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The Effects of Excessive Internet Usage on Depression and Anxiety of the University Students in Bangladesh during COVID-19

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Abstract

Background

Excessive internet use became an important concern among university students during the COVID-19 pandemic for online classes, communication, entertainment, and social connections. This study examined the association of excessive internet use with different levels of depression and anxiety among university students in Bangladesh during the pandemic.

Methods

This cross-sectional study used primary data collected from students of different public and private universities in Bangladesh. A structured questionnaire was used to collect information from 700 participants. Excessive internet use was measured using the Compulsive Internet Use Scale, depression was measured using the Patient Health Questionnaire-9, and anxiety was measured using the Generalized Anxiety Disorder-7 scale. Descriptive statistics and multinomial logistic regression were used to analyze the data.

Results

Among the students, 86.29% were classified as problematic internet users and 60.14% as excessive internet users. Depression symptoms were common: 31.86% had mild depression, 22.00% had moderate depression, 18.14% had moderately severe depression, and 11.29% had severe depression. Anxiety symptoms were also high: 34.00% had mild anxiety, 23.00% had moderate anxiety, and 17.43% had severe anxiety. From multinomial logistic regression analysis, an association of all levels of depression was found, including mild depression (OR = 2.69; 95% CI: 1.64–4.41), moderate depression (OR = 4.13; 95% CI: 2.40–7.13), moderately severe depression (OR = 6.25; 95% CI: 3.42–11.40), and severe depression (OR = 5.61; 95% CI: 2.82–11.13). Excessive internet use was also significantly associated with higher odds of mild anxiety (OR = 2.09; 95% CI: 1.38–3.18), moderate anxiety (OR = 3.72; 95% CI: 2.31–6.00), and severe anxiety (OR = 3.56; 95% CI: 2.08–6.09)..

Conclusion

Excessive internet use was strongly associated with depression and anxiety among university students in Bangladesh during COVID-19. Findings suggest that universities should consider excessive internet use an important issue for student well-being.

Introduction

Excessive internet use means using the internet so much that it becomes difficult to control and starts affecting daily life, study, sleep, social relations, and mental health [1]. The World Health Organization (WHO) describes a related behavioral problem, gaming disorder, as a pattern where a person has poor control over use, gives it higher priority than other activities, and continues it despite harmful results [2]. Excessive or compulsive internet use is not always the same as normal internet use, because normal use can support education, communication, and entertainment, while problematic use can create distress and functional problems [3].

University students are one of the most vulnerable groups because they use the internet for academic work, social communication, entertainment, and emotional support. A recent global meta-analysis of 101 studies with 128,020 university students from 38 countries and territories found that the pooled global prevalence of internet addiction among university students was 41.84% [4]. The same meta-analysis also reported that internet addiction among university students increased after the COVID-19 pandemic, and depression was positively related to internet addiction prevalence [4]. Studies during the COVID-19 period also showed that poor mental health among young people became a growing concern, and internet addiction was studied together with depression, anxiety, and stress among higher education students [5].

In Asia, the problem became more important because many students depended on the internet for online classes, communication, and entertainment during lockdowns. A study among university students in Hong Kong stated that COVID-19 increased the risk of internet addiction because students used the internet heavily for online learning and communication [6]. In Nepal, a study among undergraduate students in Kathmandu reported that internet use had become an unavoidable part of daily life and found a 29.90% prevalence of internet addiction among students [7]. In India, studies during and after COVID-19 showed that internet addiction among students was linked with anxiety, sleep problems, depression, and stress [8]. These Asian findings show that excessive internet use is not only a technology-use issue, but also an important student mental health issue.

South Asia is especially important because the region includes countries such as Bangladesh, India, Pakistan, Nepal, Sri Lanka, Afghanistan, Bhutan, and the Maldives, where many students faced long school closures, academic uncertainty, and family-level financial pressure during COVID-19. A systematic review and meta-analysis in South Asia found that the pooled prevalence of anxiety during COVID-19 was 41.3%, while the pooled prevalence of depression was 34.1% [9]. The same review reported that Bangladesh and Pakistan had a higher pooled prevalence of anxiety and depression among the South Asian countries included in the analysis [9]. In Pakistan, one COVID-19 study found that depression was significantly related to internet addiction, and the odds of extreme depression were much higher among addicted internet users than normal internet users [10]. In Sri Lanka, research during COVID-19 also showed that depression among university students was an important concern, although studies on this topic were limited [11].

