to treating clinicians working in psychiatric clinic.

Patient and public involvement

Participants, in the current study, were medical and health science students at the college of medicine and health science, 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 University of Gondar, college of medicine and health science gender office and psychiatry department for timely intervention.

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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 of this low response rate was lack of interest and limited time. The age of participants ranged from 18 to 26 with a mean age of 20.9 ± 1.66 years. Majority 284(73.6%) of the participants were orthodox Christian religion followers. Most of the respondents 317 (82.1%) were single followed by 51 (13.2%) engaged. From the total participants, 333 (86.3%) came from urban areas before they joined the university. (**Table 1**)

Table 1: Socio-demographic characteristics of female students at college of medicine and health sciences, University of Gondar, Gondar, Ethiopia, 2019. (n = 386)

Variables	Category	Frequency (n)	Percentage (%)
Age (in years)	17-20	174	45.1
	21-24	201	52.1
	>=25	11	2.8
Religion	Orthodox	284	73.6
	Muslim	16	4.1
	Protestant	78	20.2
	Catholic	8	2.1
Marital status	Married	18	4.7
	Single	317	82.1
	Engaged	51	13.2
Area they came from	Urban	333	86.3
	Rural	53	13.7
Academic year	First	73	18.9
	Second	85	22.0
	Third	99	25.6
	Fourth	89	23.1
	Fifth	40	10.4
Mothers' education	No formal education	116	30.1
	Primary school	114	29.5
	Secondary school	106	27.5
	College and above	50	12.9

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Gynecologic and obstetric related characteristics

From the total respondents, 284 (73.6%) complained menstrual pain. Of those having menstrual pain, 137 (35.5%) perceived that the menstrual pain has impact on their academic performance, ninety-nine (72.3%) missed their class at least once in their campus stay. One hundred and sixty-six (43%) respondents had family history of menstrual related problem. Of the total respondents, 223 (57.8%) had 4-5 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, coffee 51%, and only 7.1% consulted health care providers. (**Table 2**)

Table 2: Gynecologic and obstetric related characteristics of students at college of medicine and health sciences, University of Gondar, Gondar, Ethiopia, 2019. (n = 386)

Variables	Category	Frequency (n)	Percentage (n)
Age at menarche	<13	69	17.9
	13-16	269	69.7
	>16	48	12.4
Menstrual cycle	Regular	229	59.3
	Irregular	157	40.7
Menstrual pain	No	102	26.4
	Mild	34	8.8
	Moderate	138	35.8
	Severe	81	21.0
	Very severe	31	8.0
Actions they took	Painkiller	105	37.0
	Hot drinks	145	51.0
	Massage	14	4.9
	Consult specialists	20	7.1
Perception of impact on academic performance	No	147	51.8
	Yes	137	48.2
Impact of menstrual pain	Class missing	99	72.3
	Test missing	15	10.9
	Decrease result	14	10.2
	Dropout	9	6.6
Duration of menstrual bleeding	1-3 days	100	25.9
	4-5 days	223	57.8
	6-8 days	56	14.5

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	>8 days	7	1.8
Amount of menstrual bleeding	Too little	98	25.4
	Moderate	270	69.9
	Too much	18	4.7
Family history of menstrual related problems	No	220	57.0
	Yes	166	43.0

Psychosocial and substance related characteristics

Regarding psychosocial factors; among the total respondents, 216 (56%) had poor social support and one hundred seventy-four (45.1%) didn't perceive stress. Of the total respondents, 97 (25.1%), 8 (2.1%) and 4 (1%) used alcohol, khat and cigarette within the last three months respectively. (**Table 3**)

Table 3: Distribution of psychosocial and substance related characteristics among female students at college of medicine and health sciences, University of Gondar, Gondar, Ethiopia, 2019. (n = 386)

Variables	Category	Frequency (n)	Percentage (%)
Social support	Poor	216	56.0
	Moderate	95	24.6
	Strong	75	19.4
Perceived stress	No	174	45.1
	Mild	90	23.3
	Moderate	68	17.6
	Severe	54	14.0
Current us of khat	No	378	97.9
	Yes	8	2.1
Current use of alcohol	No	289	74.9
	Yes	97	25.1
Current use of cigarette	No	382	99.0
	Yes	4	1.0

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Prevalence of premenstrual dysphoric disorder

In the current study, the magnitude of premenstrual dysphoric disorder among undergraduate students in UoG, college of medicine and health sciences was 34.7% with CI (30.3, 39.1). The most commonly reported symptom was easily fatigability, or marked lack of energy (63.5%), followed by decreased interest in usual activities (58.5%). (**Table 4**)

Table 4: Proportions of premenstrual dysphoric symptoms among students at college of medicine and health science, University of Gondar, Gondar, Ethiopia, 2019. (n = 386) (According to Diagnostic and Statistical Manual of Mental Disorders - fifth edition (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	65.0
	Yes	135	35.0
Marked depressed mood, feelings of hopelessness, or self-deprecating thoughts	No	281	72.8
	Yes	105	27.2
Marked anxiety, tension, feelings of being "keyedup," or "on edge"	No	250	64.8
	Yes	136	35.2
Decreased interest in usual activities (e.g., work, school, friends, hobbies)	No	160	41.5
	Yes	226	58.5
Subjective difficulty in concentration	No	247	64.0
	Yes	139	36.0
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

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Factors associated with PMDD

In the bivariate analysis; marital status, family history of menstrual related problem, menstrual pain, impact of menstrual pain on academic performance, amount of menstrual bleeding per day, perceived stress, duration of menstrual bleeding in one cycle and history of current use of khat and cigarette were associated at a $P < 0.2$. These factors were candidates to multivariate logistic regression for further analysis. In the results of multivariate logistic regression analysis, severe menstrual pain, perceiving an impact on academic performance due to menstrual pain, and high perceived stress were significantly associated with premenstrual dysphoric disorder.

The odds of developing premenstrual dysphoric disorder was 2.30 times higher among female students who perceived an impact of menstrual pain on their academic performance than those who had not perceived (AOR = 2.30, 95% CI: 1.19, 4.45). The odds of developing premenstrual dysphoric disorder was 2.90 times higher among students having severe menstrual pain compared to those who had not menstrual pain (AOR = 2.90, 95% CI: 1.02, 8.26). The odds of developing premenstrual dysphoric disorder was 3.57 times higher among students who had high perceived stress (AOR = 3.57, 95% CI: 1.31, 9.69) compared to those who had not such stress. (**Table 5**)

Table 1: Bivariate and multivariate 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		COR (95% CI)	AOR (95% CI)
		Yes	No		
Marital status	Married	8	10	1.00	1.00
	Single	148	169	1.10 (0.42, 2.85)	1.85 (0.48, 7.22)
	Engaged	35	16	2.73 (0.91, 8.23)	0.69 (0.25, 4.22)
Menstrual pain	No	40	62	1.00	1.00
	Mild	13	21	1.02 (0.23, 2.45)	0.65 (0.47, 3.03)
	Moderate	65	73	1.44 (0.67, 3.10)	1.19 (0.49, 2.88)
	Severe	61	20	4.93 (2.09, 11.60)	**2.90 (1.10, 8.26)**
	Very severe	22	9	3.95 (1.40, 11.16)	0.88 (.22, 3.52)
Impact of menstrual pain on academic performance	No	60	87	1.00	1.00
	Yes	101	36	4.07 (2.46, 6.73)	**2.30 (1.19, 4.45)**
Duration of menstrual flow	1-3 days	40	60	1.00	1.00

