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Association of Depression with Internet Addiction among Students of a Public University in Bangladesh

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Abstract

Depression is a common mental health problem among university students and can get worse due to Internet Addiction (IA). This study aimed to examine how common depression is and how it is linked to IA among students at Rajshahi University in Bangladesh. This cross-sectional study surveyed 1,014 second- and third-year undergraduate students at Rajshahi University using a multistage sampling method. Data were collected using a structured questionnaire that included the Patient Health Questionnaire- 9 items (PHQ-9) to measure depression and Young's Internet Addiction Test (IAT) to assess IA. The collected data were analyzed using the Chi-square test and a multiple logistic regression model. The respondents had a mean age of 22.18 years; most were male (67.1%), from nuclear families (81.1%), and lived in rural areas (65.0%). Most students (59.8%) were addicted to the internet, and nearly half (48.2%) showed signs of depression. Among those addicted to the internet, 72.8% also experienced depression. IA was found to be significantly associated with depression (aOR: 4.73, 95% CI: 3.48-6.44). Students in the Commerce faculty were identified as more likely to be depressed compared to those in the Arts faculty (aOR: 1.41, 95% CI: 1.01-1.96). Being underweight (aOR: 1.62, 95% CI: 1.08-2.42) and engaging in nocturnal internet use (aOR: 1.86, 95% CI: 1.16-2.99) were also significantly associated with depression. This study found a high prevalence of IA and depression among university students, with a strong link between the two. Students addicted to the internet were significantly more likely to experience depression. Depressive symptoms were also more common among Commerce faculty students, underweight individuals, and those using the internet at night. These findings highlight the need for targeted mental health support, awareness initiatives, and strategies to promote responsible internet use among university students.

Keywords: IAT; Depression; Mental health; PHQ-9; University students; Bangladesh

AMS Classification: Primary 62P10; Secondary 92C60, 92D30.

1. Introduction

Depression is a common mental disorder marked by persistent sadness and loss of interest in previously enjoyable activities, caused by a combination of biological, psychological, and social factors. Biologically, people with a family history of depression or problems with brain chemicals

like serotonin, dopamine, and norepinephrine are more at risk [8]. Long-term health problems like heart disease or diabetes can also lead to depression. Psychologically, things like negative thoughts, low self-esteem, childhood trauma, and certain personality traits, such as being very sensitive or anxious, can make depression more likely [8]. Social and environmental issues are also important. Stressful events like losing a job, the death of a loved one, or a breakup can trigger depression. Feeling lonely, being poor, or facing violence or abuse can make the problem worse. Using alcohol or drugs also increases the chance of getting depressed or makes the symptoms worse [36]. Depression can disturb sleep and appetite; tiredness and poor concentration are common. It can be long-lasting or recurrent, substantially impairing a person's ability to function at work or school or cope with daily life.

Depression is one of the most prevalent mental health conditions among university students [21]. A systematic review and meta-analysis reported a pooled prevalence of depression among Chinese university students at 28.4%, with higher rates observed during the Coronavirus disease 2019 (COVID-19) pandemic [42]. This indicates that depression rates among university students are significantly higher than in the general population. Depression is recognized as a leading cause of disability worldwide and is a significant contributor to the global burden of disease. The effects of depression can be long-lasting or recurrent and can dramatically affect a person's ability to function and live a rewarding life. One of the primary factors fueling this rise in depression is the widespread use of social media. In particular, excessive engagement with social networking sites, such as Facebook, Instagram, and Twitter, is strongly linked to feelings of inadequacy, loneliness, and social comparison [45]. Internet addiction (IA) refers to the inability to regulate internet use, leading to significant distress and/or disruptions in personal, academic, social, or professional functioning [47]. Numerous researchers have reported that the spread of the internet worldwide has led to a relationship between IA and mental health problems such as depression, anxiety, stress, and reduced happiness [8, 9]. Consequently, the phenomenon of IA has become a topic of considerable interest due to its potential impact on mental health, particularly among young adults, including university students. Studies have indicated that excessive internet use is often associated with mental health problems such as depression, anxiety, and stress [10]. A review of 101 studies involving over 128,000 university students from 38 countries found that approximately 41.84% suffer from internet addiction, highlighting it as a widespread global issue among students [33]. The study also found that IA is more common in low-income countries and among male students. Additionally, IA rates have risen since the COVID-19 pandemic, likely due to increased online learning and digital dependence [41].

