BMJ Public Health

Depression and its association with menstrual disturbance among female university students: a cross-sectional study

Shangida Khatun Eva, Saqib Salah Aufi, Abu Sayed Md Al Mamun, Md Sabiruzzaman, Md Abdul Wadood, Md Golam Hossain

To cite: Eva SK, Aufi SS, Mamun ASMA, *et al*. Depression and its association with menstrual disturbance among female university students: a cross-sectional study. *BMJ Public Health* 2024;**2**:e000716. doi:10.1136/bmjph-2023-000716

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/bmjph-2023-000716).

Received 1 November 2023
Accepted 27 September 2024

University of Rajshahi, Rajshahi, Bangladesh

Correspondence to
Dr Md Golam Hossain;
hossain95@yahoo.com

ABSTRACT

Background Depression and menstrual disturbance are common issues among female university students worldwide. Various studies in different countries have revealed a potential connection between depression and menstrual disturbance. However, no research specifically focusing on this relationship has been conducted with the Bangladeshi population. Thus, we aimed to investigate the prevalence of depression and its impact on menstrual disturbance among female university students in Bangladesh.

Methods Data were collected from 470 female students of the University of Rajshahi in Bangladesh between September and November 2022. A multistage stratified random sampling method was employed to select a sample from the population. Depression severity was assessed using the nine-item Patient Health Questionnaire, categorising it as normal, depressive symptoms and probable depression. Two menstrual disturbances, irregular and painful menstruation, were considered. The factors associated with depression were examined using an ordinal logistic regression model.

Results The findings indicated that 45.5% of female university students exhibited depressive symptoms, while 30.9% have probable depression. Additionally, 71% experienced menstrual pain and 17.7% reported irregular menstruation. Factors significantly associated with probable depression ($p<0.05$) included being underweight; paternal occupation other than a farmer, having a job or being in business; low-income and middle-income family; and having a chronic disease. Furthermore, students with depressive symptoms and probable depression were found to be at higher risk of experiencing menstrual disturbances, particularly painful and irregular menstruation. Specifically, those with depressive symptoms and probable depression were more likely to report painful menstruation.

Conclusion In this study, it was noted that a notable proportion of female students were experiencing probable depression, which was found to have an association with menstrual disturbance. It is advisable that healthcare providers and university authorities prioritise the mental and reproductive health of female students for their holistic well-being.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The prevalence of depression and menstrual disturbances among female university students is a well-documented issue.
⇒ It is known that depression significantly contributes to menstrual disturbances.

WHAT THIS STUDY ADDS

⇒ This study emphasises that menstrual disturbances can stem from various factors such as pregnancy, hormonal imbalances, infections, diseases, trauma and certain medications.
⇒ Addressing the relationship between depression and menstrual disturbances among female university students requires a comprehensive biopsychosocial approach.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Considering the vital role of female university students in the workforce and the future productivity of a nation, the findings of this study can be valuable for healthcare providers and university authorities in addressing mental and reproductive health challenges among students.

INTRODUCTION

Depression is an emotional disorder and is considered one of the four major diseases worldwide, as well as a leading cause of disability.[1 2] It often begins during adolescence and young adulthood, with university students being particularly vulnerable to its onset. University students are transitioning from adolescence to adulthood, which is a critical period of biopsychological growth. It is also the most stressful time in their lives.[3] They face various challenges including academic pressure, fear of failure, time demands, loneliness, changes in living arrangements and lifestyle, financial pressures, low self-esteem and employment pressure.[2 4] Many students

experience anxiety as they strive to maintain good grades, plan for the future and adapt to being away from home. Depression not only affects their academic performance but also impacts their future success.[4] Research shows that depression among university students is prevalent worldwide and is on the rise.[2 5] Female students are more likely than male students to experience symptoms of depression, with factors like menstrual disturbances contributing to the higher rates.[5]

Researchers have defined menstrual health as a state of complete physical, mental and social well-being in relation to the menstrual cycle, rather than just the absence of disease or infirmity.[6] Among female university students in Bangladesh, menstrual disturbances such as pain during menstruation and irregular periods are quite common.[7] These disturbances can be caused by various factors such as pregnancy, hormonal imbalances, infections, diseases, trauma and certain medications.[8] Additionally, previous studies have linked depression to an increased risk of menstrual irregularities and severe premenstrual symptoms.[9]

University students play a crucial role in their nation's workforce and future productivity. It is important to pay special attention to their mental and reproductive health. Understanding the connection between depression and menstrual disorders among female university students is essential for several reasons. First, it can help healthcare professionals and university support services identify and address the unique needs of this population through appropriate interventions and support systems. Second, recognising the link between mental health and reproductive health can lead to comprehensive approaches in educational institutions that promote students' overall well-being. While many studies have explored the relationship between depression and menstrual disturbances in different populations worldwide,[10 11] there is scant research on this topic among Bangladeshi university students.[12 13] There is no available research on the relationship between depression and menstrual disturbances among Bangladeshi female university students in the contemporary time. Therefore, the authors aimed to identify the factors associated with depression and examine the link between depression and menstrual disturbance among female university students in Bangladesh.