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	4-5 days	110	113	1.46 (0.91, 2.36)	0.74 (0.38, 1.44)
	6-8 days	37	19	2.92 (1.48, 5.78)	1.02 (0.40, 2.61)
	>8 days	4	3	2.00 (0.43, 9.42)	0.34 (0.03, 3.39)
Amount of menstrual flow per day	Too little	40	58	1.00	1.00
	Moderate	135	135	1.45 (0.91, 2.32)	1.42 (0.72, 2.79)
	Too much	16	2	11.60 (2.53, 53.26)	5.70 (0.76, 43.00)
Family history of menstrual related problems	No	94	126	1.00	1.00
	Yes	97	69	1.88 (1.25, 2.83)	1.59 (0.92, 2.76)
Current use of khat	No	184	194	1.00	1.00
	Yes	7	1	3.68 (1.45, 9.39)	1.63 (0.46, 5.74)
Current use of cigarette	No	188	194	1.00	1.00
	Yes	3	1	3.20 (1.01, 10.11)	1.17 (0.25, 5.61)
Perceived stress	Low stress	89	112	1.00	1.00
	Moderate stress	64	42	4.00 (1.56, 10.29)	2.67 (0.46, 6.60)
	High stress	38	41	1.69 (0.37, 7.66)	**3.57 (2.31, 8.69)**

Discussion

Symptoms of premenstrual dysphoric disorder have a negative impact on academic performance of female students (36, 37).

In the current study, the magnitude of premenstrual dysphoric disorder was 34.7% with 95% CI (30.3, 39.1) which was in line with studies conducted in Ethiopia 30.9% (38), Egypt 40.5% (39) among psychiatric patients, 36.1% Nigeria (11), Korea 34.8% (40), Nepal 39.6% in nursing students and 38.9% in medical students (41) and Iran 36.3% (42). However, the finding in this study was lower than the studies conducted among college and university female students in Ethiopia 66.9% (14), Nepal 39.6% (41) and Iran 59% (43). The possible explanation for this variation might be the differences in sample size, sampling technique, method of data collection and study period. On the other hand, the magnitude of premenstrual dysphoric disorder in our study was higher than the studies conducted in Ethiopia 13.8% (12), 26.8% (13) and 27% (44). The possible reason might be due to the differences in socio-demographic characteristics, course load, study setting, population group, diagnostic tool and sample size, and the finding of this study was also higher than other study findings conducted out of Ethiopia; Jordan 7.7% (36), and India 3.7%, 12.22% (45, 46). The possible reason might be due to the differences in socio-

demographic characteristics, study population, and measurement tool used, sample size and cross-cultural differences.

Regarding the factors associated with premenstrual dysphoric disorder; students who perceived an impact of menstrual pain on academic performance were 2.30 times 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 with the premenstrual symptoms that led to difficulty of concentration and drop out/fail down from their academics. This was supported by studies conducted in (30-32). Students with severe level of menstrual pain were 2.90 times more risky for the development of PMDD than those who had no menstrual pain. The possible explanations for this association might be that dysmenorrhea causes distress and aggravates the emotional and behavioral responses to menstrual symptomatology and leads to the likelihood of PMDD. Menstrual pain also may increase anxiety, tension, sensitivity to rejection by others, and irritability. This was supported by the studies conducted in (11, 13, 14, 27-29, 42, 47, 48). The odds of developing premenstrual dysphoric disorder was 3.57 times higher among students who had severe academic stress compared to those who had not such stress. The possible reason might be that when individuals become more stressed, their concentration to study, and coping mechanism for life events decrease, and this leads to the development more anxiety and depression symptoms like tension, sense of difficulty to control one-self, depressed mood, irritability. Premenstrual symptoms like anger and irritability may be related to stress-related premenstrual decline in brain serotonin function, resulting in the worsening of cardinal mood symptoms (49). This was in agreement with other studies conducted in (50-53).

Strength and limitation of the 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 premenstrual dysphoric disorder 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 that students with mental health problem might present symptoms overlapping with the symptoms of PMS.

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Conclusion

The magnitude of premenstrual dysphoric disorder was high compared to 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 premenstrual dysphoric disorder. Since the study was conducted in a single institution, it is difficult to generalize for other students. It needs early screening and intervention before menstrual symptoms affect students' academic performance. Stress reduction programs 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 gynecological counseling to prevent future complications of PMDD.

Abbreviations

AOR: Adjusted Odd Ratio; CMHS: College of Medicine and Health Sciences; COR: Crude Odd Ratio; DSM-5: Diagnostic and Statistical Manual of mental disorder-fifth edition; ERB: Ethical Review Board; HPS: High Perceived Stress; OCP: Oral Contraceptive; PMDD: Premenstrual Dysphoric Disorder; PMS: Premenstrual Syndrome; PSS: Perceived Stress Scale; SPSS: Statistical Package for Social Science; UoG: University of Gondar

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Authors' contributions

EE: conceived the study and participated in the statistical analysis and interpretation of data; WM, DD and YM: participated in the design of the study; the review of the proposal; carried out the statistical analysis, and prepared the manuscript. All authors read and approved the final manuscript.

Ethical approval and consent to participate

Ethical clearance was obtained from the Ethical Review Board of college of medicine and health sciences, University of Gondar. Prior to participation in the study, written informed consent was obtained from each of the participants. Confidentiality of the information was maintained throughout the study period. During the data collection period, participants were informed as they have the right to withdraw from the study at any time. Respondents who had severe symptoms of menstrual disorders were referred to the nearby clinicians.

Consent for publication

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Competing interests

The authors declare that they have no competing interests.

Data sharing statement

All data were included in the manuscript including in the table. No additional data available for this study.

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Reporting checklist for cross sectional study Based on the STROBE cross sectional guidelines.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	4 & 5
Objectives	#3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	#4	Present key elements of study design early in the paper	2 & 6
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	2 & 6
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	6
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	N/A
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	7
Bias	#9	Describe any efforts to address potential sources of bias	6

Study size	#10	Explain how the study size was arrived at	6
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	N/A
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	8
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	N/A
Statistical methods	#12c	Explain how missing data were addressed	8
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	N/A
Statistical methods	#12e	Describe any sensitivity analyses	7 & 8
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	9
Participants	#13b	Give reasons for non-participation at each stage	9
Participants	#13c	Consider use of a flow diagram	N/A
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	9-12
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	9-12

Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13 & 14
Main results	#16b	Report category boundaries when continuous variables were categorized	N/A
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	N/A

Discussion

Key results	#18	Summarise key results with reference to study objectives	15 & 16
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	3 & 15
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	16
Generalisability	#21	Discuss the generalisability (external validity) of the study results	16

Other Information

Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

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Magnitude of premenstrual dysphoric disorder and its correlation with academic performance among female medical and health science students at University of Gondar, Ethiopia, 2019: 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 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 are recruited for self-administered interview using the stratified followed by simple random sampling technique.