In Bangladesh, IA has become a significant mental health concern among university students and young adults [35], particularly during the COVID-19 pandemic. Another study found that 81.7% of undergraduate students exhibited IA symptoms, including mild to severe cases, with insomnia affecting 49.4% of this group [36]. During the pandemic, about 29% of adults and 35% of people under 20 had problems with using the internet too much [44]. Risk factors for IA include being male, living in urban areas, smoking, and using the internet for more than three hours a day [37]. The shift to online learning and increased isolation during the pandemic worsened the problem and contributed to mental health issues such as depression and anxiety [14]. This impact has been particularly evident among university students in Bangladesh. Studies have found alarmingly high rates of depression, with one public university reporting a prevalence of 69.5%, significantly higher than another public institution where the rate was 47.3% [18, 19]. Most studies on mental health and its related risk factors among university students in Bangladesh have focused on private universities in Dhaka, the country's highly urbanized capital city [15]. In contrast, only a handful

of studies have been conducted at public universities, primarily concentrating on undergraduate or first-year students [18, 19, 21]. Although research on depression and IA is growing, a notable gap remains in understanding these issues among second- and third-year university students in Bangladesh. To address this gap, the present study investigates the prevalence of depression and its association with IA among students at Rajshahi University. The findings are expected to provide valuable insights to guide the development of targeted interventions aimed at supporting student mental health.

2. Methods

2.1 Study strategy and questionnaire design

This cross-sectional study collected data from students at the University of Rajshahi between April and May 2024. This is the second largest public university in Bangladesh comprises 12 faculties and 61 departments, with approximately 33,000 students enrolled. A multistage sampling technique was used to select samples covering the population. In the 1st stage, 5 faculties were considered using a simple random sampling technique. In the 2nd stage, 3 departments were selected from each faculty using a simple random sampling technique. In the 3rd stage, students were selected from the 2nd and 3rd years. In this stage, lists of 2nd and 3rd-year students were obtained and numbered consecutively in each class based on their roll numbers. All students from these classes were invited to participate in the survey, and 1,060 students participated in the study. Data has been collected through individual questionnaires. To avoid potential issues and ensure the reliability of data collection, the questionnaire was pre-tested, and necessary modifications were made based on the results. It was then translated into Bengali to enhance participants' understanding.

2.2 Sample size determination

The sample size was determined using the formula [41]: $n = \frac{z^2 p(1-p)}{\varepsilon^2} = \frac{z^2 pq}{\varepsilon^2}$, (1)

where n = sample size, z = tabulated value = 1.96, p = portion of success, q = portion of failure = $1 - p$, and ε = margin of error. Based on Eq. (1), the study is supposed to select 586 respondents from the selected study area with a 95% confidence level, considering prevalence as 57.8% [37] and a4% margin of error. To ensure robust and reliable findings, the study included a total of 1,014 respondents. Due to incomplete or missing information, data of 51 respondents were excluded from the final analysis, resulting in a high response rate of 95%.

2.3 Variables and their measurements

2.3.1 Dependent variable

Depression was the main outcome measured in this study. This was assessed by Patient Health Questionnaire- 9 items (PHQ-9). The PHQ-9 depression module, developed by [37], is a widely used screening tool for depression in non-psychiatric settings [41]. The severity of depression among students was assessed using the Bengali version of the self-reported PHQ-9 [37]. The PHQ-9 consists of 9 items rated on a 4-point Likert scale, ranging from 0 (not at all) to 3 (nearly every day). Total scores range from 0 to 27, with higher scores indicating greater severity of depression. Depression severity was categorized as follows: 0-4 indicates a 'minimal' level of depression, 5-10 is 'mild', 11-15 is 'moderate', 16-20 is 'moderately severe', and 21-27 is 'severe depression' [31]. For this study, a score of ≥10 (coded as 1) was considered indicative of depression, while a score of <10 (coded as 0) was supposed to indicate no depression [25, 27]. This scale was previously

used in epidemiological studies in Bangladesh [28, 29]. The inter-item consistency for the PHQ-9 in this sample was good (Cronbach's $\alpha = 0.84$), and is valid and reliable for screening depressive symptoms among university students in Bangladesh [37].