Research questions of the study

The following are the key research questions of the present study:

1. What is the prevalence of depression among female university students in Bangladesh?
2. What are the associated factors of depression among female university students?
3. Is depression a predictor of menstrual disturbance among female university students?

The authors hope and believe that the answers to these research questions will help improve the health policy of the concerned authorities and overcome the problems of the population.

METHODS

Study design and setting

The cross-sectional study was conducted at Rajshahi University (RU) in Bangladesh from September to November 2022. Data were collected from female students. RU is the second largest university in Bangladesh and attracts students from across the country. The campus has 18 residence halls, 6 for female students, 11 for male students and 1 international dormitory. RU has a student population of over 38 000, with approximately 10 000 female students. At any given time, around 5000 female students reside in the six female residence halls, while the rest live off-campus.

Patient and public involvement

None.

Inclusion criteria

Only female students (undergraduate and graduate) living in the residential halls of the RU campus were considered for the study.

Sample size determination

Since our target population was known (around 5000 female students), the following formula was used to calculate the sample size:

$$n = \frac{N}{1+Nd^2}$$ [14]

where n is the required sample size, N is the population size (here 5000) and d is the marginal error (we considered d=0.05), considering a 95% confidence level. According to the formula, a sample size of 371 would be required for this study. Initially, however, 500 female students were considered with a 10% absence rate.

Sampling and data collection procedure

In our study, we selected 500 female university students from six female residence halls at RU. First, we randomly chose three residence halls. Then, we used stratified sampling to select 500 students from these three halls. We obtained the necessary information for sampling from the administration office of the respective residence halls. Although 30 students did not agree to provide information, we received consent from 470 students.

We collected data from female university students using a structured questionnaire. The questionnaire contained nine questions from the Patient Health Questionnaire (PHQ-9) and other questions about menstrual patterns, demographic information and health. After drafting the questionnaire in English, we received feedback from three health experts and made necessary adjustments. SKE, a female university student, conducted the interviews and also measured the students' height and weight. The interviews took place in a female residential hall, and the selected students were proficient in English. SKE personally explained the questionnaire to the students and addressed any issues they had.

Outcome variables

There were two outcome variables in this study: depression and menstrual disturbance.

Depression

Depression was measured by the PHQ-9, a highly sensitive and specific scale for screening depression.[15] This scale had been used earlier among university students in Bangladesh.[12 16] Students were asked to answer questions about their mood during the past 2 weeks of the survey, with scores on the PHQ-9 ranging from 0 to 27 and with the following cut-off points to categorise depressive symptoms: 0–4=normal, 5–9=mild, 10–14=moderate, 15–19=moderately severe and ≥20=severely severe.[15] A score of ≥10 has both sensitivity and specificity of over 85% in the diagnosis of depression.[17] We finally classified our sample into three classes: (1) normal (PHQ-9: 0–4), (2) depressive symptoms (PHQ-9: 5–9) and (3) probable depression (PHQ-9: ≥10).[17]

Menstrual disturbance

Self-reported irregular and painful menstruation was considered as menstrual disturbance and was assessed by asking two questions: (1) Did you experience irregular menstruation during the last three periods? Yes (code: 1) or No (code: 0). (2) Did you experience painful menstruation during the last three periods? Yes (code: 1) or No (code: 0).

Measurement of menstrual disturbance

Painful menstruation

Menstrual pain usually begins 1 or 2 days before menstrual flow and continues through the first 2 days of menstruation; students report their experience of acute spasmodic pain in their lower abdomen.[7]

Irregular menstruation

Menstrual cycle is defined as the period between the first day of menstrual bleeding and the day immediately prior to the next menstrual bleeding. The menstrual cycle differs from individual to individual and usually ranges between 25 and 31 days. It has often been stated that a regular period occurs every 28 days. In this study, irregular menstrual cycle was defined as less than 25 days or more than 31 days from the first menstrual flow to the next.[7] Menstrual disturbance (painful and irregular menstruation) was reported as part of the questionnaire's history of menstrual cycles as experienced by the students.

