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Research article

Prevalence and Factors Associated with Depression, Anxiety, and Perceived Stress among Khulna University Students, Bangladesh

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ABSTRACT

Depression, anxiety, and perceived stress, these three considerable indicators of mental health are usually influenced by several socio-demographic and socio-economic factors which may vary among different clans, cultures, and countries. Hence, identifying influencing factors for different groups is an essential need. The objective of this study is to investigate the prevalence and determinants of depression, anxiety, and perceived stress among Khulna University students. A cross-sectional study was conducted by using a self-reported questionnaire at Khulna University, involving 365 students from various academic years. The study employed descriptive statistics and Chi-square tests to find the prevalence and identify significant connections between categorical dependent and independent variables. Binary logistic regression was performed to identify the potential influencing factors with 95% CI, and the significance level was set at $p< 0.05$. Depression, anxiety, and stress were present at a noticeable prevalence rate, where more than half of the students had depression and perceived stress. Father's education was found to be a highly influential factor for all of depression, anxiety, and perceived stress. Poor health students, especially males, were highly exposed to depression and anxiety. Sleeping hours also influenced depression (AOR=3.01; CI: 1.21-7.51) and anxiety (AOR=0.54; CI: 0.31-0.93). Moreover, final-year undergraduate and postgraduate students were more likely to experience perceived stress (AOR=2.72; CI: 1.29-5.74) than first-year undergraduate students. Authorities and policymakers should adopt interventions that improve mental well-being as well as make students aware of healthy lifestyles, including sufficient sleeping habits, prioritizing the more vulnerable groups like male students with poor health.

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Introduction

Mental illness has become a major public health concern specially in developing countries like Bangladesh where particularly youth are mostly affected due to the lack of proper opportunities for career development and unfairness and perceived competition in job sectors. Young individuals like university students are not falling behind in this race as they are also concerned about their upcoming future obstacles (M. A. Mamun et al., 2020). Mental health indicators such as depression, anxiety, and perceived stress are significantly impacted by socio-demographic and socio-economic factors (Nabila et al., 2022).

Depression, the third most frequent health concern in the world after cardiovascular and respiratory disorders, affects people of all ages and can have a major and long-term impact on academic progress, personal relationships, and overall quality of life among university students (Ibrahim et al., 2013; Meeks et al., 2023). The most common causes of sickness and impairment in students are stress, anxiety, and depression (WHO, 2021). Students seem to be more vulnerable to these kinds of mental diseases, particularly those studying at universities who must adjust to new surroundings, migrate away from their families, and transfer to a new town or city (Alim et al., 2015). The primary cause of growing up with a mental disorder among students is choosing their major of study as well as their future employment. Students who struggle to rapidly adjust to these new routines regularly are prone to report depression and anxiety (Abdallah & Gabr, 2014). Moreover, Students face a range of challenges in their new academic setting after graduating from high school including, study stress, dorm life, procrastination, poor diet, difficulty in sleeping, problematic internet usage, smoking habit and sedentary behavior (Siddique et al., 2022). Furthermore, some fresher students may not have

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the psychological strength to handle the many shocks and perhaps awful circumstances that the university atmosphere may present, as well as unexpected obstacles (Kulsoom & Afsar, 2015; WHO, 2023).

The prevalence rates of anxiety, stress and depression in Bangladesh are as high as 64.8%, 54.3% and 59.0%, respectively (Alim et al., 2017; M. A. Mamun et al., 2021; M. A. A. Mamun & Griffiths, 2019; Saeed et al., 2018). In the general population, the prevalence of anxiety, stress, and depression was found to be 31.9%, 33.7% and 29.6%, respectively (Salari et al., 2020). At the age of 14, approximately 50% of mental illness start, and in mid-twenties, 75% experience mental disorders (Fusar-Poli, 2019). According to studies, almost half of the Bangladeshi students were exposed to depression and anxiety (Hossain et al., 2022). Based on the previous study, the prevalence rates of student depression are 43.7% in India (Kumari et al., 2019), 75% in Pakistan (Asif et al., 2020), 36.4 % in Malaysia (Fata Nahas et al., 2019), 68.5% in Hong Kong (Lun et al., 2018), and 43% in Saudi Arabia (Kulsoom & Afsar, 2015). Anxiety among students is prevalent in 54.4% of Hong Kong (Lun et al., 2018), 68.6% of India (Kumari et al., 2019), 88.4% of Pakistan (Asif et al., 2020), 29% of Malaysia (Mohamad et al., 2021), and 63% of Saudi Arabia (Kulsoom & Afsar, 2015). The prevalence rate of stress in 41.1% of Hong Kong (Cheung et al., 2016), 47.6% of India (Kumari et al., 2019), 84.4% of Pakistan (Asif et al., 2020), and 44.6% of Malaysia (Wong et al., 2023). Among Malaysian students, lower satisfaction with the current learning experience was associated with higher stress levels, whereas mental health among Jordanian students was influenced by various lifestyle and health-related factors (Hamaideh et al., 2022; Wong et al., 2023).Despite the high prevalence of mental health issues among Southeast Asian university students, many of them were unwilling to get professional care (Dessauvagie et al., 2022). Suicide attempt rates among students were notably higher in Bangladesh (9%) and Nepal (10%) compared to lower rates observed in Indonesia (5%) and India (4%) (Arafat et al., 2024). During COVID-19, university students in Bangladesh experienced poor sleep quality primarily due to anxiety, while older students and those who provided private tuition before the pandemic showed higher levels of depression (Ahammed et al., 2021; Islam et al., 2020).