Bangladesh also experienced a major shift in student life during the COVID-19 pandemic because educational institutions were closed and learning activities moved to online platforms. A Bangladeshi study reported that most higher education institutions moved to online learning after campus closure, which made internet use more central to students' daily academic life [12]. Another study in Bangladesh found that more than two-thirds of university students experienced mild to severe depression and anxiety during the COVID-19 pandemic [13]. That study also reported that 82.4% of students had mild to severe depression and 87.7% had mild to severe anxiety [13]. Therefore, Bangladeshi university students faced two related problems at the same time: increased dependence on the internet and increased mental health pressure.

The present study focuses on Bangladeshi university students during the COVID-19 pandemic and examines how excessive internet use is related to depression and anxiety. During the pandemic, students became highly dependent on the internet for online classes, communication, entertainment, and social connections because educational institutions were closed and normal campus life was disrupted [14]. Although the internet helped students continue their education and stay connected, too much internet use may create problems in daily routine, sleep, academic concentration, and mental health [15]. In Bangladesh, university students faced long periods of uncertainty, social isolation, and academic pressure during COVID-19, which may have increased both internet use and psychological stress [13]. The findings of the present manuscript show that a large proportion of students experienced problematic and excessive internet use during this period, and excessive internet use was positively associated with both depression and anxiety. However, previous studies in Bangladesh mainly focused on general depression and anxiety among students, while fewer studies clearly examined how excessive internet use is linked with different severity levels of depression and anxiety [13, 16]. Therefore, this study is important because it tries to understand whether excessive internet use increases the chance of mild, moderate, moderately severe, and severe depression, as well as different levels of anxiety among Bangladeshi university students. The main objective of this study is to examine the effect of excessive internet use on depression and anxiety among university students in Bangladesh during the COVID-19 pandemic, and the specific objectives are to assess students' level of excessive internet use, identify the severity of depression and anxiety, and explore whether student-related factors such as gender, living status, academic performance, physical exercise, sleeping pattern, entertainment-based internet use, and daily internet-use duration are associated with their mental health outcomes.

Methodology

Data Sources and Study Design

This study used primary data collected from university students in Bangladesh during the COVID-19 pandemic. A cross-sectional study design was used, which means data were collected only once from the respondents during the study period. The study included students from different public and private universities in Bangladesh. A structured questionnaire was used to collect information on internet use, depression, anxiety, and other student-related factors. The questionnaire was first translated into Bangla

and tested through a pilot survey with 23 students. After the pilot survey, necessary corrections were made before the final data collection. Informed written consent was taken from the students before collecting data. The final survey was conducted in March 2021. The study used a non-probability convenience sampling technique because students were selected based on availability and willingness to participate rather than through random selection. At first, 820 responses were collected, but 120 incomplete responses were removed due to missing information. Finally, 700 complete responses were used for analysis. This study design was appropriate because the aim was to examine the relationship between excessive internet use and different levels of depression and anxiety among university students during COVID-19.

Outcome Variables

Outcome Variables

This study had two main outcome variables: depression level and anxiety level. Depression was measured using the Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 includes 9 questions, and each question is scored from 0 to 3. Therefore, the total depression score ranges from 0 to 27. Based on the total score, depression was divided into five levels: minimal depression = 0–4, mild depression = 5–9, moderate depression = 10–14, moderately severe depression = 15–19, and severe depression = 20–27. Anxiety was measured using the Generalized Anxiety Disorder-7 (GAD-7) scale. The GAD-7 includes 7 questions, and each question is scored from 0 to 3. Therefore, the total anxiety score ranges from 0 to 21. Anxiety was divided into four levels: minimal anxiety = 0–4, mild anxiety = 5–9, moderate anxiety = 10–14, and severe anxiety = 15–21.

Independent Variables

The main independent variable of this study was excessive internet use. It was measured using the Compulsive Internet Use Scale (CIUS). The CIUS includes 14 questions, and each question is scored from 0 to 4, where higher scores indicate higher compulsive internet use. The total CIUS score ranges from 0 to 56. Students with a CIUS score of 18 or above were classified as problematic internet users, while students with a CIUS score of 28 or above were classified as excessive internet users. Other independent variables included students' demographic, academic, lifestyle, and internet-use characteristics. The demographic variables were age and gender. Age was grouped into three categories: 18–21 years, 22–25 years, and 26–28 years. Gender was classified as female and male. Living status during COVID-19 was also included. Academic performance was grouped into three categories: low academic performance for CGPA less than 3, medium academic performance for CGPA 3 to 3.5, and high academic performance for CGPA greater than 3.5. Lifestyle-related variables included sleeping hours and physical exercise. Sleeping hours were grouped into less than normal sleep for less than 7 hours, normal sleep for 7 to 9 hours, and excess sleep for more than 9 hours. Internet-use behavior was also included as an important group of independent variables. Internet use for entertainment purposes, such as YouTube and movies, was measured as a yes/no variable. Average

daily hours of internet use during COVID-19 was divided into four groups: less than 2 hours, 2 to 4 hours, 5 to 6 hours, and more than 6 hours. These variables were included to understand whether students' internet-use patterns, lifestyle, academic condition, and family situation were associated with depression and anxiety levels during COVID-19.