2.3.2 Independent variables

The independent variables were included in this study considering their role in the previous studies [8, 31-35]. The selected variables were respondents' age, gender, academic year, type of family, residence, marital status, family income, family type, area of residence of the family, current living place, participation in social occasions, daily study, smoking status, daily internet use, primary internet using device, using the internet without study purpose, nocturnal internet use, cause of internet use, and earning through internet. Again, their body mass index (BMI) was calculated from the data originating from self-reported weights and heights.

2.3.3 Internet Addiction Test (IAT)

Young's Internet Addiction Test (IAT) scale, created by Young and colleagues in 1996, was employed to evaluate IA among the participants [47]. This scale includes 20 items, each measured on a 5-point rating system. The IAT uses a Likert scale ranging from 1 to 5, with a total score ranging from 20 to 100. Severity levels are categorized as follows: scores of 20-40 indicate a low level of addiction, 41-70 indicate a moderate level, and 71-100 signify severe Internet addiction [35]. For binary logistic regression analysis, IA levels were grouped into two categories: scores ≤ 50 (coded as 0) indicating no IA, and scores ≥ 51 (coded as 1) indicating the presence of IA [33, 37]. This study utilized the Bengali version of the IAT questionnaire [31], with excellent inter-item consistency in the sample (Cronbach's $\alpha = 0.90$).

2.4 Statistical analysis

Descriptive statistics, including frequencies and proportions, were calculated to summarize the background characteristics of the respondents. The chi-square (χ^2) test assessed the degree of association between depression status and selected factors. Factors that showed significant results in the χ^2 analysis were further examined using multiple binary logistic regression analysis. This method was used because the outcome variable (depression status) was a yes/no (binary). Multiple logistic regression model helped to understand how different factors, like IA, BMI, faculty, and lifestyle habits, were each related to depression. It also allowed us to control for the effects of other variables simultaneously. Since our data was cross-sectional and had many predictors, this method was the most suitable and commonly used. Other mental health studies have also used this method effectively [33, 37]. The underlying binary logistic regression model corresponding to each variable was as follows:

$$y = \log\left[\frac{p}{1-p}\right] = \beta_0 + \sum_{i=1}^{k} \beta_i x_i + \epsilon_i, \quad (2)$$

where $p =$ the probability of depression (coded 1), $1 - p =$ the probability of no depression (coded 0), β_0 is the intercept term, β_i are the coefficients of the factors x_i and ϵ_i be the error terms where $(i = 1, 2, \ldots, k)$. The binary logistic regression model, and adjusted odds ratios (aORs) were estimated to investigate the risk factors between depression status and factors under study. A p-value of < 0.05 was considered statistically significant. All statistical analyses were performed using STATA version 15.0 MP (STATA Corp, College Station, Texas, USA).

3. Results

Of the total 1,014 respondents, 48.2% were behaviorally dependent on the depression Table 1 exhibits the distribution of socio-demographic characteristics and lifestyle-related factors distribution among the study participants. The study comprised predominantly male students (67.1%) with the most significant proportion aged over 23 (37.6%). Most participants were in 3rd academic year (60.2%) and pursuing studies in Commerce (39.6%). The vast majority of participants were unmarried (93.2%). Family monthly income was pretty evenly distributed across income brackets, with the largest group earning between Tk. 11000 and 30000 (47.8%). Most respondents came from nuclear families (81.1%) and resided in rural areas (65.0%). Current living arrangements included staying at home (16.2%), in a mess (44.3%), or in a hall of residence (39.5%). Regarding BMI, the majority of participants had a normal weight (72.3%), followed by underweight (14.8%) and overweight/obese individuals (12.9%). Most students reported studying for less than 1 hour per day (68.3%).