Although mental health issues among university students have gained attention in many parts of the world, there remains a significant lack of context-specific research in countries where mental health is not widely prioritized or openly discussed. In the case of Bangladesh, mental health often remains a stigmatized topic, and institutional responses within higher education settings are still limited. While research on university students' mental health has gained importance worldwide, there is still a need for studies that are specific to regions like Khulna to understand the particular difficulties and factors affecting depression, anxiety, and perceived stress. The novelty of this research lies in its focus on an underrepresented population in a low-priority mental health context, providing localized evidence that can inform more culturally and institutionally relevant interventions. The objective of the study is to investigate the prevalence of depression, anxiety, and stress as well as determine the influential factors that may increase the risk of developing depression, anxiety, and perceived stress among Khulna University students in the aftermath of the COVID-19 pandemic.

Materials and Methods

A cross-sectional survey was conducted to evaluate the levels of depression, anxiety, and perceived stress among graduate and postgraduate students of Khulna University. The well-aimed questionnaires utilized short screening instruments like the 'Patient Health Questionnaire (PHQ-9)', 'General Anxiety Disorder 7 item (GAD-7)', and 'Perceived Stress Scale (PSS-10)' to determine the mental health status among university students.

Data Sources and Study Design

The survey was conducted among individuals accomplishing their undergraduate and graduate degrees at Khulna University. Based on PHQ-9, GAD-7, and PSS-10, a questionnaire was developed to gather data. We gathered the data only using face-to-face interviews. Before beginning the inquiry, respondents completed a self-reporting questionnaire and gave informed consent. The participants received no financial compensation, and anonymity was ensured for the accuracy and confidentiality of the data.

Sample size determination

There are a total of 7,644 students at Khulna University (https://ku.ac.bd/). We have used the Cochran formula for sample size calculation.

We know,

$$n_0 = \frac{z^2 \times p \times (1-p)}{d^2} \quad \text{and} \quad n = \frac{n_0}{1+\frac{(n_0-1)}{N}}.$$

$n =$ required sample size; $p = 0.5$ = the percentage of students suffering from mental health issues, approximately 50%, as determined from the pilot survey; $q = 1 - p$; $z = 1.96$; for 95% confidence level; $d = 0.05$; margin of error.

So, our sample size is-

$$n_0 = \frac{1.96^2 \times 0.5 \times (1-0.5)}{(0.05)^2} = 385 \quad ; \quad n = \frac{385}{1+\frac{(385-1)}{6965}} = 365$$

Explanatory variable

Independent factors, such as socio-demographic and personal information, were distributed across several categories. The questionnaire captured data on students' personal information such as gender, academic year, personal source of income, father's education, Relationship with household head, attendance in class regularly, study satisfaction, student performance based on the cumulative grade point average (CGPA), participation in co-curricular activities sleeping hours, smoking habit, quality of sleep, overall health condition and diagnosed mental health before or not. Furthermore, the following mental health assessment tools were utilized to assess levels of mental distress among the students.

Study variables

Depression Measurement Scale

A self-reported, nine-question version of the 'Primary Care Evaluation of Mental Disorders' is called the PHQ-9.

The PHQ-4 is one of the most widely accepted mental health assessments that can help physicians identify depression, track patient response to therapy, and assess how often respondents felt disrupted in the last two weeks. Each of the items is scored on a Likert scale of four, with 0 being the least often to 3 being almost daily. Overall scores can vary from 0 to 27, and greater values are associated with more depression. A cut-off score of greater than or equal to ten (≥10) was utilized to identify a positive screen for depressive symptoms (Kroenke et al., 2001). In this study, the Cronbach's alpha for PHQ-9 was 0.72, indicating acceptable internal consistency reliability for the measurement scale.

Anxiety Measurement Scale

In both clinical and research settings, the GAD-7 is a trustworthy and efficient instrument for determining anxiety and the severity of the disorder. According to the GAD-7, people are asked how often respondents felt bothered by anxiety symptoms during the last two weeks. "Not at all," "a few days," "more than half the days," and "almost every day" were the potential opinions, each of which scored 0, 1, 2, and 3, respectively. A cut-off value greater than or equal to ten (≥10) was identified to be the optimal balance of sensitivity and specificity for the GAD diagnosis. A score of more than 10 represents anxiety symptoms (Johnson et al., 2019; Löwe et al., 2008). In this study, the Cronbach's alpha for GAD-7 was 0.79.

Perceive Stress Measurement Scale

A self-assessment instrument called the 'Perceived Stress Scale' (PSS), devised by Cohen, Kamarak, and Mermelstein measures how stressful people perceive their daily experiences to be (Cohen, 1988). PSS 5-point response option asks people to rate several parts of their lives as unexpected, unmanageable, or overwhelming. It deals with how people see their lives. The PSS is sensitive to long-term stress brought on by a person's circumstances, despite the fact that it is more focused on global stressors than life-event stressors. Total scores ranged from 0 to 40, with a score higher than 13 indicating moderate and higher perceived stress (Lee, 2012; Mozumder, 2022). In this study, the Cronbach's alpha for PSS was 0.75.