Statistical Analysis

The collected data were first checked, cleaned, and prepared for analysis. Incomplete responses with missing information were removed, and finally 700 complete responses were used. Descriptive statistics such as frequency and percentage were used to describe the background characteristics of the students, including age, gender, living status, academic performance, sleeping hours, physical exercise, entertainment-based internet use, and daily internet-use duration. The levels of depression, anxiety, and internet use were measured using standard scoring systems. Depression was measured using the PHQ-9 scale and classified into minimal, mild, moderate, moderately severe, and severe levels. Anxiety was measured using the GAD-7 scale and classified into minimal, mild, moderate, and severe levels. Excessive internet use was measured using the CIUS scale, where students were classified as problematic or excessive internet users based on the cut-off scores. The reliability of the scales was checked using Cronbach's alpha, and all alpha values were above 0.85, showing that the scales were reliable for this study. To examine the effect of excessive internet use on different levels of depression and anxiety, multinomial logistic regression was used because both depression and anxiety were categorical outcome variables with more than two groups. Minimal depression and minimal anxiety were used as the reference categories. The model included excessive internet use and other student-related factors such as age, gender, living status, academic performance, physical exercise, sleeping hours, entertainment-based internet use, and average daily hours of internet use.

Results

Relability Analysis

Table 1
The Alpha value of the sample data

Variables	**α**
CIUS score Internet addiction during Covid-19	0.86
Depression	0.86
Anxiety	0.89

All Cronbach's alpha values are greater than 0.85, indicating that the sample data were consistent [Table 1].

Frequency analysis of demographic and some selective variables.

Table 2 illustrates the frequency analysis of demographics and some particular variables. The respondents were aged 18 to 28 years. The majority (66.29%) were aged between 22 to 25 years; 29% of the participants belonged to the (18–21) age group. Among the participants, 55.57% (389 students) were male, and 44.43% (311 students) were female. Most of them (63.57%) reported living with their family during the COVID-19 pandemic. More than half (59.14%) of the students had a CGPA between 3 to 3.5. Some of them (31.71%) had a high CGPA, and the rest (9.14%) were not performing very well- scored less than CGPA 3. More than half (59.29%) of the participants reported having aregular sleeping pattern, while 32.86% had sleep deficiency and 9.86% reported sleeping more than necessary. During the pandemic time, 57.43% of respondents participated in physical exercise while the rest of 42.57% were not involved in physical exercise.

Table 2
Frequency analysis of demographic and some selective variables.

Variable	N	(%)
Age		
18 to 21 years	203	29.00
22 to 25 years	464	66.29
26 to 28 years	33	4.71
Gender status		
Female	311	44.43
Male	389	55.57
Living status during COVID19		
Without family	255	36.43
With family	445	63.57
Academic Performance		
Low (less than CGPA 3)	64	9.14
Medium (CGPA 3 to CGPA 3.5)	414	59.14
High (greater than CGPA 3.5)	222	31.71
Hours of Sleeping		
Less than regular (< 7 hours)	230	32.86
Regualr (7 to 9 hours)	415	59.29
Excess (> 9 hours)	55	7.86
Physical exercise during COVID-19		
No	402	57.43
Yes	298	42.57
Using Internet for entertainment purposes i.e., YouTube, movies, etc. during COVID-19		
No	39	5.57
Yes	661	94.43
Average daily hours of using the Internet during Covid-19		
<2 hours	32	4.57

Variable	N	(%)
2 ≤ hours ≤ 4	154	22.00
5 ≤ hours ≤ 6	255	36.43
>6 hours	259	37.00

Most of the participants, 661 (94.43%), used the internet for entertainment during the COVID-19 period. In the case of average daily hours of using the internet, 36.43% reported using it in between 5 to 6 hours, 37% used more than 6 hours, 22% used between 2 to 4 hours, and only 4.57% engaged in using the internet less than 2 hours daily.