Table 1 exhibits the association between socio-demographic variables, lifestyle factors, and depression status. IA was found strongly associated with depression status (p<0.001), with a much higher proportion of individuals with IA exhibiting depression (72.8%) compared to those without IA (31.7%). Faculty also showed a significant association (p<0.006); Arts faculty had the highest percentage of depressed individuals (58.1%). Marital status was significantly associated with depression (p<0.029), with unmarried individuals showing a higher prevalence of depression (52.7%). BMI was also significantly associated with depression (p<0.004); underweight individuals had the highest percentage of depressed individuals (55.3%). Finally, daily study duration was significantly associated with depression (p<0.001), with those studying less than 1 hour per day showing a higher prevalence of depression (52.7%).

Table 1: Association of socio-demographic variables and lifestyle-related factors with depression

			Depression status		
Variables	**Categories**	**Total, *n* (%)**	**Absent, *n* (%)**	**Present, *n* (%)**	***p*-values**
IA status	Absent	606 (40.2)	414(68.3)	192(31.7)	0.000
	Present	408 (59.8)	111(27.2)	297(72.8)	
Age (in years)	19-21	271(26.7)	139(51.3)	132(48.7)	0.498
	22-23	362(35.7)	196(54.1)	166(45.9)	
	>23	381(37.6)	190(49.9)	191(50.1)	
Gender	Female	334(32.9)	188(56.3)	146(43.7)	0.044
	Male	680(67.1)	337(49.6)	343(50.4)	
Academic year	2nd year	404(39.8)	211(52.2)	193(47.8)	0.814
	3rd year	610(60.2)	314(51.5)	296(48.5)	
Faculty	Science	280(27.6)	146(52.1)	134(47.9)	0.006
	Arts	332(32.7)	193(58.1)	139(41.9)	
	Commerce	402(39.6)	186(46.3)	216(53.7)	
Marital status	Married	69(6.8)	27(39.1)	42(60.9)	0.029
	Unmarried	945(93.2)	498(52.7)	447(47.3)	
Monthly family	≤10000	205(20.2)	101(49.3)	104(50.7)	0.652
Income (in taka)	11000-30000	485(47.8)	251(51.8)	234(48.2)	
	≥31000	324(32.0)	173(53.4)	151(46.6)	
Family type	Nuclear family	822(81.1)	426(51.8)	396(48.2)	0.948
	Joint family	192(18.9)	99(51.6)	93(48.4)	
Residence	Urban	355(35.0)	172(48.5)	183(51.5)	0.120
	Rural	659(65.0)	353(53.6)	306(46.4)	

Current living location	Home	164(16.2)	95(57.5)	69(42.1)	0.224
	Mess	449(44.3)	226(50.3)	223(49.7)	
	Hall	401(39.5)	204(50.9)	197(49.1)	
BMI	Underweight	150(14.8)	67(44.7)	83(55.3)	0.004
	Normal	733(72.3)	403(55.0)	330(45.0)	
	Overweight and obese	131(12.9)	55(42.0)	76(58.0)	
Daily study duration (in hours)	≤1	693(68.3)	328(47.3)	365(52.7)	0.000
	1-3	216(21.3)	135(62.5)	81(37.5)	
	≥4	105(10.4)	62(59)	43(41.0)	
Smoking status	No	912(89.9)	485(53.2)	427(46.8)	0.007
	Yes	102(10.1)	40(39.2)	62(60.8)	
Daily internet use duration (in hours)	≤3	282(27.8)	185(65.6)	97(34.4)	0.000
	3-5	312(30.8)	167(53.5)	145(46.5)	
	≥6	420(41.4)	173(41.2)	247(58.8)	
Internet-using device	Smartphone	927(91.4)	474(51.1)	453(48.9)	0.264
	Computer	76(7.5)	46(60.5)	30(39.5)	
	Others	11(1.1)	5(45.5)	6(54.5)	
Using internet without a study purpose	No	100(9.9)	57(57)	43(43)	0.271
	Yes	914(90.1)	468(51.2)	446(48.8)	
Nocturnal internet use	No	168(16.6)	115(68.5)	53(31.5)	0.000
	Occasionally	514(50.7)	291(56.6)	223(43.4)	
	Always	332(32.7)	119(35.8)	213(64.2)	
Main cause of internet use	Education	236(23.3)	149(63.1)	87(36.9)	0.001
	Social media	595(58.7)	292(49.1)	303(50.9)	
	Video games	22(2.1)	9(40.9)	13(59.1)	
	YouTube	101(10.0)	50(49.5)	51(50.5)	
	Others	60(5.9)	25(41.7)	35(58.3)	
Earning through the internet	No	916(90.3)	478(52.2)	438(47.8)	0.426
	Yes	98(9.7)	47(48)	51(52)	
	Total	**1,014**	**525(51.8)**	**489(48.2)**	