Statistical Analysis

Data were processed using IBM SPSS Statistics version 26.0, and analysis was conducted using STATA version 17. Chi-square tests and descriptive statistics (frequency, percentages) were used to identify significant connections between categorical dependent and independent variables, and binary logistic regression with the outcomes reported as odds ratios (OR). We checked for multicollinearity before performing logistic regression. No variable had a VIF (Variance Inflation Factor) score greater than 2.5 or a tolerance value lower than 0.1, indicating the absence of multicollinearity in our model (Kim, 2019; Midi et al., 2010). Following the study's aim, variables with a p-value less than 0.25 and gender (as confounder) were selected from logistics regression (unadjusted model) for analyzing the multiple logistics regression (adjusted model) (Hosmer & Lemeshow, 2000; Khan et al., 2024; Khan et al., 2025). We adjusted 'gender' and other influencing factors in the adjusted model. In other words, Data were analyzed using STATA software, and with a 95% confidence interval, the significance level was set at $p< 0.05$.

Results

Table 1 shows the frequency distributions of independent variables as well as the prevalence of depression, anxiety, and stress. More than half of the respondents were male (52.33%). Only 40.82% of students had their personal income source.

Most of the students (90.41%) attended classes regularly and more than half of the students (58.08%) had enough sleep of 7 to 9 hours. In addition, 14.25% of students had a smoking habit where 13.97% of students were diagnosed with mental health earlier. Figure 1 also presents the prevalence scenario of depression, anxiety, and stress among the respondents. The overall prevalence of depression, anxiety, and stress was 60.55%, 42.47%, and 54.79% respectively, among the students of Khulna University.

Male students had a higher prevalence of depression (67.54%) where female students were going through stress more (59.2%). Depression (64.79%) and anxiety (46.48%) hit 3rd year students the most where nearly 3 out of every four students pursuing master's degree were going through stress. Almost three out of four students (72.88%) had a strong connection with their household head. It is only 12.05% of students, who lacked sound sleep and more than half of the students (51.51%) had an average health condition. Nearly two out of three students (66.58%) didn't participate in any co-curricular activities.

Approximately, 88 % of the students who doesn't attend class regularly were depressed as well as 77.08% students who sleep more than 9 hours were facing depression. Most of the smokers (82.69%) were depressed where 84.31% students who diagnosed for mental health earlier were still depressed. Figure 2 presents the scenario of smoking habits among the respondents.

Students with CGPA lower than 3.00 were going through depression (85.00%), anxiety (65.00%) and stress (70.00%) altogether. Around 65% of the students who don't have any personal income source were found depressed. Four out of five students (79.31%) were in depression whose father had no education and 69.44% were stressed in case of the students whose father had primary education. Also, students having bad quality sleep were also suffering from depression (75.00%), anxiety (68.18%) and stress (63.64%). Similarly, students with nearly poor overall health were also facing all of depression (88.37%), anxiety (79.07%) and stress (72.09%).

Table 2 presents the influencing factors of depression among students of Khulna University. From the binary logistic regression, variables namely gender, personal income, father's education, attend class regularly, satisfied with study, sleeping hours, smoking habit, diagnosed with mental health before, CGPA, quality of sleep, and overall health conditions were found to influence depression where p-value less than 0.05.

Table 1: Frequency distribution of independent variables and prevalence of depression, anxiety and stress

