

ORIGINAL ARTICLE

Internet and Game Addiction in Relation to Sleep Disturbances: Findings From a University Student Sample

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ABSTRACT

Introduction: Sleep health among university students is understudied, despite its critical importance to well-being. As digital technologies become deeply integrated into daily life, understanding the impact of internet and gaming addiction on sleep quality is vital. This study aims to assess the prevalence of sleep disturbances among university students and investigate the relationships between internet addiction, gaming addiction, and sleep quality within this population. **Methods:** This cross-sectional study included 308 university students. Internet addiction was assessed using the Internet Addiction Test, while game addiction was evaluated with the Game Addiction Scale. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI). **Results:** The findings indicated that 37% of participants reported moderate to severe internet addiction, while 59.1% were classified as pathological gaming addicts. The prevalence of sleep disturbances was 79%. The findings from logistic regression analysis indicate a significant correlation between game addiction and sleep quality. It suggests that individuals with pathological game addiction are more likely to experience sleep disturbances in comparison to those with normal levels of game addiction (OR = 2.038, 95% CI [1.106, 3.757]). Neither gender nor internet addiction levels significantly predicted sleep disturbances. **Conclusion:** Our findings highlight the need to promote balanced and healthy digital habits, especially regarding gaming behaviour, to protect sleep health and student well-being. This study emphasises integrating sleep health into university-level policy-making and intervention programs.

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INTRODUCTION

Decades of research have underscored the essential role of sleep in maintaining physical and mental health (1). Yet, many populations are experiencing a concerning decline in sleep duration and an increase in insomnia and sleep disturbances (2). University students are particularly at risk due to their demanding schedules, academic pressures, and lifestyle changes (3). Studies reveal that a significant number of students face sleep-related issues, such as insomnia, poor sleep quality, and delayed sleep phase disorder (4). For instance, Becker et al. (5) found that 62% of participants reported poor sleep, with 36% sleeping less than 7 hours per night and 43% taking over 30 minutes to fall asleep regularly. In Malaysia, Naito et al. (6) discovered that 58.1% of undergraduates suffered from sleep deprivation, with

another study (7) indicating that about three-fourths of students had poor sleep quality. These disturbances can impair cognitive function, reduce academic performance, and increase mental health risks, ultimately undermining students' overall well-being and success (4, 8, 9). Identifying modifiable risk factors for sleep issues is critical for developing effective interventions tailored to this population.

One such factor that has gained increasing attention is the impact of digital dependencies, such as internet and gaming addiction, on sleep health. Advancements in digital technology, including social media, online gaming, and streaming services, have significantly reshaped daily life. While these technologies offer convenience and entertainment, concerns about behavioural addictions like internet and gaming addiction are growing (10). Unlike substance addictions, these behavioural addictions arise from activities and are marked by excessive, uncontrollable use that disrupts daily functioning (11). Internet addiction is characterised by a lack of self-regulation in preference for and use

of the Internet, significantly affecting the individual's personal life (12,13). Gunuc further described internet addiction as "increased investment of resources in internet-related activities, unpleasant feelings when offline, growing tolerance to being online, and denial of problematic behaviour" (11, p. 13). These dependencies are particularly concerning in the context of sleep, as they may contribute to delayed sleep onset and poor sleep quality, warranting further exploration of their impact on university students.

Building on these concerns, the rapid growth of global internet use has not only transformed social interactions, education, and information sharing. Still, it has also led to emerging addiction issues, particularly among young adults (14), which can result in adverse mental health effects like depression (15). There is increasing evidence linking internet addiction to sleep disturbances (16, 17). Prior work (18) indicates that individuals with internet addiction are more than twice as likely to experience sleep problems compared to their non-addicted peers. However, findings are inconsistent, as some studies report no significant association between internet use and sleep quality (19, 20). University students are particularly vulnerable to internet addiction due to their high usage, developmental stage, and limited supervision (21). These demographic face significant risks to their health, especially concerning sleep, with prevalence rates of internet addiction in Malaysian university students reported between 36.9% (22) and 83.5% (23). This issue requires further investigation, given the importance of sleep for overall well-being.