Independent variables

There were some socioeconomic, demographic and health-related factors which were assumed to be factors associated with our outcome variables.

Socioeconomic and demographic factors included parents' educational level, parents' occupation, family monthly income (Bangladeshi taka), number of siblings, order of birth, type of family, place of residence, body mass index (BMI) (kg/m^2), duration of menstrual flow (days), age at first menarche (years) and chronic disease (self-reported). We followed a previous study to select the independent variables for our study.[7] All independent variables with their categories are shown in table 1.

Statistical analysis

In this study, we used frequency distribution to calculate the prevalence of depression and menstrual disturbances. We considered depression status as an ordinal variable and employed both univariable and multivariable ordinal logistic regression models to identify the associated factors. We confirmed that the proportional odds assumption under the models was met. Independent variables with a p value of <0.20 from the likelihood ratio test in the univariable model were included in the multivariable model. The multicollinearity problem among independent variables was examined using a variance inflation factor (VIF). If 0<VIF<5, there is no evidence of a multicollinearity problem; if 5≤VIF≤10, there is a moderate multicollinearity problem; and if VIF >10, there is a serious multicollinearity problem of variables.[18] We used both univariable and multivariable logistic regression models to determine the association between depression and menstrual disturbance among female university students. We used binary logistic regression for the outcome variables painful menstruation (yes or no) and irregular menstruation (yes or no). Ordinal logistic regression was used for the ordinal outcome variable (no disturbance, at least one or both). Also, the assumption of the model was checked. Statistical significance was accepted at p<0.05. Statistical analyses were carried out using IBM SPSS V.20 software and Microsoft Excel (V.2013).

RESULTS

In the present study, we wanted to investigate the depression status of female university students and its association with their menstrual disturbances. We selected suitable statistical tools/models according to the objectives of the study.

General characteristics of the female university students

We examined 470 female university students as our sample. Majority of the students (54.3%) came from rural areas, and the largest proportion of the students were at the master's level (28.3%). It is worth noting that 20% of the students were underweight, while 11.9% were overweight or obese. Over 50% of the students' fathers had a higher level of education, whereas 27.9% of the students' mothers were highly educated. Over 30% and 32% of the students' fathers were employed and in business, respectively, while the majority of the students' mothers (86.2%) were housewives. Around 60% of students reached menarche at the age of 12–13 years, while 15.3% experienced it at 9–11 years. Furthermore, 13.6% of the students had abnormal menstrual flow. A significant portion of the students (95%) did not have any chronic illnesses. Most of the students (80%) came from nuclear families, and 23% had four or more siblings, while 48.9% had one to two siblings and 36.4% were a single child. The highest proportion of the students' family income fell within the range of 20 001–49 999 Bangladeshi taka

Table 1 Socioeconomic, demographic and menstrual-related characteristics of female university students and their depression status (N=470)