Variables	N (%)	Depression		Anxiety		Stress	
		No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)
Overall	365 (100)	144(39.45)	221(60.55)	210(57.53)	155(42.47)	165(45.21)	200(54.79)
Gender							
Female	174(47.67)	82(47.13)	92(52.87)	103(59.2)	71(40.8)	71(40.8)	103(59.2)
Male	191(52.33)	62(32.46)	129(67.54)	107(56.02)	84(43.98)	94(49.21)	97(50.79)
Academic year							
1st year	120(32.88)	46(38.33)	74(61.67)	70(58.33)	50(41.67)	68(56.67)	52(43.33)
2nd year	91(24.93)	36(39.56)	55(60.44)	53(58.24)	38(41.76)	42(46.15)	49(53.85)
3rd year	71(19.45)	25(35.21)	46(64.79)	38(53.52)	33(46.48)	28(39.44)	43(60.56)
4th year	58(15.89)	24(41.38)	34(58.62)	34(58.62)	24(41.38)	20(34.48)	38(65.52)
Masters	25(6.85)	13(52)	12(48)	15(60)	10(40)	7(28)	18(72)
Having personal income							
No	216(59.18)	75(34.72)	141(65.28)	119(55.09)	97(44.91)	98(45.37)	118(54.63)
Yes	149(40.82)	69(46.31)	80(53.69)	91(61.07)	58(38.93)	67(44.97)	82(55.03)
Father's education							
No Education	29(7.95)	6(20.69)	23(79.31)	9(31.03)	20(68.97)	13(44.83)	16(55.17)
Primary	36(9.86)	9(25)	27(75)	18(50)	18(50)	11(30.56)	25(69.44)
Secondary	64(17.53)	34(53.13)	30(46.88)	46(71.88)	18(28.13)	43(67.19)	21(32.81)
Higher Secondary	80(21.92)	32(40)	48(60)	52(65)	28(35)	38(47.5)	42(52.5)
Graduate & Higher	156(42.74)	63(40.38)	93(59.62)	85(54.49)	71(45.51)	60(38.46)	96(61.54)
Attend class regularly							
No	35(9.59)	4(11.43)	31(88.57)	17(48.57)	18(51.43)	12(34.29)	23(65.71)
Yes	330(90.41)	140(42.42)	190(57.58)	193(58.48)	137(41.52)	153(46.36)	177(53.64)
Satisfied with study							
No	176(48.22)	55(31.25)	121(68.75)	85(48.3)	91(51.7)	65(36.93)	111(63.07)
Yes	189(51.78)	89(47.09)	100(52.91)	125(66.14)	64(33.86)	100(52.91)	89(47.09)
Sleeping hours							
≤6	105(28.77)	44(41.9)	61(58.1)	52(49.52)	53(50.48)	39(37.14)	66(62.86)
7-9	212(58.08)	89(41.98)	123(58.02)	135(63.68)	77(36.32)	104(49.06)	108(50.94)
>9	48(13.15)	11(22.92)	37(77.08)	23(47.92)	25(52.08)	22(45.83)	26(54.17)
Smoking habit							
No	313(85.75)	135(43.13)	178(56.87)	184(58.79)	129(41.21)	142(45.37)	171(54.63)
Yes	52(14.25)	9(17.31)	43(82.69)	26(50)	26(50)	23(44.23)	29(55.77)
Diagnostic mental health before							
No	314(86.03)	136(43.31)	178(56.69)	186(59.24)	128(40.76)	140(44.59)	174(55.41)
Yes	51(13.97)	8(15.69)	43(84.31)	24(47.06)	27(52.94)	25(49.02)	26(50.98)
CGPA							
<3.00	20(5.48)	3(15)	17(85)	7(35)	13(65)	6(30)	14(70)
3.00-3.49	173(47.4)	69(39.88)	104(60.12)	97(56.07)	76(43.93)	83(47.98)	90(52.02)
>3.50	172(47.12)	72(41.86)	100(58.14)	106(61.63)	66(38.37)	76(44.19)	96(55.81)
Relation with household head							
Weak	16(4.38)	3(18.75)	13(81.25)	5(31.25)	11(68.75)	7(43.75)	9(56.25)
Average	83(22.74)	24(28.92)	59(71.08)	38(45.78)	45(54.22)	40(48.19)	43(51.81)
Strong	266(72.88)	117(43.98)	149(56.02)	167(62.78)	99(37.22)	118(44.36)	148(55.64)
Quality of sleep							
Bad	44(12.05)	11(25)	33(75)	14(31.82)	30(68.18)	16(36.36)	28(63.64)
Normal	166(45.48)	65(39.16)	101(60.84)	98(59.04)	68(40.96)	75(45.18)	91(54.82)
Good	155(42.47)	68(43.87)	87(56.13)	98(63.23)	57(36.77)	74(47.74)	81(52.26)
Overall health condition							
Excellent	47(12.88)	23(48.94)	24(51.06)	34(72.34)	13(27.66)	26(55.32)	21(44.68)
somewhat good	87(23.84)	40(45.98)	47(54.02)	61(70.11)	26(29.89)	33(37.93)	54(62.07)
Average	188(51.51)	76(40.43)	112(59.57)	106(56.38)	82(43.62)	94(50)	94(50)
Somewhat Poor	43(11.78)	5(11.63)	38(88.37)	9(20.93)	34(79.07)	12(27.91)	31(72.09)
Involved cocurricular activities							
No	243(66.58)	91(37.45)	152(62.55)	132(54.32)	111(45.68)	113(46.5)	130(53.5)
Yes	122(33.42)	53(43.44)	69(56.56)	78(63.93)	44(36.07)	52(42.62)	70(57.38)

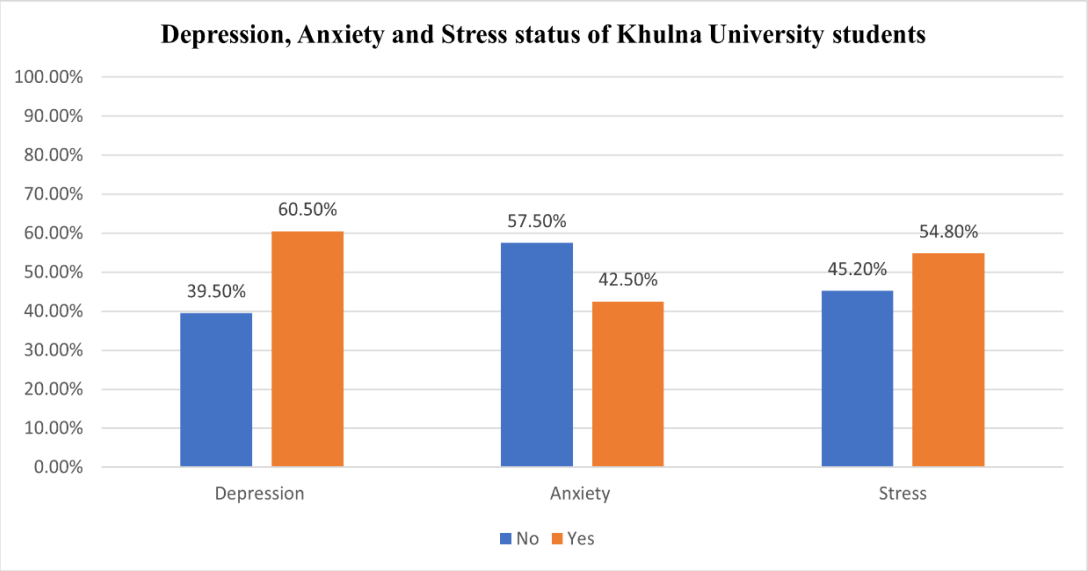

Figure 1: Prevalence of depression, anxiety, and perceived stress among Khulna University students