Note: 'BMI, Body mass index', 'Taka, Bangladeshi currency, 1$=110 Taka'

Table 2 exhibits the multiple logistic regression analysis results examining the association of various factors with depression status. The model revealed a significant association between IA and depression status (aOR: 4.73, 95% CI: 3.48-6.44), indicating that individuals with IA were substantially more likely to experience depression. Students in the Commerce faculty are 1.41 times (aOR: 1.41, 95% CI: 1.01-1.96) more likely to be depressed compared to those in the Arts faculty. Underweight individuals were 1.62 times (aOR: 1.62, 95% CI: 1.08-2.42) more likely to experience depression compared to those with normal BMI, overweight and obese individuals showed a similar trend (aOR: 1.52, 95% CI: 1.01-2.32). Those who 'always' engaged in nocturnal internet use were 1.86 times (aOR: 1.86, 95% CI: 1.16-2.99) more likely to be depressed compared to those who did not.

Table 2: Multiple logistic regression analysis of variables associated with depression

Variables with category	**aOR, 95% CI**	***p*-values**
IA status (Ref.= Absent)		
Present	4.73(3.48-6.44)	0.00
Gender (Ref. = Female)		
Male	1.03(0.76-1.40)	0.83
Faculty (Ref. = Arts)		
Science	1.35(0.94-1.94)	0.10
Commerce	1.41(1.01-1.96)	0.04
Marital Status (Ref. = Unmarried)		
Married	1.59(0.91-2.80)	0.10
Body mass index (Ref.= Normal)		
Underweight	1.62(1.08-2.42)	0.02
Overweight and obese	1.52(1.01-2.32)	0.05
Smoking Status (Ref. = No)		
Yes	1.25(0.77-2.02)	0.35
Daily study duration (in hours) (Ref.= ≥4)		
≤1	0.92(0.57-1.49)	0.74
1-3	0.63(0.37-1.07)	0.08
Daily internet use duration (in hours) (Ref. = ≤3)		
3-5	1.22(0.83-1.76)	0.30
≥6	1.22(0.83-1.77)	0.30
Nocturnal internet use (Ref. =No)		
Occasionally	1.44(0.95-2.18)	0.08
Always	1.86(1.16-2.99)	0.01
Main cause of Internet use (Ref. = Education)		
Social media	1.029(0.715-1.482)	0.876
Video games	1.621(0.609-4.313)	0.333
YouTube	1.072(0.625-1.838)	0.802
Others	1.886(1.01-3.583)	0.05

Note. 'Ref., reference category', 'aOR, adjusted odds ratio', 'CI, confidence interval'

4. Discussion

This study found a considerable rate (48.2%) of depression among Rajshahi University students in Bangladesh. Compared to other studies, it was higher than neighboring country: 27.4% in Chandigarh of India [35]; relatively comparable to approximately 30% respondents in Malaysia [22], 36.2% in Oman [20], 33% in Iran [38], 93.7% in Syria [42] and 23.60% in Serbia [40]. A study [45] performed on Bangladeshi students, found a lower prevalence (39.1%) of depression compared to the current study (48.2%). The high prevalence of depression in this study may reflect the unique socioeconomic and academic pressures faced by university students in Bangladesh, as well as the growing influence of internet usage on mental health.