Variables	Group		Depression status		
			Normal (PHQ-9: 0–4) (23.60%)	Depressive symptoms (PHQ-9: 5–9) (45.50%)	Probable depression (PHQ-9: ≥10) (30.90%)
		n (%)	n (%)	n (%)	n (%)
Place of residence	Rural	255 (54.3)	58 (22.7)	128 (50.2)	69 (27.1)
	Urban	215 (45.7)	53 (24.7)	86 (40.0)	76 (35.3)
BMI	Underweight	94 (20.0)	18 (19.1)	37 (39.4)	39 (41.5)
	Normal	320 (68.1)	77 (24.1)	150 (46.9)	93 (29.1)
	Overweight and obese	56 (11.9)	16 (28.6)	27 (48.2)	13 (23.2)
Father's educational level	Uneducated	31 (6.6)	11 (35.5)	12 (38.7)	8 (25.8)
	Primary	62 (13.2)	10 (16.1)	35 (56.5)	17 (27.4)
	Secondary	124 (26.4)	32 (25.8)	57 (46.0)	35 (28.2)
	Higher	253 (53.8)	58 (22.9)	110 (43.5)	85 (33.6)
Mother's educational level	Uneducated	22 (4.7)	4 (18.2)	11 (50.0)	7 (31.8)
	Primary	89 (18.9)	19 (21.3)	42 (47.2)	28 (31.5)
	Secondary	228 (48.5)	52 (22.8)	103 (45.2)	73 (32.0)
	Higher	131 (27.9)	36 (27.5)	58 (44.3)	37 (28.2)
Father's occupation	Farmer	85 (18.1)	20 (23.5)	40 (47.1)	25 (29.4)
	Job	150 (31.9)	37 (24.7)	71 (47.3)	42 (28.0)
	Business	152 (32.3)	42 (27.6)	66 (43.4)	44 (28.9)
	Others*	83 (17.7)	12 (14.5)	37 (44.6)	34 (41.0)
Mother's occupation	Housewife	405 (86.2)	91 (22.5)	193 (47.7)	121 (29.9)
	Job	65 (13.8)	20 (30.8)	21 (32.3)	24 (36.9)
Order of birth	First	171 (36.4)	44 (25.7)	76 (44.4)	51 (29.8)
	Second	162 (34.5)	40 (24.7)	75 (46.3)	47 (29.0)
	Third or later	137 (29.1)	27 (19.7)	63 (46.0)	47 (34.3)
Type of family	Joint	82 (17.4)	18 (22.0)	38 (46.3)	26 (31.7)
	Nuclear	388 (82.6)	93 (24.0)	176 (45.4)	119 (30.7)
Age at first menarche (years)	9–11	72 (15.3)	13 (18.1)	38 (52.8)	21 (29.2)
	12–13	279 (59.4)	71 (25.4)	117 (41.9)	91 (32.6)
	≥14	119 (25.3)	27 (22.7)	59 (49.6)	33 (27.7)
Duration of menstrual flow	Abnormal (<4 or >7 days)	64 (13.6)	12 (18.8)	25 (39.1)	27 (42.2)
	Normal (4–7 days)	406 (86.4)	99 (24.4)	189 (46.6)	118 (29.1)
Chronic disease	No	445 (94.7)	107 (24.0)	206 (46.3)	132 (29.7)
	Yes	25 (5.3)	4 (16.0)	8 (31.0)	13 (52.0)
Number of siblings	1–2	230 (48.9)	52 (22.6)	113 (49.1)	65 (28.3)
	3	131 (27.9)	32 (24.4)	56 (42.7)	43 (32.8)
	≥4	109 (23.2)	27 (24.8)	45 (41.3)	37 (33.9)
Family income (Bangladeshi taka)	<10 000	47 (10.0)	8 (17.0)	21 (44.7)	18 (38.3)
	10 000–20,000	153 (32.6)	34 (22.2)	71 (46.4)	48 (31.4)
	20 001–49 999	194 (41.3)	42 (21.6)	88 (45.4)	64 (33.0)
	≥50 000	76 (16.2)	27 (35.5)	34 (44.7)	15 (19.7)

n, number of individuals.
*Rickshaw puller, bus driver, labour, etc.
BMI, body mass index; PHQ-9, nine-item Patient Health Questionnaire.

(41.3%), while 10.0% and 16.2% had a family income of <10 000 Bangladeshi taka and >50 000 Bangladeshi taka, respectively (table 1).

Prevalence of depression among female university students

The study found that 45.5% of female university students exhibited depressive symptoms, while 30.9% were identified as having probable depression. A higher proportion of urban students (35.3%) were found to have probable depression compared with their rural counterparts (27.1%). The likelihood of probable depression decreased with increasing BMI. Daughters of uneducated fathers showed higher rates of probable depression compared with those with educated fathers, with no significant variation observed based on mothers' educational level. Students with fathers working in roles other than farming, employment or business were more likely to suffer from probable depression (41%) compared with those whose fathers were employed in traditional occupations. Additionally, daughters of housewives showed lower rates of probable depression compared with those whose mothers were in paid employment. Students born as the third child or later exhibited higher rates of probable depression (34%) compared with those born as first or second sibling. Students who experienced early menarche (9–11 years) demonstrated a higher prevalence of depression symptoms (53%) compared with their peers. Those with abnormal menstrual flow and chronic diseases also exhibited higher rates of probable depression (42.2% and over 50%, respectively) compared with their counterparts. Moreover, a positive association was observed between the number of siblings and the likelihood of probable depression. Interestingly, students from affluent families (with a monthly income ≥50 000 Bangladeshi taka) were more likely to experience probable depression compared with their peers (table 1).