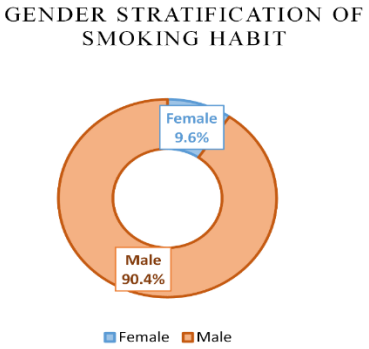

Figure 2: Smoking habits among Khulna University students

From the multiple logistic regression analysis, male students were found two times (AOR=2.63; 95% CI: 1.45-4.79) more likely to struggle with depression than female students. Students who have any personal income source were 0.48 (AOR=0.48; 95% CI: 0.27-0.85) times less exposed to depression compared to the ones who didn't have any personal income source. In cases where students' fathers had secondary-level education, students were found to be depressed 82% (AOR=0.16; 95% CI: 0.05-0.57) less compared to the students whose father didn't have any formal education. Students who used to sleep more than 9 hours were three (AOR=3.01; 95% CI: 1.21-7.51) times more likely to go through depression. Students who had diagnosed with mental health earlier were still found to be more (AOR=4.60; 95% CI: 1.21-11.23) likely to face depression than the students who never had any mental health diagnosis as well as students whose overall health condition was nearly poor were four times (AOR=4.67; 95% CI: 1.94-17.59) more likely to experience depression compared to the students with excellent overall health condition.

Table 3 presents the influencing factors of anxiety among students of Khulna University. From the binary logistic regression gender, father's education, satisfied with study, sleeping hours, CGPA, Relationship with household head, quality of sleep, overall health condition, and co-curricular activities were found to influence anxiety where p-value less than 0.05. From the multiple logistic regression analysis, male respondents were found to suffer from anxiety 1.73 (AOR=1.73; 95% CI: 1.01-2.95) times more than female students. In cases where students whose fathers had secondary level education were 0.20 (AOR=0.20; 95% CI: 0.06-0.61) times less likely to experience anxiety compared to the students whose fathers didn't have any formal education. Students who used to sleep 7 to 9 hours were 0.54 (AOR=0.54; 95% CI: 0.31-0.93) times less likely to face anxiety compared to students who used to sleep less than 7 hours. Students whose overall health condition was nearly poor had 4.76 (AOR=4.76; 95% CI: 1.53-14.76) times more odds of facing anxiety compared to the students with excellent overall health condition. Students regularly participating in co-curricular activities were (AOR=0.55; 95% CI: 0.32-0.92) less likely to experience anxiety compared to the rest.

Table 2: Logistic regression analysis of depression among students of Khulna University

Variables	COR	P-value	AOR	P-value
Gender				
Female	1		1	
Male	1.85 (1.21-2.84)	**0.004***	2.63 (1.45-4.79)	**0.001***
Academic year				
1st year	1		1	
2nd year	0.95 (0.54-1.66)	0.856	1.53 (0.76-3.06)	0.228
3rd year	1.14 (0.62-2.11)	0.666	1.55 (0.74-3.24)	0.240
4th year	0.88 (0.46-1.67)	0.697	2.07 (0.92-4.68)	0.078
Masters	0.57 (0.24-1.36)	0.209	0.65 (0.21-2.07)	0.475
Having personal income				
No	1		1	
Yes	0.62 (0.40-0.95)	**0.026***	0.48 (0.27-0.85)	**0.012***
Father's education				
No Education	1		1	
Primary	0.78 (0.24-2.53)	0.682	1.02 (0.26-3.99)	0.976
Secondary	0.23 (0.08-0.64)	**0.005***	0.16 (0.05-0.57)	**0.005***
Higher Secondary	0.39 (0.14-1.07)	0.067	0.51 (0.16-1.68)	0.276
Graduate & Higher	0.38 (0.15-1.00)	0.050	0.53 (0.17-1.66)	0.279
Attend class regularly				
No	1		1	
Yes	0.18 (0.06-0.51)	**0.001***	0.38 (0.11-1.36)	0.138
Satisfied with study				
No	1		1	
Yes	0.51 (0.33-0.78)	**0.002***	0.73 (0.43-1.25)	0.253
Sleeping hours				
≤6	1		1	
7-9	1.00 (0.62-1.60)	0.990	0.98 (0.56-1.71)	0.955
>9	2.42 (1.12-5.28)	**0.025***	3.01 (1.21-7.51)	**0.018***
Smoking habit				
No	1		1	
Yes	3.62 (1.71-7.69)	**0.001***	2.18 (0.87-5.49)	0.096
Diagnostic mental health before				
No	1		1	
Yes	4.11 (1.87-9.02)	**<0.001***	4.67 (1.94-11.23)	**<0.001***
CGPA				
<3.00	1		1	
3.00-3.49	0.27 (0.08-0.94)	**0.040***	0.81 (0.19-3.42)	0.778
≥3.50	0.25 (0.07-0.87)	**0.029***	0.87 (0.21-3.76)	0.863
Relation with household head				
Weak	1		1	
Average	0.57 (0.15-2.17)	0.408	1.65(0.33-8.33)	0.542
Strong	0.29 (0.08-1.06)	0.060	0.89 (0.18-4.18)	0.884
Quality of sleep				
Bad	1		1	
Normal	0.52 (0.24-1.10)	0.086	1.35 (0.52-3.51)	0.532
Good	0.43 (0.20-0.91)	**0.026***	0.79 (0.31-2.07)	0.646
Overall health condition				
Excellent	1		1	
somewhat good	1.13 (0.55-2.29)	0.743	0.99 (0.44-2.25)	0.998
Average	1.41 (0.74-2.68)	0.292	1.12 (0.51-2.42)	0.769
Somewhat Poor	7.28 (2.44-21.75)	**<0.001***	4.60 (1.21-17.59)	**0.025***
Involved cocurricular activities				
No	1			
Yes	0.78 (0.50-1.21)	0.269		

COR Crude Odds Ratio; AOR Adjusted Odds Ratio; *significant at <0.