Measurements of Depression, Anxiety and Excessive Internet Usage

Table 3
The level of severity of depression and anxiety.

Variable	Level of Severity	Total (n = 700)	
		n	%
Depression	Minimal, 0–4	117	16.71
	Mild, 5–9	223	31.86
	Moderate, 10–14	154	22.00
	Moderately severe, 15–19	127	18.14
	Severe, 20–27	79	11.29
Anxiety	Minimal, 0–4	179	25.57
	Mild, 5–9	238	34.00
	Moderate, 10–14	161	23.00
	Severe, 15–21	122	17.43
Nature of Internet Users	Problematic, CIUS ≥ 18	604	86.29
	Excessive, CIUS ≥ 28	421	60.14

The most significant portion (31.86%) of the participants appears to have mild depression. 127(18.14%) participants reported having moderately severe depression, whereas 79 (11.29%) showed alarmingly severe symptoms, and the remaining 16.71% of respondents suffered from a minimal level of depression. Many participants (34%) also showed mild symptoms of anxiety. 122 (17.43%) participants reported having severe levels of anxiety. Severe anxiety symptoms appear to be more common than severe depression symptoms among the participants. 23% of respondents had moderate anxiety

symptoms, and the rest of 25.57% of students had a minimal level of anxiety. The CIUS consists of 14 items with a 5-point scale: 0, never; 1, seldom; 2, sometimes; 3, often; and 4, very often. The maximum attainable score in CIUS is 56. The cut-off value for problematic internet use validated by Guertler et al. (2014) was ≥ 18. Khazaal et al. (2012) dichotomized the maximum score in half and used values ≥ 50% (≥ 28) to indicate excessive internet use. During the pandemic, 604 (86.29%) out of 700 participants reported problematic internet use, and 421 (60.14%) were excessive users. The mean scores of each measure presented in the appendix indicate the average experience of the participants about each item **[**Table 3**]**.

Risk factors of Depression and Anxiety

Table 4
Predictors of depression level

Variables	Mild	Moderate	Moderately severe	Severe
Age	0.95 (0.83–1.08)	0.93 (0.81–1.08)	1.00 (0.86–1.17)	1.02 (0.86–1.21)
Gender Status (Male)	0.63* (0.38–1.03)	0.60* (0.35–1.02)	0.38*** (0.21–0.67)	0.54* (0.28–1.03)
Living status during COVID-19 (With Family)	0.61* (0.37–1.02)	0.60* (0.34–1.04)	0.94 (0.51–1.73)	1.90* (0.90–3.99)
Excessive Internet Uses	2.69*** (1.64–4.41)	4.13*** (2.40–7.13)	6.25*** (3.42–11.40)	5.61*** (2.82–11.13)
Average daily hours: 2 ≤ hours < 4	0.82 (0.28–2.39)	1.12 (0.31–4.10)	1.21 (0.25–5.80)	0.29* (0.07–1.17)
Average daily hours: 5 ≤ hours ≤ 6	1.32 (0.45–3.81)	2.07 (0.57–7.47)	3.60 (0.78–16.69)	0.75 (0.20–2.85)
Average daily hours: ≥6 hours	1.35 (0.45–4.06)	1.98 (0.53–7.44)	4.05* (0.85–19.40)	1.20 (0.31–4.70)
Using Internet for entertainment purpose (Yes)	1.96 (0.58–6.61)	0.73 (0.24–2.24)	0.34* (0.11–1.04)	0.41 (0.12–1.42)
Academic Performance: Medium	0.60 (0.19–1.96)	0.42 (0.13–1.38)	0.24** (0.07–0.77)	0.32* (0.09–1.13)
Academic Performance: High	0.36* (0.11–1.21)	0.25** (0.07–0.85)	0.13*** (0.04–0.46)	0.13*** (0.03–0.49)
Physical exercise during COVID-19 (Yes)	0.92 (0.57–1.47)	0.51** (0.30–0.86)	0.63* (0.36–1.09)	0.91 (0.49–1.70)
Sleeping hours: Normal (7 to 9 hours)	0.74 (0.44–1.24)	0.58* (0.33–1.02)	0.58* (0.31–1.05)	0.63 (0.32–1.26)
Sleeping hours: Excess (> 9 hours)	0.74 (0.25–2.24)	0.95 (0.31–2.94)	0.97 (0.30–3.12)	1.88 (0.57–6.21)