Impact of socioeconomic, demographic and other factors on probable depression

It was noted that 71.1% and 17.7% of students had painful and irregular menstruation, respectively. In the study, we found that 63.2% of students had at least one disturbance (either painful or irregular menstruation), while 12.8% had both disturbances. A clear increasing pattern of menstrual disturbances (painful, irregular, at least one disturbance and both disturbances) was observed with increasing pattern of depressive symptoms (table 2).

The independent variables of the ordinal multivariable logistic model were selected on the basis of the p value (p<0.2) of the crude OR (COR), and these were nutritional status, father's occupation, mother's occupation, family income and chronic disease. The VIF of the multivariable model showed that there was no evidence of multicollinearity problem among the independent variables of the model. We found that underweight students had a 2.007-fold higher chance of having probable depression compared with overweight or obese students (adjusted OR (AOR)=2.007, 95% CI 1.055 to 3.817, p<0.05). Students' fathers working as a farmer (AOR=0.501, 95% CI 0.277 to 0.906, p<0.05), having a job (AOR=0.608, 95% CI 0.364 to 0.980, p<0.05) and being in business (AOR=0.538, 95% CI 0.323 to 0.895, p<0.05) were less likely to have probable depression compared with students whose fathers were doing other works. Students coming from low-income family (monthly income <10 000 Bangladeshi taka) (AOR=2.796, 95% CI 1.328 to 5.890, p<0.01), low-income to middle-income family (family monthly income of 10 000–20 000 Bangladeshi taka) (AOR=1.858, 95% CI 1.084 to 3.185, p<0.05), and middle-income family (family monthly income of 20 001–49 999 Bangladeshi taka) (AOR=1.958, 95% CI 1.180 to 3.250, p<0.01) were more likely to have probable depression compared with students who came from high-income family (family monthly income ≥50 000 Bangladeshi taka). Students having chronic disease had a 2.784-fold higher chance of having probable depression (AOR=2.784, 95% CI 1.233 to 6.290, p<0.5) compared with students who did not have chronic disease (table 3 and online supplemental table).

Association between depression status and menstrual disturbances among female university students

Binary logistic regression model demonstrated that students suffering from depressive symptoms (COR=1.647, 95% CI 1.017 to 2.668, p<0.05; AOR=1.729, 95% CI 1.039 to 2.877, p<0.05) and probable depression (COR=2.415, 95% CI 1.394 to 4.185, p<0.01; AOR=2.187, 95% CI 1.217 to 3.930, p<0.01) were more likely to have painful menstruation compared with students who were normal. Ordinal logistic regression model showed that students having depressive symptoms (COR=1.161, 95% CI 1.014 to 1.324, p<0.05; AOR=1.164, 95% CI 1.015 to 1.335, p<0.05) and probable depression (COR=1.299,

Table 2 Depression and menstrual disturbance among female university students

	Painful menstruation (71.10%)	Irregular menstruation (17.70%)	At least one problem (63.20%)	Both problem (12.80%)	No problem (24.00%)
Normal (PHQ-9: 0–4)	67 (60.4)	15 (13.5)	62 (55.9)	10 (9.0)	39 (35.1)
Depressive symptoms (PHQ-9: 5–9)	153 (71.5)	37 (17.3)	136 (63.6)	27 (12.6)	51 (23.8)
Probable depression (PHQ-9: ≥10)	114 (78.6)	31 (21.4)	99 (68.3)	23 (15.9)	23 (15.9)

PHQ-9, nine-item Patient Health Questionnaire.

Table 3 Impact of socioeconomic, demographic and health-related factors on depression status of female university students

Independent variable	COR (95% CI)	P value	AOR (95% CI)	P value	VIF
Place of residence					
Rural vs urban*	0.839 (0.597 to 1.179)	0.311			
BMI					
Underweight vs overweight and obese*	2.064 (1.108 to 3.844)	0.001	2.007 (1.055 to 3.817)	0.034	1.027
Normal vs overweight and obese*	1.298 (0.767 to 2.198)	0.331	1.328 (0.776 to 2.274)	0.301	
Father's occupation					
Farmer vs others*	0.592 (0.336 to 1.041)	0.069	0.501 (0.277 to 0.906)	0.022	1.023
Job vs others*	0.555 (0.336 to 0.916)	0.021	0.608 (0.364 to 0.980)	0.048	
Business vs others*	0.527 (0.319 to 0.873)	0.013	0.538 (0.323 to 0.895)	0.017	
Mother's occupation					
Housewife vs job*	1.014 (0.610 to 1.685)	0.959			
Family income (Bangladeshi taka)					
<10 000 vs ≥50 000*	2.587 (1.304 to 5.134)	0.007	2.796 (1.328 to 5.890)	0.007	1.044
10 000–20 000 vs ≥50 000*	1.895 (1.129 to 3.178)	0.015	1.858 (1.084 to 3.185)	0.024	
20 001–49 999 vs ≥50 000*	2.007 (1.217 to 3.309)	0.006	1.958 (1.180 to 3.250)	0.009	
Chronic disease					
Yes vs no*	2.329 (1.058 to 5.125)	0.036	2.784 (1.233 to 6.290)	0.014	1.010

*Reference category.
AOR, adjusted OR; BMI, body mass index; COR, crude OR; VIF, variance inflation factor.