Measurement: Data are collected by self-administered interview. Diagnostic and statistical manual of mental disorder-fifth edition (DSM-5) is used to measure premenstrual dysphoric disorder. The Perceived Stress Scale (PSS) and the Oslo-3 social support are used to assess the factors. The data are checked, cleaned, and entered into EPI-data version 3.1 and exported to SPSS version 21.0 for analysis. Bivariate and multivariable binary logistic regressions are used. Odds ratio with 95% confidence interval is employed to see the strength of associations between dependent and independent variables. Variables with a P-value < 0.05 in multivariable logistic regression are declared as significantly associated.

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

Conclusion: Premenstrual dysphoric disorder 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 an impact on academic performance, and high perceived stress.

Keywords: Premenstrual Dysphoric Disorder, Magnitude, University Students, Ethiopia.

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Strength and limitation of the 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 PMS.

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Introduction

Menstruation is the reproductive process whereby the upper two thirds of the endometrium is shed and regenerated on a repetitive basis (1). Physical or emotional symptoms are experienced by the majority of women of reproductive age group before their 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 percent of women with regular menstrual cycles experience symptoms premenstrual syndrome, and 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 5-20% of women at reproductive age have moderate to severe premenstrual complaints and up to 75% of all women of reproductive age may experience symptoms of PMS. Premenstrual syndrome, which is characterized by one or more physical, emotional or behavioral symptoms during the days before menstruation, was found in 94.8% of women at reproductive age (15-49 years old) (6). In India it was shown that 12.2% had PMDD and 67% were not having interest to go to school during menstruation, and 71% were reported about 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 there were 36.1% of PMDD in the country prevalence (11). The studies conducted in other universities of Ethiopia showed that the prevalence of premenstrual dysphoric disorder ranged from 13.8% to 66.9% among medical and health science students (12-14).

Premenstrual syndrome (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 left untreated and when women faced

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with other environmental or personal stress, the symptoms increase and the severity worsens, forming a mental disorder called premenstrual dysphoric disorder (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). Dysmenorrhea 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 premenstrual dysphoric disorder 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, this also affects their academic performance especially prior to their menstruation. If these premenstrual related problems left untreated, they increase in number and severity, and then can form a mental disorder called premenstrual dysphoric disorder which is a severe form of premenstrual syndrome. Therefore, the result of this study was intended for alarming concerned bodies to develop appropriate policies, strategic plans and intervention programs to screen and treat such premenstrual related problems early. This also aids to minimize or eliminate its negative effect on their academic achievement.

Objective

The aim of this study was to assess the magnitude of premenstrual dysphoric disorder and associated factors among medical and health science students at college of medicine and health science, University of Gondar, Gondar, Ethiopia.

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METHODS AND MATERIALS

Study design and period

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

Study participants and sampling procedure

We have 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 2018/19 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 premenstrual dysphoric disorder 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), 10% non-response rate.

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

n = minimum sample size required

p = proportion of premenstrual dysphoric disorder in previous study (66.9%)

d = tolerable margin of error (4%)

$z\alpha/2$ = standard normal distribution, 1.96 and, commonly α = 5% with 95% confidence level

$$n = (1.96)^2.0.669(1-0.669)/0.04^2$$

$$= 532$$

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But the number of female students in the University of Gondar, college of medicine and health sciences was less than 10,000 during the study year which was 1879, so we have used correction formula to calculate the final sample size (nf).

$$nf = {}^{n}/_{1 + n/N}$$

$$nf = {}^{532}/_{1 + 532/1879}$$

$$= 414$$

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

Study variables

Outcome variable was premenstrual dysphoric disorder which was assessed by diagnostic and statistical manual of mental disorder-fifth edition (DSM-V). 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 gynecologic 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 by using the Amharic version of the tool for ten 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 becoming aware about 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 it is used to diagnose clinical PMDD in Ethiopia. Those women

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experiencing at least five symptoms from diagnostic criteria of DSM-V in the majority of menstrual cycles were considered as having PMDD. These symptoms must 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 ranges from 3 to 14 and had three broad categories. According to this category, respondents who scored 3–8, 9–11 and 12-14 were considered as having poor, moderate and strong social support respectively (34). In the current study, its chrombach'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 is found to be very reliable for determining the role of stress in the etiology of psychological and behavioral disorders. Based on PSS-10, Scores ranging from 0-13 were considered to indicate low perceived stress; 14-26 moderate perceived stress, and 27-40 high perceived stress (HPS) (35). Its reliability was tested with a chrombach's alpha of 0.88.

Data processing and analysis

Data were coded and entered in the computer using Epi-data version 3.1, and exported to the Statistical Package for Social Science (SPSS) version 21 for analysis. After data cleaning, bivariate analysis was used to assess the associations between dependent and predictive variables. Adjusted odds ratio (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 premenstrual dysphoric disorder, at a p-value of less than 0.05 in the bivariate logistic regression, were further analyzed 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 premenstrual dysphoric disorder.

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Ethical consideration

Ethical clearance was obtained from the Ethical Review Board (ERB) of UoG, CMHS. Written informed consent was obtained from each of the participants. Confidentiality of the information was kept and will be maintained for the future. During the data collection, participants were informed as they have the right to withdraw from the study at any time. Participants having a severe form of premenstrual syndrome were consulted to treating clinicians working in psychiatric clinic.

Patient and public involvement

Participants, in the current study, were medical and health science students at the college of medicine and health science, 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 science, 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 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**)

Table 1: Socio-demographic characteristics and their associations with PMDD among female 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)	OR with 95% CI	P-value	OR with 95% CI	p-value
Age (in years)	18-20	42.5(57)	46.4 (117)	0.85(0.56,1.30)	0.465	0.45(0.24,1.26)	0.728
	>20	57.5(77)	53.6 (135)	1.00		1.00	
Religion	Orthodox	69.4(93)	75.7(191)	1.00		1.00	
	Protestant	23.1(31)	18.7(47)	1.36(0.81, 2.27)	0.250	1.12(0.63,1.24)	0.258

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	Others	7.5(10)	5.6(14)	1.47(0.63, 3.43)	0.376	1.02(0.34,2.98)	0.275
Marital status	Married	21.6(29)	15.9(40)	1.00		1.00	
	Single	78.4(105)	84.1(212)	1.68(2.40,4.16)	0.015	1.68(2.40,4.16)	0.015
Area they came from	Urban	88.1(118)	85.3(215)	1.00		1.00	
	Rural	11.9(16)	14.7(37)	0.79(0.42,1.48)	0.457	0.59(0.27,1.17)	0.274
Academic year	First	20.1(27)	18.3(46)	1.17(0.36,3.80)	0.789	1.08(0.15,2.56)	0.687
	Second	26.9(36)	25.4(64)	1.13(0.36,3.55)	0.841	1.03(0.24,2.65)	0.631
	Third	25.4(34)	29.8(75)	0.91(0.29,2.86)	0.867	0.57(0.11,1.84)	0.565
	Fourth	23.9(32)	22.6(57)	1.12(0.35,3.57)	0.845	0.86(0.18,3.57)	0.744
	Fifth	3.7(5)	3.9(10)	1.00		1.00	
Mothers' education	Illiterate	13.4(18)	13.5(34)	1.05(0.54,2.02)	0.886	0.92(0.45,1.84)	0.786
	Primary school	17.2(23)	16.3(41)	1.11(0.61,2.04)	0.731	1.04(0.47,1.95)	0.726
	Secondary school	28.4(38)	26.9(68)	1.11(0.66,1.85)	0.696	1.02(0.57,1.41)	0.572
	College and above	41.0(55)	43.3(109)	1.00		1.00	