In the depression model, excessive internet use was the most consistent significant predictor. Students with excessive internet use had higher odds of mild depression (OR = 2.69; 95% CI: 1.64–4.41; p < .01), moderate depression (OR = 4.13; 95% CI: 2.40–7.13; p < .01), moderately severe depression (OR = 6.25; 95% CI: 3.42–11.40; p < .01), and severe depression (OR = 5.61; 95% CI: 2.82–11.13; p < .01) compared with students with minimal depression. This means that excessive internet use increases the chance of having higher levels of depression. Male students had lower odds of depression than female students. Being male reduced the odds of mild depression (OR = 0.63; 95% CI: 0.38–1.03; p < .10), moderate depression (OR = 0.60; 95% CI: 0.35–1.02; p < .10), moderately severe depression (OR = 0.38; 95% CI: 0.21–0.67; p < .01), and severe depression (OR = 0.54; 95% CI: 0.28–1.03; p < .10). This suggests that

female students were more vulnerable to depression during COVID-19. Living with family was associated with lower odds of mild depression (OR = 0.61; 95% CI: 0.37–1.02; p < .10) and moderate depression (OR = 0.60; 95% CI: 0.34–1.04; p < .10), but it was associated with higher odds of severe depression (OR = 1.90; 95% CI: 0.90–3.99; p < .10). This indicates that family living may reduce some lower levels of depression, although prolonged home stay during lockdown may also increase severe mental pressure for some students. Academic performance was also significantly related to depression. Students with medium academic performance had lower odds of moderately severe depression (OR = 0.24; 95% CI: 0.07–0.77; p < .05) and severe depression (OR = 0.32; 95% CI: 0.09–1.13; p < .10) compared with students with low academic performance. Students with high academic performance also had lower odds of mild depression (OR = 0.36; 95% CI: 0.11–1.21; p < .10), moderate depression (OR = 0.25; 95% CI: 0.07–0.85; p < .05), moderately severe depression (OR = 0.13; 95% CI: 0.04–0.46; p < .01), and severe depression (OR = 0.13; 95% CI: 0.03–0.49; p < .01). This suggests that better academic performance may protect students from depression. Physical exercise was negatively associated with depression. Students who did physical exercise had lower odds of moderate depression (OR = 0.51; 95% CI: 0.30–0.86; p < .05) and moderately severe depression (OR = 0.63; 95% CI: 0.36–1.09; p < .10). Normal sleeping hours also reduced the odds of moderate depression (OR = 0.58; 95% CI: 0.33–1.02; p < .10) and moderately severe depression (OR = 0.58; 95% CI: 0.31–1.05; p < .10). These findings suggest that physical activity and regular sleep may help reduce depressive symptoms **[**Table 4**].**

Table 5
Predictors of anxiety level

Variables	Mild	Moderate	Severe
Age	0.97 (0.86–1.09)	1.04 (0.92–1.18)	1.11 (0.96–1.27)
Gender Status (Male)	0.90 (0.58–1.37)	0.68 (0.42–1.08)	0.76 (0.46–1.27)
Living status during COVID-19 (With Family)	0.93 (0.60–1.46)	1.00 (0.61–1.62)	1.69* (0.98–2.93)
Excessive Internet Uses	2.09*** (1.38–3.18)	3.72*** (2.31–6.00)	3.56*** (2.08–6.09)
Using Internet for entertainment purposes (Yes)	0.89 (0.36–2.18)	1.30 (0.43–3.94)	0.49 (0.17–1.36)
Average daily hours: 2 ≤ hours < 4	0.37* (0.12–1.11)	0.53 (0.13–2.11)	0.27* (0.07–1.03)
Average daily hours: 5 ≤ hours ≤ 6	0.38* (0.13–1.13)	1.02 (0.27–3.89)	0.40 (0.11–1.47)
Average daily hours: ≥6 hours	0.32** (0.10–0.97)	0.53 (0.14–2.09)	0.62 (0.17–2.30)
Academic Performance: Medium	0.71 (0.31–1.63)	0.40** (0.17–0.93)	0.67 (0.27–1.66)
Academic Performance: High	0.63 (0.26–1.51)	0.46* (0.19–1.13)	0.41* (0.15–1.09)
Physical exercise during COVID-19 (Yes)	0.64** (0.42–0.96)	0.79 (0.50–1.24)	1.04 (0.63–1.70)
Sleeping hours: Normal (7 to 9 hours)	0.65* (0.42–1.03)	0.54** (0.33–0.89)	0.46*** (0.27–0.80)
Sleeping hours: Excess (> 9 hours)	1.06 (0.44–2.53)	0.82 (0.31–2.16)	1.13 (0.43–2.95)