Excessive internet use is closely linked to other behavioural addictions, such as game addiction (11). Lemmens et al. defines game addiction as "the compulsive use of computers or video games, featuring symptoms such as salience, mood modification, tolerance, withdrawal, conflict, and relapse," which can lead to significant social and emotional challenges (24, p. 79). While gaming offers cognitive and psychosocial benefits (25), concerns about its pathological use are growing. Recognised as a gaming disorder in the ICD-11 (26) and DSM-5 (27), it is associated with adverse outcomes, including lower academic performance, mental health issues, and reduced psychological well-being (28). Game addiction also poses a significant risk for sleep-related problems, such as poor sleep quality, shorter duration, frequent disruptions, and daytime impairment (29). Research shows that young adults with gaming addiction experience substantially worse sleep outcomes compared to their peers without addiction (30). Despite gaming's popularity as a dominant leisure activity, studies on its negative impact on sleep among university students remain limited. This gap is concerning, given the growing recognition of problematic gaming behaviour as a pressing public health issue for young adults (30).

The present study

Good sleep is vital for health, yet sleep problems remain understudied among university students. This gap is notable compared to the extensive research on other risky behaviours like poor eating habits and substance misuse (1). Addressing this disparity is crucial for understanding well-being and developing targeted interventions and policies. This study aims to investigate the prevalence of sleep disturbances among university students in Malaysia and to explore how internet addiction and game addiction relate to these sleep disturbances within the campus community. Prior research indicates differences in the prevalence of sleep disturbances across genders (31) and highlights gender-related differences in digital addiction (32). Therefore, we also examine gender differences in sleep quality, internet addiction, and game addiction. We hypothesise that students with higher levels of internet and game addiction are more likely to experience sleep disorders than those with lower levels of these addictions. Additionally, based on the literature (32), we hypothesise that male students will exhibit higher levels of internet and game addiction and, consequently, more pronounced sleep disturbances than female students.

MATERIALS AND METHODS

Sample and procedure

This cross-sectional study was carried out among first— to fourth-year undergraduate students from a faculty at a public university in Malaysia. Participants eligible for inclusion were undergraduate students aged 18 to 25 currently enrolled at the university and willing to provide informed consent. Students who had a history of diagnosed sleep disorders or medical conditions known to affect sleep (e.g., insomnia) or psychiatric disorders such as anxiety and depression were excluded to minimise confounding variables.

A minimum sample size of 297 was determined using the Raosoft Digital Sample Size Calculator (33). Parameters included a 5% margin of error, a 95% confidence interval (CI), a population size of 1,321, and a response distribution of 50%. Participants were recruited using convenience sampling through invitations sent via email and WhatsApp. The questionnaire was administered in a paper-and-pencil format rather than online. Informed consent was obtained from students after the aims and objectives of the study were explained to them. The study received ethical clearance from the Universiti Malaysia Terengganu Research Ethical Committee (UMT/JKEPM/2022/102).

Questionnaire

Respondents were administered questionnaires, collecting information on their backgrounds, including age, gender, race, study program, and year of study. The study utilised the Internet Addiction Test (IAT; 34) to assess levels of Internet addiction. This test

includes 20 items, each rated from 0 (not applicable) to 5 (always), with a total score range of 0 to 100. Young (34) categorised the scores as follows: 0 to 30 for normal internet usage, 31 to 49 for mild internet addiction, 50 to 79 for moderate addiction, and 80 to 100 for severe dependence or pathological use. Lu and Yeo (35) validated and confirmed the reliability of the Malay version of this scale for university students. The IAT demonstrated a Cronbach's α of 0.91 in the present study.

Game addiction was measured using the Game Addiction Scale (GAS; 24). This scale includes 21 items designed to identify internet game addiction in adolescents, rated on a 5-point Likert scale ranging from 1 (never) to 5 (very often). In the game addiction scale, Lemmens et al. (24 p. 88) categorized pathological gamers "as individuals who meet at least 3 out of 7 criteria on the seven subscales (salience, tolerance, mood modification, withdrawal, relapse, conflict, and problems)". In a previous study, the GAS demonstrated internal reliability among Malaysian university students (36). In the current study, the reliability of the GAS was high, with a Cronbach's α of 0.95.