Table 3: Logistic regression analysis of anxiety among students of Khulna University

Variables	COR	P Value	AOR	P Value
Gender				
Female	1		1	
Male	1.14 (0.75-1.73)	0.540	1.73 (1.01-2.95)	**0.044***
Academic year				
1st year	1			
2nd year	1.00 (0.58-1.74)	0.989		
3rd year	1.22 (0.67-2.20)	0.517		
4th year	0.99 (0.52-1.87)	0.971		
Masters	0.93 (0.39-2.25)	0.878		
Having personal income				
No	1			
Yes	0.78 (0.51-1.20)	0.256		
Father's education				
No Education	1		1	
Primary	0.45 (0.16-1.25)	0.126	0.55 (0.17-1.76)	0.319
Secondary	0.18 (0.07-0.46)	**0.001***	0.20(0.06-0.61)	**0.005***
Higher Secondary	0.24 (0.10-0.60)	**0.002***	0.37 (0.13-1.04)	0.061
Graduate & Higher	0.38 (0.16-.088)	**0.024***	0.63 (0.23-1.67)	0.356
Attend class regularly				
No	1			
Yes	0.67 (0.33-1.35)	0.262		
Satisfied with study				
No	1		1	
Yes	0.48 (0.31-0.73)	**0.001***	0.64 (0.39-1.04)	0.076
Sleeping hours				
≤6	1		1	
7-9	0.56 (0.35-0.90)	**0.016***	0.54 (0.31-0.93)	**0.028***
>9	1.07 (0.54-2.11)	0.854	0.92 (0.42-2.03)	0.849
Smoking habit				
No	1		1	
Yes	1.43 (0.79-2.57)	0.237	0.75 (0.35-1.60)	0.460
Diagnostic mental health before				
No	1		1	
Yes	1.63 (0.90-1.96)	0.105	1.66 (0.82-3.35)	0.156
CGPA				
<3.00	1		1	
3.00-3.49	0.42 (0.16-1.11)	0.080	1.01 (0.32-3.11)	0.985
≥3.50	0.34 (0.13-0.88)	**0.027***	0.78 (0.25-2.40)	0.670
Relation with household head				
Weak	1		1	
Average	0.54 (0.17-1.69)	0.288	1.14 (0.30-4.35)	0.840
Strong	0.27 (0.09-0.80)	**0.018***	0.60 (0.17-2.14)	0.437
Quality of sleep				
Bad	1		1	
Normal	0.32 (0.16-0.66)	**0.002***	0.63 (0.27-1.45)	0.284
Good	0.27 (0.13-0.55)	**<0.001***	0.49 (0.21-1.12)	0.093
Overall health condition				
Excellent	1		1	
somewhat good	1.11 (0.51-2.45)	0.787	0.94 (0.40-2.21)	0.895
Average	2.02 (1.00-4.08)	**0.049***	1.54 (0.70-3.38)	0.276
Somewhat Poor	9.88 (3.73-26.16)	**<0.001***	4.76 (1.53-14.76)	**0.007***
Involved co-curricular activities				
No	1		1	
Yes	0.67 (0.43-1.05)	0.080	0.55 (0.32-0.92)	**0.024***

COR Crude Odds Ratio; AOR Adjusted Odds Ratio; *significant at <0.05

Table 4 presents the influencing factors of depression among students of Khulna University. From the simple logistic regression academic year, father's education, satisfaction with study, sleeping hours, and overall health condition were found to influence depression where the p-value less than 0.05.

From the multiple logistic regression analysis, students who are studying honors 4th year are two times (AOR=2.72; 95% CI: 1.29-5.74) and masters students are three times (AOR=3.53; 95% CI: 1.21-10.32) more likely to struggle with stress than freshers or honors 1st-year students. In cases where students whose fathers had primary level education were 3.47 (AOR=3.47; 95% CI: 1.12-10.18) times more likely to experience anxiety compared to the students whose fathers didn't have any formal education. Students who were satisfied with their study were found to be stressed (AOR=0.53; 95% CI: 0.32-0.87) less than the rest.