In the anxiety model, excessive internet use was again a strongly significant predictor. Students with excessive internet use had higher odds of mild anxiety (OR = 2.09; 95% CI: 1.38–3.18; p < .01), moderate anxiety (OR = 3.72; 95% CI: 2.31–6.00; p < .01), and severe anxiety (OR = 3.56; 95% CI: 2.08–6.09; p < .01) compared with students with minimal anxiety. This means that excessive internet use increases the chance of anxiety at all levels. Living with family was associated with higher odds of severe anxiety (OR = 1.69; 95% CI: 0.98–2.93; p < .10). This may indicate that long-term home confinement, family pressure, or uncertainty during COVID-19 increased severe anxiety among some students. Academic performance was significantly associated with anxiety. Students with medium academic performance had lower odds of moderate anxiety (OR = 0.40; 95% CI: 0.17–0.93; p < .05). Students with high academic performance had lower odds of moderate anxiety (OR = 0.46; 95% CI: 0.19–1.13; p < .10) and severe anxiety (OR = 0.41; 95% CI: 0.15–1.09; p < .10). This suggests that better academic performance may reduce anxiety among students. Physical exercise reduced the odds of mild anxiety (OR = 0.64; 95% CI: 0.42–0.96; p <

.05). Normal sleeping hours were also protective against anxiety. Students who slept 7 to 9 hours had lower odds of mild anxiety (OR = 0.65; 95% CI: 0.42–1.03; p < .10), moderate anxiety (OR = 0.54; 95% CI: 0.33–0.89; p < .05), and severe anxiety (OR = 0.46; 95% CI: 0.27–0.80; p < .01). This means that regular sleep was strongly related to lower anxiety symptoms **[**Table 5**].**

Discussion

The present study found a high level of mental health problems and excessive internet use among university students in Bangladesh during the COVID-19 pandemic. In this study, 83.29% of students had mild to severe depression, and 74.43% had mild to severe anxiety; additionally, 86.29% were problematic internet users and 60.14% were excessive internet users. These findings show that both mental health problems and excessive internet use were common among university students during the pandemic period. This result is similar to an earlier Bangladeshi study, where Islam et al. reported that 82.4% of university students had mild to severe depression and 87.7% had mild to severe anxiety during COVID-19 [13]. The findings are also close to Faisal et al., who found that 72% of Bangladeshi university students had depressive symptoms and 40% had moderate to severe anxiety during the pandemic [16]. Compared with a global meta-analysis where the pooled prevalence of internet addiction among university students was 41.84%, the present study found a higher level of excessive internet use, which may be related to long campus closure, online classes, social isolation, and increased dependence on the internet during COVID-19 [3]. This higher level is also greater than the pre-pandemic Bangladeshi study by Islam and Hossin, where nearly 24% of graduate students showed problematic internet use, suggesting that the pandemic period may have increased problematic internet behavior among students [17].

The prevalence of excessive internet use in this study was higher than in many previous studies. The present study found that 60.14% of students were excessive internet users, while Sayeed et al. reported 39.3% problematic internet use among Bangladeshi university students during the COVID-19 pandemic [18]. Similarly, Biswas et al. found that the overall prevalence of internet addiction among adults during the COVID-19 pandemic was 29.4%, although the rate was higher among younger participants [19]. This difference may be due to differences in study population, measurement tools, cut-off points, data collection time, and the level of dependence on online classes. In the present study, the sample included university students during a period when academic, social, and entertainment activities were strongly internet-based. This may explain why the proportion of problematic and excessive internet users was very high. A study among Hong Kong university students also reported that online learning and reduced offline activities during COVID-19 created a situation where students became more vulnerable to internet addiction [20]. Thus, the high prevalence in the present study is consistent with the idea that pandemic-related lifestyle changes increased students' internet dependence.

The most important finding of this study was that excessive internet use was significantly associated with both depression and anxiety. Students with excessive internet use had higher odds of mild, moderate, moderately severe, and severe depression compared with students with minimal depression. They also had higher odds of mild, moderate, and severe anxiety compared with students with minimal

anxiety. This finding is supported by Xie et al., who found that problematic internet use was significantly associated with higher risks of depressive and anxiety symptoms among young people during the COVID-19 pandemic [21]. A study by Gavurova et al. among higher education students in the Czech Republic and Slovakia also found that internet addiction was associated with depressive symptoms, anxiety symptoms, and stress [3]. Similarly, a Bangladeshi study by Sayeed et al. reported that problematic internet use was related to depressive symptoms, health status, and internet-use behaviors among university students [22]. These findings support the present study and suggest that excessive internet use may not only be a behavioral problem but also a mental health concern.