Sleep disturbances were evaluated using the Pittsburgh Sleep Quality Index (PSQI; 37), a 19-item self-report tool. This questionnaire generates seven component scores: subjective sleep quality, sleep latency, duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each component score ranges from 0 to 3, where higher scores indicate more severe sleep disturbances. A total PSQI score of 5 or more differentiates between good and poor sleepers. The Malay version of the PSQI has demonstrated strong psychometric properties in previous research (38). In this study, the PSQI exhibited a Cronbach's α of 0.81.

Statistical Analysis

We evaluated the data using version 26.0 of the Statistical Package for the Social Sciences (SPSS). Descriptive methods were utilised to analyse the demographic profiles of respondents by gender, ethnicity, and year of study, along with assessing the prevalence of internet addiction, game addiction, and sleep disturbances. Gender differences in internet addiction, game addiction, and sleep quality were examined using a Pearson Chi-Square test and t-test. The relationships between gender, internet addiction, and game addiction with sleep disturbances were analysed using a binary logistic regression model. The Hosmer–Lemeshow test assessed the model's fit, which confirmed its suitability. Predictors of sleep disturbances were determined to be statistically significant if the p-value was less than 0.05 and the Adjusted Odds Ratio (AOR) had a 95% Confidence Interval (CI) that did not include one.

RESULTS

Respondent Demographics

Table I presents the demographic characteristics of the study participants. In terms of gender distribution, the majority of respondents were female, comprising 74.5% of the sample, while males accounted for 25.6%. The average age of the participants was 21.31 years, with a standard deviation of 1.28. Regarding years of study, there was a relatively even distribution across the four academic years, with approximately 30.5% of participants in each year, except for the final year. In terms of ethnicity, Malays comprised 90.6% of the respondents, representing the largest group in the sample.

Table I: Respondent demographics

Gender	n	%
Male	79	25.6%
Female	229	74.5%
<i>Years of study</i>		
1 year	94	30.5%
2 years	94	30.5%
3 years	93	30.2%
4 years	27	8.8%
<i>Ethnicities</i>		
Malay	279	90.6%
Chinese	10	3.2%
Indians	7	2.3%
Others	12	3.9%

Descriptive Statistics

Table II reports the prevalence of internet addiction, gaming addiction, and sleep quality by gender. Among the 308 students assessed, 50 (16.2%) showed normal internet usage, 144 (46.8%) exhibited mild addiction, 108 (35.1%) displayed moderate addiction, and 6 (1.9%) demonstrated severe dependence. A Pearson Chi-Square test revealed significant gender differences in internet addiction levels ($\chi^2(3, N = 308) = 20.676, p < .001$), with females more likely to report mild internet addiction and males more likely to report moderate and severe dependence. Regarding gaming, 126 students (40.9%) exhibited normal behaviour, while 182 (59.1%) showed signs of pathological gaming. The Chi-Square analysis also found a significant association between gender and gaming addiction levels ($\chi^2(1, N = 308) = 18.754, p < .001$), indicating that males were more inclined towards pathological gaming compared to females.

Table II: Mean and standard deviation, prevalence of internet addiction, game addiction and sleep disturbances.

	Male	Females	<i>p</i> -value	Total
<i>Internet addiction</i>			< .001 ^a	
<i>n</i> (%)				
Normal	8 (10.1%)	42 (18.3%)		50 (16.2%)
Mild	26 (32.9%)	118 (51.5%)		144 (46.8%)
Moderate	41 (51.9%)	67 (29.3%)		108 (35.1%)
Dependence	4 (5.1%)	2 (0.9%)		6 (1.9%)
Mean $\pm$ S.D	52.35 $\pm$ 15.78	43.06 $\pm$ 14.25	< .001 ^b	45.45 $\pm$ 15.18
<i>Game addiction</i>			< .001 ^a	
<i>n</i> (%)				
Normal	16 (20.3%)	110 (48.0%)		126 (40.9%)
Pathology	63 (79.7%)	119 (52.0%)		182 (59.1%)
Mean $\pm$ S.D	56.72 $\pm$ 18.00	40.52 $\pm$ 16.44	< .001 ^b	44.68 $\pm$ 18.25
<i>Sleep Quality</i>			0.11 ^a	
<i>n</i> (%)				
Normal	11 (14.0%)	51 (22.3%)		62 (20.1%)
Disturbances	68 (86.0%)	178 (77.7%)		246 (79.95)
Mean $\pm$ S.D	8.25 $\pm$ 3.41	6.97 $\pm$ 3.36	< .01 ^b	7.30 $\pm$ 3.42

Note: ^aSignificance of gender differences in ordinal scales was determined using Chi-Square tests; ^bSignificance of gender differences in continuous scales was determined using t-tests.