Gynecologic and obstetric related characteristics

Of the total respondents, 284 (73.6%) complained menstrual pain. Of those having menstrual pain, 137 (35.5%) perceived that the menstrual pain has an impact on their academic performance, ninety-nine (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 4-5 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, coffee 51%, and only 7.1% consulted health care providers. (**Table 2**)

Table 2: PMDD associated with Gynecologic and obstetric related characteristics of students at 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)	1.00		1.00	
	13-16	68.6 (92)	70.2 (177)	0.92(0.53,1.59)	0.752	0.76(0.55,1.42)	0.275
	>16	12.7 (17)	12.3 (31)	0.97(0.45,2.08)	0.928	0.74(0.24,1.56)	0.369
Menstrual cycle	Regular	35.1 (47)	25 (63)	1.00		1.00	
	Irregular	64.9 (87)	75 (189)	0.68(0.41,1.13)	0.139.	0.52(0.35,1.12)	0.023
Menstrual pain	No	16.4 (22)	31.7 (80)	1.00		1.00	
	Mild	6.0 (8)	10.3 (26)	1.02(0.23,2.45)	0.131	1.31(0.53,3.22)	0.560
	Moderate	36.6 (49)	35.4 (89)	1.44(0.67,3.10)	0.188	1.72(0.62,4.78)	0.301
	Severe	30.6 (41)	15.9 (40)	4.93(2.09,11.60)	0.009	1.34(0.69,2.59)	0.389
	Very severe	10.4 (14)	6.7 (17)	3.95(1.40,11.16)	0.069	1.76(0.84,3.69)	0.132
Actions they took	Painkiller	42 (47)	33.7 (58)	1.00		1.00	
	Hot drinks	44.6 (50)	55.2 (95)	0.65(0.39,1.09)	0.101	0.36(0.23,1.43)	0.034

	Massage	6.3 (7)	4.1 (7)	1.23(0.40,3.76)	0.712	0.45(0.36,1.24)	0.875
	Consultation	7.1 (8)	7.0 (12)	1.23(0.29,5.20)	0.774	1.35(0.43,4.87)	0.341
Perception of impact on academic performance	No	36.6 (41)	61.6 (106)	1.00		1.00	
	Yes	63.4 (71)	38.4 (66)	4.07 (2.46, 6.73)	0.001	2.42(1.31,4.46)	0.005
Impact of pain	Class missing	72.4 (55)	69.9 (51)	0.46(0.16,1.33)	0.152	0.65(0.46,1.78)	0.025
	Test missing	7.9 (6)	16.4 (12)	1.55(0.52,4.56)	0.430	1.34(0.78,1.04)	0.145
	Decrease result	13.2 (10)	8.2 (6)	1.16(0.30,4.56)	0.833	1.02(0.36,3.56)	0.237
	Dropout	6.5 (5)	5.5 (4)	1.00		1.00	
Duration of menstrual bleeding	1-3 days	20.9 (28)	28.6 (72)	1.00		1.00	
	4-5 days	59.7 (80)	56.7 (143)	1.46 (0.91, 2.36)	0.167	0.80(0.42, 1.50)	0.479
	>=6 days	19.4 (26)	14.7 (37)	2.92 (1.48, 5.78)	0.041	0.97(0.41, 2.27)	0.941
Amount of menstrual bleeding	Too little	20.9 (28)	27.8 (70)	1.00		1.00	
	Moderate	70.1 (94)	69.8 (176)	1.46 (0.91, 2.36)	0.262	1.22(0.65,2.29)	0.545
	Too much	9.0 (12)	2.4 (6)	2.92 (1.48, 5.78)	0.003	2.18(0.65,7.34)	0.210
Family history of menstrual related problems	No	46.3 (62)	62.7 (158)	1.00		1.00	
	Yes	53.7 (72)	37.3 (94)	1.95(1.28,2.99)	0.002	1.76(1.05,2.92)	0.031

Psychosocial and substance related characteristics

Regarding psychosocial factors; among the total respondents, 246 (63.7%) had poor social support and one hundred seventy-four (45.1%) didn't perceive stress. Of the total respondents, 97 (25.1%), 8 (2.1%) and 4 (1%) used alcohol, khat and cigarette within the last three months respectively. (**Table 3**)

Table 3: Associations between PMDD and psychosocial and substance related characteristics among female 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)	OR with 95 % CI	p-value	OR with 95 % CI	p-value
Social support	Poor	63.4(85)	63.9(161)	0.66(0.17,2.52)	0.543	1.53(0.98,1.23)	0.568
	Moderate	33.6(45)	34.1(86)	0.65(0.17,2.56)	0.542	0.54(0.37, 1.02)	0.351
	Strong	3.0(4)	2.0(5)	1.00		1.00	
Perceived stress	No stress	38.8(52)	48.4(122)	1.00		1.00	
	Low stress	23.9(32)	23.0(58)	1.29(0.75,2.22)	0.349	1.13(0.45,2.02)	0.229
	Moderate stress	22.4(30)	15.1(38)	1.85(1.04,3.30)	0.037	1.65(1.01,3.30)	0.027
	High stress	14.9(20)	13.5(34)	1.38(0.73,2.62)	0.024	1.28(0.43,1.62)	0.324
Current use of khat	No	96.3(129)	98.8(249)	1.00		1.00	
	Yes	3.7(5)	1.2(3)	3.22(0.76,13.67)	0.014	2.86(0.65,12.49)	0.163
Current use of alcohol	No	71.6(96)	76.6(193)	1.00		1.00	
	Yes	28.4(38)	23.4(59)	1.29(0.81,2.08)	0.287	0.25(0.15,0.97)	0.765
Current use of cigarette	No	98.5(132)	99.2(250)	1.00		1.00	
	Yes	1.5(2)	0.8(2)	1.89(0.26,13.60)	0.025	1.61(0.21,12.36)	0.646

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Prevalence of premenstrual dysphoric disorder

In the current study, the magnitude of premenstrual dysphoric disorder among undergraduate students in UoG, college of medicine and health sciences was 34.7% with 95% CI (30.3, 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**)

Table 4: Proportions of premenstrual dysphoric symptoms among students at college of medicine and health science, 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	65.0
	Yes	135	35.0
Marked depressed mood, feelings of hopelessness, or self-deprecating thoughts	No	281	72.8
	Yes	105	27.2
Marked anxiety, tension, feelings of being "keyedup," or "on edge"	No	250	64.8
	Yes	136	35.2
Decreased interest in usual activities (e.g., work, school, friends, hobbies)	No	160	41.5
	Yes	226	58.5
Subjective difficulty in concentration	No	247	64.0
	Yes	139	36.0
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

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, six and above days of menstrual bleeding in one cycle, and current use of khat and cigarette were associated with PMDD at a p value of less than 0.05. These factors were fitted with adjusted logistic regression for further analysis. In the overall adjusted logistic regression analysis, severe

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menstrual pain, perceiving an impact on academic performance due to menstrual pain and high perceived stress were significantly associated with premenstrual dysphoric disorder.