There are several possible reasons why excessive internet use was strongly associated with depression and anxiety in this study. During the COVID-19 pandemic, students used the internet for online classes, communication, entertainment, and coping with boredom, but long and uncontrolled use may have disturbed their sleep, reduced physical activity, increased academic distraction, and increased emotional dependence on online activities. A study by Singla et al. found that internet use during lockdown was associated with sleep, cognition, and physical activity patterns, which supports the possible link between excessive internet use and poorer daily functioning [3]. Jiang reported that problematic social media use was associated with anxiety among university students during COVID-19, and this relationship was connected with psychological capital and academic burnout [23]. This means that students who used online platforms excessively may have experienced more academic pressure, emotional tiredness, and anxiety. Therefore, the present study's findings may be explained by the fact that excessive internet use can disturb students' normal routine and increase mental pressure during a crisis period.

Gender was another significant factor in the depression model. Male students had lower odds of depression than female students, which means female students were more likely to experience depressive symptoms during the pandemic. This finding is consistent with several studies showing that female students were more vulnerable to psychological distress during COVID-19. Albikawi found that anxiety among female university students was influenced by family support, family income, chronic illness, and exposure to COVID-19 patients [24]. A study among Bangladeshi university students by Shovo et al. also examined determinants of generalized anxiety, depression, and sleep quality during COVID-19 and showed that student mental health was influenced by several sociodemographic and lifestyle factors [25]. Female students may have been more affected because of greater emotional pressure, increased household responsibilities, social restrictions, safety concerns, and uncertainty during lockdown. This does not mean that male students did not suffer, but it suggests that female students may need special attention in university mental health support programs.

Living with family during COVID-19 showed a mixed relationship with mental health. Students living with family had lower odds of mild and moderate depression, but higher odds of severe depression and severe anxiety. This finding may look contradictory, but it is reasonable in the context of the pandemic lockdown. For many students, family support may reduce loneliness and provide emotional and financial support, which can help reduce mild or moderate depression. Research on social support during COVID-19 suggests that stronger support is generally related to better mental health outcomes among students

[26]. However, living with family for a long time during lockdown may also create stress because of family conflict, lack of privacy, financial problems, caregiving responsibilities, and fear of family members becoming infected. Liu et al. found that poor family functioning and negative coping style increased depression and anxiety among college students during and after COVID-19 [27]. Therefore, family living can be protective for some students but stressful for others, depending on the quality of family relationships and the home environment.

Academic performance was found to be a protective factor against depression and anxiety. Students with medium or high academic performance had lower odds of several levels of depression and anxiety compared with students with low academic performance. This finding may indicate that students with better academic performance had more confidence, better study habits, and stronger hope about their future. During COVID-19, academic uncertainty was one of the major stressors for university students, and students who felt academically weaker may have been more worried about online classes, examinations, graduation delay, and future employment. A study on university students' wellbeing during the pandemic reported that academic disruption and uncertainty were important factors connected with poorer student wellbeing [28]. Another study by Chaturvedi et al. reported that COVID-19 affected students' education, social life, and mental health, which supports the idea that academic pressure and mental health were closely related during the pandemic [29].

Physical exercise was also significantly associated with lower depression and anxiety. Students who did physical exercise had lower odds of moderate and moderately severe depression and lower odds of mild anxiety. This finding is consistent with Luo et al., who found that physical activity significantly improved anxiety and depression among college students during the COVID-19 pandemic [30]. Another study among health-related university students during COVID-19 also reported that physical activity was linked with depressive, anxiety, and stress symptoms [31].

Normal sleeping hours were another important protective factor. Students who slept 7 to 9 hours had lower odds of moderate and moderately severe depression and also lower odds of mild, moderate, and severe anxiety. This finding is supported by Ahammed et al., who found strong links among sleep quality, anxiety, depression, and fear of COVID-19 among Bangladeshi university students [32]. Sleep may be important because poor sleep can increase emotional instability, reduce concentration, and make students more sensitive to stress. Excessive internet use may also disturb sleep because students may use devices late at night for social media, videos, games, or online communication.