95% CI 1.123 to 1.502, p<0.01; AOR=1.283, 95% CI 1.105 to 1.489, p<0.01) were at high risk of having both menstrual disturbances (painful and irregular menstruation) compared with normal students (table 4).

DISCUSSION

In this study, we focused on investigating depression and its related factors, with a specific interest in exploring the connection between depression and menstrual disturbances among female university students in Bangladesh. Our findings revealed that 45.5% of the students exhibited depressive symptoms (PHQ-9: 5–9) and 30.9% experienced probable depression (PHQ-9: ≥10), indicating a higher prevalence compared with a previous study in Bangladesh[12] reporting a depressive symptom prevalence of 32.65% (PQH-9: ≥9) during the COVID-19 pandemic. Another study in Bangladesh found a 39.3% prevalence of depression (PQH-9: ≥5) among female university students,[16] while a previous study involving Bangladeshi college students reported a 30.7% prevalence

Table 4 Association between depression status and menstrual disturbance among university students

Menstrual disturbance	Independent variable and its groups	COR (95% CI)	AOR (95% CI)†
Irregular menstruation (yes=1, no=0)	Depressive symptoms		
	Depressive symptoms vs normal‡	1.338 (0.699 to 2.561)	1.202 (0.599 to 2.408)
	Probable depression vs normal‡	1.740 (0.887 to 3.413)	1.815 (0.867 to 3.801)
Painful menstruation (yes=1, no=0)	Depressive symptoms		
	Depressive symptoms vs normal‡	1.647 (1.017 to 2.668)*	1.729 (1.039 to 2.877)*
	Probable depression vs normal‡	2.415 (1.394 to 4.185)**	2.187 (1.217 to 3.930)**
Disturbance (no problem=0, at least one=1, both=2)	Depression status		
	Depressive symptoms vs normal‡	1.161 (1.014 to 1.324)*	1.164 (1.015 to 1.335)*
	Probable depression vs normal‡	1.299 (1.123 to 1.502)**	1.283 (1.105 to 1.489)**

*P<0.05 (5% level of significance), **P<0.01 (1% level of significance).
†Controlling for the effect of other selected variables.
‡Reference category.
AOR, adjusted OR; COR, crude OR.

of depressive symptoms,[19] which was lower than that of female university students. Some South Asian studies have also reported the prevalence of depressive symptoms. In India, 37.7%, 13.1% and 2.4% of university students were suffering from moderate, severe and extremely severe depression, respectively.[20] In Pakistan, researchers found that 85% of university students had some degree of depression and that depression among female students was significantly higher than male students.[21] In Nepal, 21.2% of university students were suffering from depression.[22] In Sri Lanka, 70% of students claimed to have experienced some form of depression ranging from mild to severe.[23] There may be differences in the prevalence of depression and its associated risk factors due to varying sample sizes, depression measurement techniques and cultural norms.[24] We found students' family income was significantly associated with depressive symptoms, with about 83%, 78.4% and 64.5% of students coming from the poorest, middle-income and rich family suffering from depressive symptoms, respectively. A similar finding was found in a Bangladeshi study.[19]

Menstrual disturbances are a common issue that significantly affects the day-to-day lives of women. Unfortunately, this problem often receives little attention in developing and underdeveloped nations. This cross-sectional study revealed that 17.7% of female university students experienced irregular menstruation, while 71.1% reported experiencing painful menstruation. These findings are consistent with a previous study of university students in Bangladesh where 72.3% of students reported menstrual pain and 12.9% experienced irregular menstruation.[7]