The odds of developing premenstrual dysphoric disorder was 2.31 times higher among female students who perceived an impact of menstrual pain on their academic performance than those who had not perceived (AOR = 2.31, 95% CI: 1.23, 4.32). The odds of developing premenstrual dysphoric disorder was 2.82 times higher among students having severe menstrual pain compared to those who had not menstrual pain (AOR = 2.82, 95% CI: 1.83, 4.23). The odds of developing premenstrual dysphoric disorder was also 3.52 times higher among students who had high perceived stress (AOR = 3.52, 95% CI: 2.58, 5.60) compared to those who had not such stress. (**Table 5**)

Table 1: 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)	1.00		1.00	
	Single	78.4(105)	84.1(212)	1.68(2.40,4.16)	0.015	0.72(0.35, 1.50)	0.382
Menstrual pain	No	16.4 (22)	31.7 (80)	1.00		1.00	
	Mild	6.0 (8)	10.3 (26)	1.02 (0.23, 2.45)	0.131	1.36(0.54, 3.45)	0.517
	Moderate	36.6 (49)	35.4 (89)	1.44 (0.67, 3.10)	0.188	1.82(0.630,5.24)	0.269
	Severe	30.6 (41)	15.9 (40)	4.93 (2.09, 11.60)	0.009	**2.82(1.83,4.23)**	**0.023**
	Very severe	10.4 (14)	6.7 (17)	3.95 (1.40, 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)	1.00		1.00	
	Yes	63.4 (71)	38.4 (66)	4.07 (2.46, 6.73)	0.001	**2.31(1.23, 4.32)**	**0.009**
Duration of menstrual bleeding	1-3 days	20.9 (28)	28.6 (72)	1.00		1.00	
	4-5 days	59.7 (80)	56.7 (143)	1.78(0.82, 2.57)	0.167	0.79(0.42,1.51)	0.475
	>=6 days	19.4 (26)	14.7 (37)	2.73(1.05, 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)	1.00		1.00	
	Moderate	70.1 (94)	69.8 (176)	1.45(0.91, 2.32)	0.262	1.24(0.64, 2.39)	0.521
	Too much	9.0 (12)	2.4 (6)	11.60(2.53, 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)	1.00		1.00	
	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)	1.00		1.00	
	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)	1.00		1.00	
	Yes	1.5(2)	0.8(2)	3.20(1.01,10.11)	0.025	1.17 (0.25, 5.61)	
Perceived stress	No stress	38.8(52)	48.4(122)	1.00		1.00	

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)	0.140
High stress	14.9(20)	13.5(34)	1.38(0.73,2.62)	0.024	**3.52(2.58,5.60)**	**0.001**

Discussion

Symptoms of premenstrual dysphoric disorder have a negative impact on academic performance of female students (36, 37). Therefore, it needs to determine the prevalence of PMDD, and identify the predictors associated with it. This also helps to prevent the problem and to prepare treatment strategies that promote the academic performance among female university students.

In the current study, the magnitude of premenstrual dysphoric disorder was 34.7% with 95% CI (30.3, 39.1) which was marginally similar with studies conducted in another area of Ethiopia 30.9% (38), Egypt 40.5% (39), Nigeria 36.1% (11), Korea 34.8% (40), Nepal 38.9% of medical students (41) and Iran 36.3% (42). However, the magnitude of PMDD in this study was lower than the studies conducted among female students in Ethiopia 66.9% (14), Nepal 39.6% (41) and Iran 59% (43). The possible explanation for this difference might be sample size (254), socio-demographic characteristics and data collection period (February 1-15, 2017) among female students of college of medicine & health science, Wollo University, Ethiopia. The prevalence of premenstrual dysphoric disorder in the current study was lower than the prevalence among nursing students of a tertiary care teaching hospital in Nepal due to the different possible reasons like differences in socio-demographic characteristics, level of academic stress, course load and study setting. In a study done in Iranian adolescent school girls, the prevalence was reported as highly prevalent. This variation could be differences in measurement tool (Premenstrual Assessment Scale (PAS)), sample size (1379), socio-culture, sampling technique and being young as the contribution of mixed psychobiological signs and symptoms of premenstrual problem. On the other hand, the magnitude of premenstrual dysphoric disorder in this study was higher than the studies conducted in another area of Ethiopia 13.8% (12), 26.8% (13) and 27% (44), Jordan 7.7% (36), and India 3.7%, 12.22% (45, 46). In studies conducted in 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

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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 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, a sensation of "bloating," weight gain (56.5%). It was consistent with the study findings indicated in Mekelle University, Ethiopia (12, 31, 44), Iran (42) and India (45). Sense of being overwhelmed or out of control 17.1% and marked depressed mood, feelings 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 hyper-vigilant with the premenstrual symptoms that led to difficulty of concentration, missing class, dysmenorrhea (menstrual pain) and dropout/fail from their academics. This was supported by studies conducted in other areas of Ethiopia and Kingdom of Saudi Arabia (30-32). Students with severe menstrual pain were more risky for the development of PMDD compared to those who had no menstrual pain. The possible explanations for this association might be menstrual pain or dysmenorrhea that causes distress and aggravates the emotional and behavioral responses to menstrual symptomatology and leads to the likelihood of PMDD. Menstrual pain also may 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), Egypt (29) and Iran (42). The odds of developing premenstrual dysphoric disorder was higher among the students who had high academic stress compared to those who had not such stress. The possible reason might be that when individuals become more stressed, their concentration to study, and coping mechanism for life events decrease, and this leads to the development of anxiety and depressive symptoms like tension, sense of difficulty to control one-self, depressed mood, irritability. With stressful life events, the level of cortisol increases, which in turn worsen the premenstrual symptoms. Premenstrual symptoms like anger and irritability

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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), US, Iowa (52, 53), and India (54).

Strength and limitation of the 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 premenstrual dysphoric disorder 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 that students with mental health problem might present symptoms overlapping with the symptoms of PMS.

Conclusion

The magnitude of premenstrual dysphoric disorder was high compared to 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 premenstrual dysphoric disorder. Since the study was conducted in a single institution, it is difficult to generalize for other students. It needs early screening and intervention before menstrual symptoms affect students' academic performance. Stress reduction programs 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 gynecological counseling to prevent future complications of PMDD.

Abbreviations

AOR: Adjusted Odd Ratio; CMHS: College of Medicine and Health Sciences; COR: Crude Odd Ratio; DSM-5: Diagnostic and Statistical Manual of mental disorder-fifth edition; ERB: Ethical Review Board; HPS: High Perceived Stress; OCP: Oral Contraceptive; PMDD: Premenstrual Dysphoric Disorder; PMS: Premenstrual Syndrome; PSS: Perceived Stress Scale; SPSS: Statistical Package for Social Science; UoG: University of Gondar

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Authors' contributions

EE: conceived the study and participated in the statistical analysis and interpretation of data; WM, DD and YM: participated in the design of the study; the review of the proposal; carried out the statistical analysis, and prepared the manuscript. All authors read and approved the final manuscript.

Ethical approval and consent to participate

Ethical clearance was obtained from the Ethical Review Board of college of medicine and health sciences, University of Gondar. Prior to participation in the study, written informed consent was obtained from each of the participants. Confidentiality of the information was maintained throughout the study period. During the data collection period, participants were informed as they have the right to withdraw from the study at any time. Respondents who had severe symptoms of menstrual disorders were referred to the nearby clinicians.