The study found a strong association between IA and depression, with students experiencing IA being 4.73 times more likely to suffer from depression. This finding is consistent with previous research, which has consistently highlighted the detrimental effects of excessive internet use on mental health, particularly among young adults [7, 17]. The pervasive use of the internet, especially for non-academic purposes such as social media and entertainment, may contribute to increased feelings of isolation, anxiety, and depression [32]. Furthermore, nocturnal internet use

was significantly associated with depression, suggesting that late-night internet usage disrupts sleep patterns, which is a known risk factor for depression [21].

The study identified several socio-demographic and lifestyle factors associated with depression. Students in the Commerce faculty were 1.41 times more likely to experience depression compared to those in the Arts faculty. This finding aligns with previous research indicating that students in more competitive academic programs, such as Commerce, may face higher levels of stress and academic pressure, contributing to mental health issues [41]. Additionally, underweight students were 1.62 times more likely to experience depression compared to those with a normal BMI, while overweight and obese students also showed a similar trend. These findings are consistent with studies linking poor nutritional status and body image issues to depression [46].

Although the study found no significant gender difference in depression prevalence, male students exhibited a slightly higher rate (50.4%) than female students (43.7%). This finding contrasts with some studies that reported higher rates of depression among female students [23], but is consistent with others that found no significant gender differences [43, 39]. The lack of substantial gender differences in this study may reflect the unique cultural and social dynamics in Bangladesh, where both male and female students face distinct but equally significant stressors.

The key strengths of this research were its specifically targeted population of second and third-year Rajshahi University students in Bangladesh. It was conducted using primary data that considers socio-demographic variables, lifestyle-related factors, and mental health measurements. Several limitations may impact the study of depression and socio-demographic characteristics. Firstly, the study primarily relied on cross-sectional data, which limits its ability to establish causal relationships between variables. Secondly, the sample size of 1,014 participants does not adequately represent the broader population of university students in Bangladesh, and data were exclusively gathered from the University of Rajshahi, without considering students from other institutions. Moreover, only certain faculties and departments were included, resulting in an incomplete representation of the full spectrum of academic disciplines. Thirdly, this study did not consider mental and physical health-related variables like anxiety, stress, morbidity, mortality, and disability.

5. Conclusion

This study reveals a concerning prevalence of both internet addiction and depressive symptoms among university students, with a strong association observed between the two. Students addicted to the internet were nearly five times more likely to experience depression. Additionally, being underweight, studying in the Commerce faculty, and engaging in nocturnal internet use was also significantly linked to higher rates of depression. These findings suggest the need for comprehensive mental health strategies within universities, including routine mental health screening, awareness campaigns promoting responsible internet use, targeted support for high-risk faculties, and wellbeing initiatives that address physical and psychological wellbeing. Implementing such measures may help mitigate the rising burden of depression and improve the overall mental health of university students. Further research could benefit from large-scale nationwide longitudinal studies that include all possible factors related to students' depression.

List of abbreviations: BMI: Body Mass Index, CI: Confidence Interval, COVID-19: Coronavirus disease 2019, Internet Addiction, IAT: Internet Addiction Test, PHQ-9: Patient Health Questionnaire-9, aOR: adjusted odds ratio.

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Ethical Approval: The Institutional Animal, Medical Ethics, Biosafety, and Biosecurity Committee (IAMEBBC) of the Institute of Biological Sciences (IBSc) at the University of Rajshahi, Bangladesh, reviewed and approved this study (Memo No: 09(17)/3201/IAMEBBC/IBSc), dated January 16, 2024. After explaining the purpose, procedures, and potential risks of the study, informed consent was obtained from all participants.

Authors' contributions: MNIM and MRI contributed to the study's conceptualization, developed the methodology, curated the data, performed the formal analysis, and interpreted the results. MRI drafted the initial version of the manuscript and contributed to its subsequent review and revision. MNIM, MH, and SP reviewed the manuscript, provided supervision, and validated the research. All authors reviewed and edited the final version of the article. All authors have read and approved the final manuscript.

Conflict of interest: The authors declared no conflicts of interest.

Availability of data: The data used in this study are available from the corresponding author upon reasonable request. Due to ethical and privacy considerations, the data are not publicly available.

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