The relationship between depression and irregular menstruation is quite significant, as observed in our study. It is theorised that depressive mood can impact the menstrual cycle through the hypothalamic–pituitary axis (HPA).[25] Stress, known to disrupt the neuroendocrine system, particularly affects the HPA axis in both children and adults.[11] As a result, female individuals experiencing high levels of stress or depression are likely to experience irregular menstrual periods.[26] This is attributed to the activation of the corticotrophin-releasing hormone system in response to stress, which can disrupt menstrual function.[26] Additionally, our study also found a higher likelihood of depressive symptoms among students with painful menstruation compared with those without. These findings are consistent with studies in different populations.[27 28] Premenstrual symptoms, on the other hand, can be caused by hormonal imbalance, nutritional deficiencies, environmental influences and abnormal HPA function.[29]

Strength and limitations of the study

This study included primary data to investigate depression and its association with menstrual disturbance among female university students in Bangladesh using suitable statistical tools/models. However, there were some limitations to the study. First, due to the study's cross-sectional design, it was not possible to analyse students' behaviour over a period of time and to determine the cause and effect. Second, self-reported information was gathered from students and thus there could be recall bias. Third, although there were more than 50% students living in the residence halls of the RU campus and the RU is the second largest university in Bangladesh with students coming from different parts of the country, this study considered only female students currently living in the residence halls of the campus, which might limit the generalisability of the results. Moreover, some important factors, such as sleep disorder, having treatment, etc, were not considered as possible predictors of depression and menstrual disturbance among female university students. Fourth, we used an English questionnaire to gather information from the female students. Some students did not understand English and therefore only students who could speak English were included in the study. Clearly, more research regarding depression and its association with menstrual disturbance among female university students in Bangladesh is required.

CONCLUSIONS

This cross-sectional study involving 470 female university students in Bangladesh revealed that a significant portion of the participants experienced symptoms of probable depression and menstrual disturbances. The study identified several modifiable factors linked to depression and found that depression is a significant predictor of menstrual issues. Based on these findings, it is recommended that healthcare providers and university authorities focus on addressing the mental and reproductive health needs of female students by implementing suitable interventions and support measures.

Acknowledgements We are grateful to Rajshahi University authorities for giving permission to collect data from female students. We also thank the participants for taking part in this study.

Contributors SKE, MGH and ASMAM conceived the presented idea. SKE and MGH designed the methodology. SKE and MGH were involved in data curation and performed the analysis. SKE, ASMAM and MS were involved in data interpretation. SKE, MGH and ASMAM drafted the manuscript. MGH, ASMAM, SSA and MAW verified the analytical methods. MGH, SSA, MS and MAW critically revised the manuscript. MGH, SSA and MAW finalised the manuscript. MGH supervised the study. All the authors read and approved the manuscript. MGH is the corresponding author and guarantor of the paper.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Ethics approval This study involves human participants and was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Institute of Biological Sciences, University of Rajshahi, Bangladesh (memo no: 120/320/IAMEBBC/IBSc, dated 11 April 2019). Participants were explained about the objective of the study and informed consent was documented. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. This study was based on primary data. Data are available from the corresponding author on reasonable request.