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Data sharing statement

All data were included in the manuscript including in the table. No additional data available for this study.

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Magnitude of premenstrual dysphoric disorder and its correlation with academic performance among female medical and health science students at University of Gondar, Ethiopia, 2019: 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 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 are recruited for self-administered interview using the stratified followed by simple random sampling technique.

Measurement: Data are collected by self-administered interview. Diagnostic and statistical manual of mental disorder-fifth edition (DSM-5) is used to measure premenstrual dysphoric disorder. The Perceived Stress Scale (PSS) and the Oslo-3 social support are used to assess the factors. The data are checked, cleaned, and entered into EPI-data version 3.1 and exported to SPSS version 21.0 for analysis. Bivariate and multivariable binary logistic regressions are used. Odds ratio with 95% confidence interval is employed to see the strength of associations between dependent and independent variables. Variables with a P-value < 0.05 in multivariable logistic regression are declared as significantly associated.

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

Conclusion: Premenstrual dysphoric disorder 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 an impact on academic performance, and high perceived stress.
Keywords: Premenstrual Dysphoric Disorder, Magnitude, University Students, Ethiopia.

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Strength and limitation of the 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 PMS.

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Introduction

Menstruation is the reproductive process whereby the upper two thirds of the endometrium is shed and regenerated on a repetitive basis (1). Physical or emotional symptoms are experienced by the majority of women of reproductive age group before their onset of menstruation (2).

More than 200 premenstrual symptoms have been known over the last 50 years, which include three main emotional, behavioral 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 percent of women with regular menstrual cycles experience symptoms premenstrual syndrome, and 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 5-20% of women at reproductive age have moderate to severe premenstrual complaints and up to 75% of all women of reproductive age may experience symptoms of PMS. Premenstrual syndrome, which is characterized by one or more physical, emotional or behavioral symptoms during the days before menstruation, was found in 94.8% of women at reproductive age (15-49 years old) (6). In India it was shown that 12.2% had PMDD and 67% were not having interest to go to school during menstruation, and 71% were reported about 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 there were 36.1% of PMDD in the country prevalence (11). The studies conducted in other universities of Ethiopia showed that the prevalence of premenstrual dysphoric disorder ranged from 13.8% to 66.9% among medical and health science students (12-14).

Premenstrual syndrome (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 left untreated and when women faced

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with other environmental or personal stress, the symptoms increase and the severity worsens, forming a mental disorder called premenstrual dysphoric disorder (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). Dysmenorrhea 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 premenstrual dysphoric disorder 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, this also affects their academic performance especially prior to their menstruation. If these premenstrual related problems left untreated, they increase in number and severity, and then can form a mental disorder called premenstrual dysphoric disorder which is a severe form of premenstrual syndrome. Therefore, the result of this study was intended for alarming concerned bodies to develop appropriate policies, strategic plans and intervention programs to screen and treat such premenstrual related problems early. This also aids to minimize or eliminate its negative effect on their academic achievement.

Objective

The aim of this study was to assess the magnitude of premenstrual dysphoric disorder and associated factors among medical and health science students at college of medicine and health science, University of Gondar, Gondar, Ethiopia.

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METHODS AND MATERIALS

Study design and period

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

Study participants and sampling procedure

We have 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 2018/19 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 premenstrual dysphoric disorder 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), 10% non-response rate.

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

n = minimum sample size required

p = proportion of premenstrual dysphoric disorder in previous study (66.9%)

d = tolerable margin of error (4%)

$z\alpha/2$ = standard normal distribution, 1.96 and, commonly α = 5% with 95% confidence level

$$n = (1.96)^2.0.669(1-0.669)/0.04^2$$

$$= 532$$

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But the number of female students in the University of Gondar, college of medicine and health sciences was less than 10,000 during the study year which was 1879, so we have used correction formula to calculate the final sample size (nf).

$$nf = {}^{n}/_{1 + n/N}$$

$$nf = {}^{532}/_{1 + 532/1879}$$

$$= 414$$

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

Study variables

Outcome variable was premenstrual dysphoric disorder which was assessed by diagnostic and statistical manual of mental disorder-fifth edition (DSM-V). 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 gynecologic 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 by using the Amharic version of the tool for ten 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 becoming aware about 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 it is used to diagnose clinical PMDD in Ethiopia. Those women

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experiencing at least five symptoms from diagnostic criteria of DSM-V in the majority of menstrual cycles were considered as having PMDD. These symptoms must 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 ranges from 3 to 14 and had three broad categories. According to this category, respondents who scored 3–8, 9–11 and 12-14 were considered as having poor, moderate and strong social support respectively (34). In the current study, its chrombach'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 is found to be very reliable for determining the role of stress in the etiology of psychological and behavioral disorders. Based on PSS-10, Scores ranging from 0-13 were considered to indicate low perceived stress; 14-26 moderate perceived stress, and 27-40 high perceived stress (HPS) (35). Its reliability was tested with a chrombach's alpha of 0.88.

Data processing and analysis

Data were coded and entered in the computer using Epi-data version 3.1, and exported to the Statistical Package for Social Science (SPSS) version 21 for analysis. After data cleaning, bivariate analysis was used to assess the associations between dependent and predictive variables. Adjusted odds ratio (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 premenstrual dysphoric disorder, at a p-value of less than 0.05 in the bivariate logistic regression, were further analyzed 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 premenstrual dysphoric disorder.

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Ethical consideration

Ethical clearance was obtained from the Ethical Review Board (ERB) of University of Gondar, College of Medicine and Health Science. Written informed consent was obtained from each of the participants. Confidentiality of the information was kept and will be maintained for the future. During the data collection, participants were informed as they have the right to withdraw from the study at any time. Participants having a severe form of premenstrual syndrome were consulted to treating clinicians working in psychiatric clinic.

Patient and public involvement

Participants, in the current study, were medical and health science students at the college of medicine and health science, 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 science, 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 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**)

Table 1: Socio-demographic characteristics and their associations with PMDD among female 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)	OR with 95% CI	P-value	OR with 95% CI	p-value
Age (in years)	18-20	42.5(57)	46.4 (117)	0.85(0.56,1.30)	0.465	0.45(0.24,1.26)	0.728
	>20	57.5(77)	53.6 (135)	1.00		1.00	
Religion	Orthodox	69.4(93)	75.7(191)	1.00		1.00	
	Protestant	23.1(31)	18.7(47)	1.36(0.81, 2.27)	0.250	1.12(0.63,1.24)	0.258