Table 4: Logistic regression analysis of stress among students of Khulna University

Variables	COR	P Value	AOR	P Value
Gender				
Female	1		1	
Male	0.71 (0.47-1.08)	0.107	1.00 (0.60-1.66)	0.986
Academic year				
1st year	1		1	
2nd year	1.53 (0.88-2.63)	0.131	1.43 (0.77-2.64)	0.247
3rd year	2.01 (1.11-3.65)	**0.022***	1.91 (0.98-3.71)	0.056
4th year	2.48 (1.30-4.76)	**0.006***	2.72 (1.29-5.74)	**0.008***
Masters	3.36 (1.31-8.65)	**0.012***	3.53 (1.21-10.32)	**0.021***
Having personal income				
No	1			
Yes	1.02 (0.67-1.55)	0.939		
Father's education				
No Education	1		1	
Primary	1.85 (0.67-5.12)	0.238	3.47 (1.12-10.78)	**0.031***
Secondary	0.40 (0.16-0.97)	**0.044***	0.59 (0.21-1.66)	0.322
Higher Secondary	0.90 (0.38-2.11)	0.805	1.51 (0.58-4.11)	0.383
Graduate & Higher	1.30 (0.58-2.89)	0.520	1.24 (0.82-5.23)	0.121
Attend class regularly				
No	1		1	
Yes	0.60 (0.29-1.25)	0.176	0.70(0.30-1.65)	0.424
Satisfied with study				
No	1		1	
Yes	0.52 (0.34-0.79)	**0.002***	0.53 (0.32-0.87)	**0.013***
Sleeping hours				
≤6	1		1	
7-9	0.61 (0.38-0.99)	**0.046***	0.79 (0.46-1.34)	0.395
>9	0.69 (0.35-1.40)	0.309	0.71 (0.32-1.57)	0.404
Smoking habit				
No	1			
Yes	1.05 (0.58-1.89)	0.879		
Diagnostic mental health before				
No	1			
Yes	0.84 (0.46-1.51)	0.555		
CGPA				
<3.00	1		1	
3.00-3.49	0.46 (0.17-1.27)	0.134	0.52 (0.17-1.58)	0.255
≥3.50	0.54 (0.20-1.48)	0.230	0.53 (0.17-1.61)	0.267
Relation with household head				
Weak	1			
Average	0.84 (0.28-2.46)	0.745		
Strong	0.98 (0.35-2.70)	0.962		
Quality of sleep				
Bad	1		1	
Normal	0.70 (0.35-1.38)	0.295	0.92 (0.41-2.08)	0.859
Good	0.63 (0.31-1.25)	0.183	0.69 (0.31-1.54)	0.375
Overall health condition				
Excellent	1		1	
somewhat good	2.03 (0.99-4.16)	0.055	1.63 (0.75-3.55)	0.217
Average	1.24 (0.65-2.35)	0.515	0.82 (0.39-1.70)	0.603
Somewhat Poor	3.20 (1.33-7.71)	**0.010***	1.66 (0.57-4.83)	0.345
Involved co-curricular activities				
No	1			
Yes	1.17 (0.75-1.81)	0.483		

COR Crude Odds Ratio; AOR Adjusted Odds Ratio; *significant at <0.0

Discussion

This study utilized data from students at Khulna University, including first-year undergraduates to master's-level students, to investigate the associations among depression, anxiety, and perceived stress. The current study found that academic year, father's education, satisfaction with studies, adequate sleep duration (7–9 hours), secondary-level father's education, and overall health condition significantly influence depression, anxiety, and perceived stress among students at Khulna University. The overall prevalence of depression, anxiety, and stress was 60.55%, 42.47%, and 54.79%, respectively among the students. Moreover, one of our significant findings is that the females of Khulna University have higher levels of stress, which coincides with a prior study on Bangladesh undergraduate rehabilitation students (Ali et al., 2022). Previous research indicates that female Jordanian university students experience greater levels of

stress (Hamdan-Mansour et al., 2018). However, in our study, we found that the males of Khulna University have a higher score in depression and anxiety, which is contradictory to the previous study (Hamaideh et al., 2022; Hamdan-Mansour et al., 2018; Hossain et al., 2022). According to research on medical students in 2015, the percentages of men and women who suffered from depression were 52.6% and 56.3%; anxiety 66.7% and 62.5%; and stress 59.6% and 58.3% (Alim et al., 2015). One possible reason for our study findings could be concern about future job uncertainty in Bangladesh, where men are traditionally expected to provide the majority of the income in a patriarchal society. Low job opportunities after graduation, as well as a lack of internship opportunities, may lead to depression and anxiety among male university students. Furthermore, males are more exposed to smoking habits, which could be linked to male depression symptoms compared to females (Boden et al., 2010; Tjora et al., 2014).

The study's findings, which indicate an association between higher academic years (3rd year, 4th year, and Master's level) and increased depression, anxiety, and perceived stress, are consistent with previous research demonstrating greater odds of psychological distress among students advancing through higher levels of study (Barbayannis et al., 2022; Deng et al., 2022). The study also indicated that 4th-year and Master's students had a substantially higher likelihood of experiencing mental health concerns compared to their peers. This elevated mental health burden among senior students may stem from accumulating stressors — including increasing academic pressure, job-seeking stress, thesis and project workloads, and fear of an uncertain future as graduation approaches (Barbayannis et al., 2022; Steare et al., 2023).

Students whose fathers had primary education were more likely to report depression, anxiety, and stress compared to those whose fathers had no formal education. Using similar analytical methods, a longitudinal study in Indonesia (Fakhrunnisak & Patria, 2022) and a meta-analysis from China (Liu et al., 2024) revealed that fathers with lower educational attainment have a significant impact on their children's mental health. One possible explanation of our finding is that fathers with primary education may have slightly higher but still limited expectations, possibly placing academic or financial pressure on their children while lacking sufficient resources to provide robust support (Wu et al., 2022). Another reason, fathers with no education may have lower expectations, leading to less performance-related pressure on their children (Fakhrunnisak & Patria, 2022).