Daily internet-use duration showed mixed findings in this study. Some categories of daily internet use were associated with lower odds of anxiety or severe depression, while using the internet for 6 hours or more was associated with higher odds of moderately severe depression. This suggests that the number of hours alone may not fully explain mental health problems; rather, the purpose, control, and psychological dependence on internet use may be more important. Sayeed et al. found that problematic internet use among Bangladeshi university students was associated with longer internet use, purpose of internet use, and specific online activities such as movie or TV series downloading [18]. This supports

the present study because simple internet use for study or communication may not be harmful, but uncontrolled and compulsive use may increase mental health risks. In the present study, the CIUS-based excessive internet-use variable was more consistently associated with depression and anxiety than daily hours of internet use.

Using the internet for entertainment purposes was negatively associated with moderately severe depression in this study. This finding may mean that some entertainment-based internet use worked as a coping strategy during lockdown. During COVID-19, students had fewer offline recreational options, so watching videos, movies, or other online content may have reduced boredom and loneliness for some students. However, this result should be interpreted carefully because entertainment use was not consistently protective across all levels of depression and anxiety. Research on problematic internet and social media use shows that online activities can have both positive and negative effects depending on whether they are controlled, meaningful, and balanced with offline life [23].

Strengths and Limitations

This study has several strengths. First, it used primary data collected directly from university students in Bangladesh during the COVID-19 pandemic. Second, the final sample size was good, as 700 complete responses were included in the analysis. Third, the study used standard measurement tools, including CIUS for excessive internet use, PHQ-9 for depression, and GAD-7 for anxiety. Fourth, the tools showed good reliability, with Cronbach's alpha values above 0.85 for all three scales. Fifth, the study used multinomial logistic regression, which helped examine different severity levels of depression and anxiety instead of only simple yes/no outcomes.

However, this study also has some limitations. Since it used a cross-sectional design, it can show association but cannot prove cause and effect. In addition, the study used convenience sampling and self-reported data, so the findings may not fully represent all university students in Bangladesh and may include some reporting bias.

Recommendations

Based on the findings, universities should develop a clear student digital well-being and mental health policy. Since excessive internet use was strongly associated with depression and anxiety, university authorities should provide guidelines on healthy internet use, balanced screen time, digital breaks during online classes, and safe use of social media. Internet use should be promoted for learning and communication, but students should also be encouraged to maintain regular sleep, study routines, and offline activities. Universities should also strengthen mental health screening and counseling services. Students should be screened for problematic internet use, depression, and anxiety using short standard tools, and high-risk students should be referred to trained counselors or mental health professionals. These services should be confidential, affordable, and easily accessible. As female students were more vulnerable to depression, gender-sensitive counseling and peer-support groups should also be introduced. Academic and lifestyle support should be included in student wellbeing programs. Since

better academic performance, physical exercise, and regular sleeping hours were protective factors, universities should provide academic mentoring, support for low-performing students, physical activity programs, and sleep-hygiene awareness. Policymakers, including the Ministry of Education and University Grants Commission, should support universities in building integrated student wellbeing programs that combine digital wellbeing, counseling, academic support, physical activity, sleep management, and family awareness.

Conclusion

This study provides evidence that excessive internet use was significantly associated with depression and anxiety among university students in Bangladesh during the COVID-19 pandemic. The findings indicate that students who used the internet excessively were more likely to experience higher levels of depressive and anxiety symptoms than those with minimal symptoms. This suggests that uncontrolled internet use may create an additional mental health burden for university students during periods of academic disruption, social isolation, and uncertainty. The study also identified several protective factors. Better academic performance, regular physical exercise, and normal sleeping hours were associated with lower levels of depression and anxiety. In addition, gender differences were observed in depression, where female students appeared to be more vulnerable than male students. These findings highlight the need for university-based mental health support that considers students' digital behavior, academic pressure, lifestyle habits, and gender-specific needs. Finally, the study suggests that excessive internet use should be treated as an important issue for student well-being. Universities and policymakers should promote healthy internet-use practices, accessible counseling services, academic mentoring, physical activity, and sleep-hygiene awareness. Such integrated support can help reduce depression and anxiety among university students during future public health emergencies and in regular academic settings.

Declarations

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Ethical Considerations

We received the ethical approval from the ethical review committee of Anthropology department of Shahjalal Universit of Science and Technology, Bangladesh. This study was conducted in accordance with the ethical standards of the Declaration of Helsinki and its later amendments or comparable ethical standards. The study does not need to seek any ethical approval from the institution. Informed written consent assured prior to interview. Data privacy and confidentiality ensured.

Declaration of Conflicting interests

The authors declare no competing interests.

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Data Availability Statement

The data are freely available on request to the corresponding author.

Consent to Publish

Yes.

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