ORCID iD

Md Golam Hossain http://orcid.org/0000-0002-3822-5489

REFERENCES

1 Sarokhani D, Delpisheh A, Veisani Y, *et al*. Prevalence of Depression among University Students: A Systematic Review and Meta-Analysis Study. *Depress Res Treat* 2013;2013:373857.
2 Ibrahim AK, Kelly SJ, Adams CE, *et al*. A systematic review of studies of depression prevalence in university students. *J Psychiatr Res* 2013;47:391–400.
3 Abedini S, Davachi A, Sohbaee F, *et al*. Prevalence of depression in nursing students in Hormozgan University of Medical Sciences. *Hormozgan Med J* 2007;11:139–45.
4 Gao L, Xie Y, Jia C, *et al*. Prevalence of depression among Chinese university students: a systematic review and meta-analysis. *Sci Rep* 2020;10:15897.
5 Arabatzis TJ, Marsidi J, Ashraf M, *et al*. Gender Disparities in Symptoms of Depression After Medical School Exams and Student Coping Strategies for Postexam Depression Symptoms. *J Med Educ Curric Dev* 2022;9:23821205211055391.
6 Hennegan J, Winkler IT, Bobel C, *et al*. Menstrual health: a definition for policy, practice, and research. *Sex Reprod Health Matters* 2021;29:1911618.
7 Hossain MG, Sabiruzzaman M, Islam S, *et al*. Influence of anthropometric measures and socio-demographic factors on menstrual pain and irregular menstrual cycles among university students in Bangladesh. *AS* 2011;119:239–46.
8 Marnach ML, Laughlin-Tommaso SK. Evaluation and Management of Abnormal Uterine Bleeding. *Mayo Clin Proc* 2019;94:326–35.
9 Padda J, Khalid K, Hitawala G, *et al*. Depression and Its Effect on the Menstrual Cycle. *Cureus* 2021;13:e16532.
10 Weyand AC, Fitzgerald KD, McGrath M, *et al*. Depression in Female Adolescents with Heavy Menstrual Bleeding. *J Pediatr* 2022;240:171–6.
11 Maurya P, Meher T, Muhammad T. Relationship between depressive symptoms and self-reported menstrual irregularities during adolescence: evidence from UDAYA, 2016. *BMC Public Health* 2022;22:758.
12 Islam MA, Barna SD, Raihan H, *et al*. Depression and anxiety among university students during the COVID-19 pandemic in Bangladesh: A web-based cross-sectional survey. *PLoS ONE* 2020;15:e0238162.
13 Hossain MM, Alam MA, Masum MH. Prevalence of anxiety, depression, and stress among students of Jahangirnagar University in Bangladesh. *Health Sci Rep* 2022;5:e559.
14 Rana M, Sayem A, Karim R, *et al*. Assessment of knowledge regarding tuberculosis among non-medical university students in Bangladesh: a cross-sectional study. *BMC Public Health* 2015;15:716.
15 Kroenke K, Spitzer RL, Williams JBW. The PHQ-9. *J Gen Intern Med* 2001;16:606–13.
16 Rasheduzzaman M, Al Mamun F, Faruk MO, *et al*. Depression in Bangladeshi university students: The role of sociodemographic, personal, and familial psychopathological factors. *Perspect Psychiatr Care* 2021;57:1585–94.
17 Levis B, Benedetti A, Thombs BD, *et al*. Accuracy of Patient Health Questionnaire-9 (PHQ-9) for screening to detect major depression: individual participant data meta-analysis. *BMJ* 2019;365:l1476.
18 Chatterjee S, Hadi AS. *Regression Analysis by Example*. New Jersey: John Wiley & Sons, 2006.
19 Al Mamun ASMd, Zeshan MHL, Khatun MstF, *et al*. The prevalence and factors associated with depressive symptoms among tertiary level students in Bangladesh: A survey in Rajshahi district. *J Affect Disord Rep* 2022;10:100445.
20 Deb S, Banu PR, Thomas S, *et al*. Depression among Indian university students and its association with perceived university academic environment, living arrangements and personal issues. *Asian J Psychiatr* 2016;23:108–17.
21 Gul F, Yuefen W, Ullah I, *et al*. Study of depression in university students in Pakistan. *J Pak Med Assoc* 2020;70:650–4.
22 Bhandari PM, Neupane D, Rijal S, *et al*. Sleep quality, internet addiction and depressive symptoms among undergraduate students in Nepal. *BMC Psychiatry* 2017;17:106.
23 Wickramasinghe A, Essén B, Surenthirakumaran R, *et al*. Prevalence of depression among students at a Sri Lankan University: A study using the Patient Health Questionnaire-9 (PHQ-9) during the COVID-19 pandemic. *BMC Public Health* 2023;23:528.
24 Gautam P, Dahal M, Ghimire H, *et al*. Depression among Adolescents of Rural Nepal: A Community-Based Study. *Depress Res Treat* 2021;2021:7495141.
25 Maniam J, Antoniadis C, Morris MJ. Early-Life Stress, HPA Axis Adaptation, and Mechanisms Contributing to Later Health Outcomes. *Front Endocrinol (Lausanne)* 2014;5:73.
26 Chrousos GP, Torpy DJ, Gold PW. Interactions between the hypothalamic-pituitary-adrenal axis and the female reproductive system: clinical implications. *Ann Intern Med* 1998;129:229–40.
27 Gollenberg AL, Hediger ML, Mumford SL, *et al*. Perceived stress and severity of perimenstrual symptoms: the BioCycle Study. *J Womens Health (Larchmt)* 2010;19:959–67.
28 Kollipaka R, Arounassalame B, Lakshminarayanan S. Does psychosocial stress influence menstrual abnormalities in medical students? *J Obstet Gynaecol* 2013;33:489–93.
29 Direkvand-Moghadam A, Sayehmiri K, Delpisheh A, *et al*. Epidemiology of Premenstrual Syndrome (PMS)-A systematic review and meta-analysis study. *J Clin Diagn Res* 2014;8:106–9.