Students who had any personal income source were less exposed to depression compared to the ones who didn't have any personal income source. According to earlier research (Hamaideh et al., 2022), students' income level has a negative correlation with their levels of anxiety, stress, and depression, suggesting that financial status has an impact on their mental well-being. As students' personal income ensure the economic independence of a student, which results less depression, anxiety and stress. Students who had been diagnosed with mental disorders before were still found to be more likely to face depression than students who never had any mental disorders before. A study on Bangladeshi undergraduate rehabilitation students who got mental illness last year had a significant impact on depression (Ali et al., 2022).

Our study also found that students who reported being satisfied with their studies had significantly lower odds of depression, anxiety, and perceived stress than those who were dissatisfied. Similar results have also been observed in China (Barbayannis et al., 2022), Germany (Karing, 2021), and the United Arab Emirates (Awadalla et al., 2020), where longitudinal data were used in studies from the USA, while cross-sectional data were employed in other studies. Various potential mechanisms could clarify our study finding; these include satisfaction with academic progress and confidence in their chosen program, which may serve as a protective factor, reducing stress and anxiety by helping students view challenges positively and manage academic burdens effectively (Pascoe et al., 2020).

Our study also showed that adequate sleep (7–9 hours) had a significant protective association with the mental health of students. The results of this study are consistent with a previous study conducted in Norway (Vestergaard et al., 2024), where the authors examined the relationship between sleep duration and mental health in young adults. Likewise, another study in Saudi Arabia (Alwhaibi & Al Aloola, 2023) revealed that sleep quality elevated the risk of mental health for young students and that the incidence of mental health was substantially greater in university students. Sleep is essential for emotional regulation and cognitive performance, with 7–9 hours linked to better mental health, while poor sleep heightens stress, negative moods, and the risk of depression and anxiety (Alwhaibi & Al Aloola, 2023; Hu et al., 2023; Scott et al., 2021; Vestergaard et al., 2024). Researchers suggest that students' self-rated overall health may be a significant factor influencing the likelihood of mental health concerns, with those reporting "somewhat poor" health facing higher risks compared to peers reporting "excellent" health (Jones & Schreier, 2023). Our study also found a constant result similar to prior study. Previous research has shown that students who rate their health poorly are more likely to experience co-occurring depression, anxiety, and perceived stress (Franzoi et al., 2021; Umami et al., 2022). Poor perceived health could contribute directly to stress and negative mood, or it could be a result of depression and anxiety themselves, creating a bidirectional effect (Demenech et al., 2021; Gniewosz, 2024).

Our study revealed that students with co-curricular activities experienced less anxiety than students who were not involved in any co-curricular activities after adjusting for other factors in the study. A prior longitudinal study revealed that improved mental health was linked to a shift from nonparticipation to some involvement in volunteer activities (Yao et al., 2023).

Strengths and limitations

The study's strengths include its comprehensive and data-driven approach to evaluating mental health among university students in a developing country like Bangladesh. Another key strength, the study used widely accepted psychological measurement scales like PHQ-9 for depression, GAD-7 for anxiety, and PSS-10 for perceived stress, which ensures the reliability and consistency of the measurements. Moreover, the study also

employed a structured face-to-face data collection method, which likely improved the accuracy of responses compared to other data collection methods like online and self-administered surveys. Lastly, strengths lie in the extensive range of socio-demographic and lifestyle variables included, which allows for more detailed insights into this study.

Despite its considerable strengths, this study is not without limitations. Firstly, the sample used in this study consisted only of 365 students from a single public university, which may not accurately reflect the overall mental health status of university students, across Bangladesh. Secondly, the cross-sectional design captures data at only one point in time, limiting the ability to establish causal relationships. Thirdly, reliance on self-reported data introduces potential response and recall biases, as students may underreport or overreport their mental health status due to stigma or misunderstanding of symptoms.

Recommendations for Interventions and Future Research

Based on our results, it is suggested that various specific actions be taken to help university students who are having mental health problems. Educational institutions must establish organized mental health initiatives, encompassing counselling services, awareness courses, and routine screenings for depression, anxiety, and stress. Special attention should be given to high-risk groups, such as male students, those with poor sleep patterns, low academic satisfaction, or inadequate parental education. Future research should include data from various universities, both public and private, to find more realistic results and accurately reflect the prevalence of depression, anxiety, and perceived stress among university students in Bangladesh. Longitudinal studies are also encouraged to explore causal relationships over time and to evaluate the effectiveness of mental health interventions in university conditions.

Conclusion

This study explored the mental health status of Khulna University students and identified some influential risk factors of depression, anxiety, and stress. Males were found to be at higher risk of depression and anxiety, whereas stress was higher among female students. Father's education was significantly influenced by depression, anxiety, and stress. Sleeping hours were found to influence depression and anxiety only. Implementing community-based psychological solutions within the educational system can enhance student well-being. Furthermore, encouraging students to maintain a healthy lifestyle and participate in co-curricular activities can significantly improve their mental health. The university should provide mental health consultations, seminars, and workshops to enlighten students about depression, anxiety, and Stress.

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Competing Interest

The author(s) declared no competing interest.

Ethics statement

The study was approved by the Khulna University Ethical Clearance Committee (Reference No. KUECC-2023-12-84) review board to ensure adherence to ethical guidelines and protection of participants' rights. Before the interviews, all respondents were informed about the study and their role as participants, as well as the anonymity, confidentiality of their responses, and the right to withdraw from the interview at any moment if they are unwilling to participate.

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