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	Others	7.5(10)	5.6(14)	1.47(0.63, 3.43)	0.376	1.02(0.34,2.98)	0.275
Marital status	Married	21.6(29)	15.9(40)	1.00		1.00	
	Single	78.4(105)	84.1(212)	1.68(2.40,4.16)	0.015	1.68(2.40,4.16)	0.015
Area they came from	Urban	88.1(118)	85.3(215)	1.00		1.00	
	Rural	11.9(16)	14.7(37)	0.79(0.42,1.48)	0.457	0.59(0.27,1.17)	0.274
Academic year	First	20.1(27)	18.3(46)	1.17(0.36,3.80)	0.789	1.08(0.15,2.56)	0.687
	Second	26.9(36)	25.4(64)	1.13(0.36,3.55)	0.841	1.03(0.24,2.65)	0.631
	Third	25.4(34)	29.8(75)	0.91(0.29,2.86)	0.867	0.57(0.11,1.84)	0.565
	Fourth	23.9(32)	22.6(57)	1.12(0.35,3.57)	0.845	0.86(0.18,3.57)	0.744
	Fifth	3.7(5)	3.9(10)	1.00		1.00	
Mothers' education	Illiterate	13.4(18)	13.5(34)	1.05(0.54,2.02)	0.886	0.92(0.45,1.84)	0.786
	Primary school	17.2(23)	16.3(41)	1.11(0.61,2.04)	0.731	1.04(0.47,1.95)	0.726
	Secondary school	28.4(38)	26.9(68)	1.11(0.66,1.85)	0.696	1.02(0.57,1.41)	0.572
	College and above	41.0(55)	43.3(109)	1.00		1.00	

Gynecologic and obstetric related characteristics

Of the total respondents, 284 (73.6%) complained menstrual pain. Of those having menstrual pain, 137 (35.5%) perceived that the menstrual pain has an impact on their academic performance, ninety-nine (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 4-5 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, coffee 51%, and only 7.1% consulted health care providers. (**Table 2**)

Table 2: PMDD associated with Gynecologic and obstetric related characteristics of students at 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)	1.00		1.00	
	13-16	68.6 (92)	70.2 (177)	0.92(0.53,1.59)	0.752	0.76(0.55,1.42)	0.275
	>16	12.7 (17)	12.3 (31)	0.97(0.45,2.08)	0.928	0.74(0.24,1.56)	0.369
Menstrual cycle	Regular	35.1 (47)	25 (63)	1.00		1.00	
	Irregular	64.9 (87)	75 (189)	0.68(0.41,1.13)	0.139.	0.52(0.35,1.12)	0.023
Menstrual pain	No	16.4 (22)	31.7 (80)	1.00		1.00	
	Mild	6.0 (8)	10.3 (26)	1.02(0.23,2.45)	0.131	1.31(0.53,3.22)	0.560
	Moderate	36.6 (49)	35.4 (89)	1.44(0.67,3.10)	0.188	1.72(0.62,4.78)	0.301
	Severe	30.6 (41)	15.9 (40)	4.93(2.09,11.60)	0.009	1.34(0.69,2.59)	0.389
	Very severe	10.4 (14)	6.7 (17)	3.95(1.40,11.16)	0.069	1.76(0.84,3.69)	0.132
Actions they took	Painkiller	42 (47)	33.7 (58)	1.00		1.00	
	Hot drinks	44.6 (50)	55.2 (95)	0.65(0.39,1.09)	0.101	0.36(0.23,1.43)	0.034

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	Massage	6.3 (7)	4.1 (7)	1.23(0.40,3.76)	0.712	0.45(0.36,1.24)	0.875
	Consultation	7.1 (8)	7.0 (12)	1.23(0.29,5.20)	0.774	1.35(0.43,4.87)	0.341
Perception of impact on academic performance	No	36.6 (41)	61.6 (106)	1.00		1.00	
	Yes	63.4 (71)	38.4 (66)	4.07 (2.46, 6.73)	0.001	2.42(1.31,4.46)	0.005
Impact of pain	Class missing	72.4 (55)	69.9 (51)	0.46(0.16,1.33)	0.152	0.65(0.46,1.78)	0.025
	Test missing	7.9 (6)	16.4 (12)	1.55(0.52,4.56)	0.430	1.34(0.78,1.04)	0.145
	Decrease result	13.2 (10)	8.2 (6)	1.16(0.30,4.56)	0.833	1.02(0.36,3.56)	0.237
	Dropout	6.5 (5)	5.5 (4)	1.00		1.00	
Duration of menstrual bleeding	1-3 days	20.9 (28)	28.6 (72)	1.00		1.00	
	4-5 days	59.7 (80)	56.7 (143)	1.46 (0.91, 2.36)	0.167	0.80(0.42, 1.50)	0.479
	>=6 days	19.4 (26)	14.7 (37)	2.92 (1.48, 5.78)	0.041	0.97(0.41, 2.27)	0.941
Amount of menstrual bleeding	Too little	20.9 (28)	27.8 (70)	1.00		1.00	
	Moderate	70.1 (94)	69.8 (176)	1.46 (0.91, 2.36)	0.262	1.22(0.65,2.29)	0.545
	Too much	9.0 (12)	2.4 (6)	2.92 (1.48, 5.78)	0.003	2.18(0.65,7.34)	0.210
Family history of menstrual related problems	No	46.3 (62)	62.7 (158)	1.00		1.00	
	Yes	53.7 (72)	37.3 (94)	1.95(1.28,2.99)	0.002	1.76(1.05,2.92)	0.031

Psychosocial and substance related characteristics

Regarding psychosocial factors; among the total respondents, 246 (63.7%) had poor social support and one hundred seventy-four (45.1%) didn't perceive stress. Of the total respondents, 97 (25.1%), 8 (2.1%) and 4 (1%) used alcohol, khat and cigarette within the last three months respectively. (**Table 3**)

Table 3: Associations between PMDD and psychosocial and substance related characteristics among female 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)	OR with 95 % CI	p-value	OR with 95 % CI	p-value
Social support	Poor	63.4(85)	63.9(161)	0.66(0.17,2.52)	0.543	1.53(0.98,1.23)	0.568
	Moderate	33.6(45)	34.1(86)	0.65(0.17,2.56)	0.542	0.54(0.37, 1.02)	0.351
	Strong	3.0(4)	2.0(5)	1.00		1.00	
Perceived stress	No stress	38.8(52)	48.4(122)	1.00		1.00	
	Low stress	23.9(32)	23.0(58)	1.29(0.75,2.22)	0.349	1.13(0.45,2.02)	0.229
	Moderate stress	22.4(30)	15.1(38)	1.85(1.04,3.30)	0.037	1.65(1.01,3.30)	0.027
	High stress	14.9(20)	13.5(34)	1.38(0.73,2.62)	0.024	1.28(0.43,1.62)	0.324
Current use of khat	No	96.3(129)	98.8(249)	1.00		1.00	
	Yes	3.7(5)	1.2(3)	3.22(0.76,13.67)	0.014	2.86(0.65,12.49)	0.163
Current use of alcohol	No	71.6(96)	76.6(193)	1.00		1.00	
	Yes	28.4(38)	23.4(59)	1.29(0.81,2.08)	0.287	0.25(0.15,0.97)	0.765
Current use of cigarette	No	98.5(132)	99.2(250)	1.00		1.00	
	Yes	1.5(2)	0.8(2)	1.89(0.26,13.60)	0.025	1.61(0.21,12.36)	0.646

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Prevalence of premenstrual dysphoric disorder

In the current study, the magnitude of premenstrual dysphoric disorder among undergraduate students in UoG, college of medicine and health sciences was 34.7% with 95% CI (30.3, 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**)

Table 4: Proportions of premenstrual dysphoric symptoms among students at college of medicine and health science, 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	65.0
	Yes	135	35.0
Marked depressed mood, feelings of hopelessness, or self-deprecating thoughts	No	281	72.8
	Yes	105	27.2
Marked anxiety, tension, feelings of being "keyedup," or "on edge"	No	250	64.8
	Yes	136	35.2
Decreased interest in usual activities (e.g., work, school, friends, hobbies)	No	160	41.5
	Yes	226	58.5
Subjective difficulty in concentration	No	247	64.0
	Yes	139	36.0
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

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, six and above days of menstrual bleeding in one cycle, and current use of khat and cigarette were associated with PMDD at a p value of less than 0.05. These factors were fitted with adjusted logistic regression for further analysis. In the overall adjusted logistic regression analysis, severe

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menstrual pain, perceiving an impact on academic performance due to menstrual pain and high perceived stress were significantly associated with premenstrual dysphoric disorder.

The odds of developing premenstrual dysphoric disorder was 2.31 times higher among female students who perceived an impact of menstrual pain on their academic performance than those who had not perceived (AOR = 2.31, 95% CI: 1.23, 4.32). The odds of developing premenstrual dysphoric disorder was 2.82 times higher among students having severe menstrual pain compared to those who had not menstrual pain (AOR = 2.82, 95% CI: 1.83, 4.23). The odds of developing premenstrual dysphoric disorder was also 3.52 times higher among students who had high perceived stress (AOR = 3.52, 95% CI: 2.58, 5.60) compared to those who had not such stress. (**Table 5**)

Table 1: 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)	1.00		1.00	
	Single	78.4(105)	84.1(212)	1.68(2.40,4.16)	0.015	0.72(0.35, 1.50)	0.382
Menstrual pain	No	16.4 (22)	31.7 (80)	1.00		1.00	
	Mild	6.0 (8)	10.3 (26)	1.02 (0.23, 2.45)	0.131	1.36(0.54, 3.45)	0.517
	Moderate	36.6 (49)	35.4 (89)	1.44 (0.67, 3.10)	0.188	1.82(0.630,5.24)	0.269
	Severe	30.6 (41)	15.9 (40)	4.93 (2.09, 11.60)	0.009	**2.82(1.83,4.23)**	**0.023**
	Very severe	10.4 (14)	6.7 (17)	3.95 (1.40, 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)	1.00		1.00	
	Yes	63.4 (71)	38.4 (66)	4.07 (2.46, 6.73)	0.001	**2.31(1.23, 4.32)**	**0.009**
Duration of menstrual bleeding	1-3 days	20.9 (28)	28.6 (72)	1.00		1.00	
	4-5 days	59.7 (80)	56.7 (143)	1.78(0.82, 2.57)	0.167	0.79(0.42,1.51)	0.475
	>=6 days	19.4 (26)	14.7 (37)	2.73(1.05, 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)	1.00		1.00	
	Moderate	70.1 (94)	69.8 (176)	1.45(0.91, 2.32)	0.262	1.24(0.64, 2.39)	0.521
	Too much	9.0 (12)	2.4 (6)	11.60(2.53, 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)	1.00		1.00	
	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)	1.00		1.00	
	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)	1.00		1.00	
	Yes	1.5(2)	0.8(2)	3.20(1.01,10.11)	0.025	1.17 (0.25, 5.61)	
Perceived stress	No stress	38.8(52)	48.4(122)	1.00		1.00	

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)	0.140
High stress	14.9(20)	13.5(34)	1.38(0.73,2.62)	0.024	**3.52(2.58,5.60)**	**0.001**

Discussion

Symptoms of premenstrual dysphoric disorder have a negative impact on academic performance of female students (36, 37). Therefore, it needs to determine the prevalence of PMDD, and identify the predictors associated with it. This also helps to prevent the problem and to prepare treatment strategies that promote the academic performance among female university students.

In the current study, the magnitude of premenstrual dysphoric disorder was marginally similar with studies conducted in another area of Ethiopia 30.9% (38), Egypt 40.5% (39), Nigeria 36.1% (11), Korea 34.8% (40), Nepal 38.9% of medical students (41) and Iran 36.3% (42). However, the magnitude of PMDD in this study was lower than the studies conducted among female students in other part of Ethiopia 66.9% (14), Nepal 39.6% nursing students (41) and Iran 59% (43). The possible explanation for this difference might be: smaller sample size (254), socio-demographic characteristics, time of data collection (February 1-15, 2017), curriculum difference. In Wollo University, Ethiopia, medical students joined the University by losing their work, salary and spousal affiliation that 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 school girls was high compared to the current study finding. The possible variation for this difference could be tool difference (Premenstrual Assessment Scale (PAS)), sample size (1379), socio-culture, 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 premenstrual dysphoric disorder in this study was higher than the studies conducted in another area of Ethiopia 13.8% (12), 26.8% (13) and 27% (44), Jordan 7.7% (36), and India 3.7%, 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

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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 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, a sensation of "bloating," weight gain (56.5%). It was consistent with the study findings indicated in Mekelle University, Ethiopia (12, 31, 44), Iran (42) and India (45). Sense of being overwhelmed or out of control 17.1% and marked depressed mood, feelings 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 hyper-vigilant with the premenstrual symptoms that led to difficulty of concentration, missing class, dysmenorrhea (menstrual pain) and dropout/fail from their academics. This was supported by studies conducted in other areas of Ethiopia and Kingdom of Saudi Arabia (30-32). Students with severe menstrual pain were more risky for the development of PMDD compared to those who had no menstrual pain. The possible explanations for this association might be menstrual pain or dysmenorrhea that causes distress and aggravates the emotional and behavioral responses to menstrual symptomatology and leads to the likelihood of PMDD. Menstrual pain also may 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), Egypt (29) and Iran (42). The odds of developing premenstrual dysphoric disorder was higher among the students who had high academic stress compared to those who had not such stress. The possible reason might be that when individuals become more stressed, their concentration to study, and coping mechanism for life events decrease, and this leads to the development of anxiety and depressive symptoms like tension, sense of difficulty to control one-

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self, depressed mood, irritability. With stressful life events, the level of cortisol increases, which in turn worsen 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), US, Iowa (52, 53), and India (54).

Strength and limitation of the 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 premenstrual dysphoric disorder 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 that 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 generalize for other students.

Conclusion

The magnitude of premenstrual dysphoric disorder was high compared to 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 premenstrual dysphoric disorder. It needs early screening and intervention before menstrual symptoms affect students' academic performance. Stress reduction programs 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 gynecological counseling to prevent future complications of PMDD.

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Abbreviations: AOR: Adjusted Odd Ratio; CMHS: College of Medicine and Health Sciences; COR: Crude Odd Ratio; DSM-5: Diagnostic and Statistical Manual of mental disorder-fifth edition; ERB: Ethical Review Board; HPS: High Perceived Stress; OCP: Oral Contraceptive; PMDD: Premenstrual Dysphoric Disorder; PMS: Premenstrual Syndrome; PSS: Perceived Stress Scale; SPSS: Statistical Package for Social Science; UoG: University of Gondar

Authors' contributions: EE: conceived the study and participated in the statistical analysis and interpretation of data; WM, DD and YM: participated in the design of the study; the review of the proposal; carried out the statistical analysis, and prepared the manuscript. All authors read and approved the final manuscript.

Ethical approval and consent to participate: 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 sharing statement: All data were included in the manuscript including in the table. No additional data available for this study.

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