Regarding sleep quality, the mean Pittsburgh Sleep Quality Index (PSQI) score was 7.30 (SD = 3.42), with 246 students (79.9%) experiencing sleep disturbances (PSQI global score > 5). However, no significant association between gender and sleep quality was observed (χ^2 (1, N = 308) = 2.545, p = .111). Nonetheless, t-tests indicated significant gender differences in internet addiction, game addiction, and sleep quality scores (p < .001 for all variables), with males reporting significantly higher levels of digital addictions and sleep disturbances.

Logistic Regression Analysis

A logistic regression analysis was performed to predict sleep disturbances using gender, internet addiction, and game addiction as predictors. The dependent variable was sleep quality, categorised as normal (0) or disturbances (1). The independent variables were internet addiction (with four levels: normal, mild, moderate, dependence), game addiction (with two levels: normal, pathology), and gender. The regression model was significant, χ^2 (5) = 22.772, p < .001, indicating that the predictors collectively differentiated between normal and disturbed sleep. The Hosmer and

Lemeshow Test indicated a good fit (χ^2 (7) = 1.069, p = .994). The model explained between 7.1% (Cox & Snell R^2) and 11.2% (Nagelkerke R^2) of the variance in sleep quality and correctly classified 80.2% of cases.

Table III: Logistic regression results predicting sleep disturbances

	B	S.E.	Wald	<i>p</i> -value	Exp(B)	95% C.I.
Intercepts	2.771	1.844	2.258	0.133	15.980	[0.212, 1206.215]
Gender						
Male	0.316	0.392	0.648	0.421	1.371	[0.636, 2.957]
Female	0a	-	-	-	-	-
Internet addiction						
Normal	-0.219	0.955	0.052	0.819	0.803	[0.124, 5.227]
Mild	-1.159	0.931	1.549	0.213	0.314	[0.051, 1.947]
Moderate	-1.486	0.941	2.494	0.114	0.226	[0.036, 1.431]
Dependence	0a	-	-	-	-	-
Game addiction						
Normal	0.712	0.312	5.208	0.022*	2.038	[1.106, 3.757]
Pathology	0a	-	-	-	-	-

Note: The dependent variable is sleep quality, with disturbances sleep as the response category and normal sleep quality as the reference category. B = regression coefficient; SE = standard error; Exp(B) = odds ratio; CI = Confidence Interval; * p < .05.

Gender was not a statistically significant predictor of sleep quality (OR = 1.371, 95% CI [0.636, 2.957], p = 0.421). Similarly, different levels of internet addiction (normal, mild, moderate) did not significantly impact sleep quality compared to the dependence category (p > 0.05 for all levels). We also tested the predictive effect of internet addiction as a continuous variable on sleep disturbances. The results showed a similar pattern (B = 0.017, p = .141, OR = 1.017, 95% CI [0.994, 1.040]). In contrast, game addiction showed a significant relationship with sleep disturbances. Specifically, individuals with pathological game addiction were more likely to experience poor sleep compared to those with normal levels of game addiction (B = 0.712, p = .022, OR = 2.038, 95% CI [1.106, 3.757]).

DISCUSSION

This study sheds light on the prevalence of sleep disturbances among Malaysian undergraduate students. It investigates their connection with the internet and game addiction, underscoring the impact of digital dependencies on sleep health in this demographic. Our findings show a prevalence of 79%, which is slightly higher than the rates reported in other Malaysian university studies: 73.7% (7) and 70.6%

(39). Comparatively, other studies have reported lower prevalence rates: 32.9% (40) and 63.9% (41). Studies outside the university setting, involving adult samples, found lower prevalence rates of 45% (38), suggesting that student populations might be at higher risk for experiencing sleep disturbances than other groups.

Interestingly, our results did not confirm any connection between internet addictions and sleep quality. This contradicts the consistent patterns found in most previous studies on university students (16, 17). However, our findings align with a few studies that indicate no substantial link between internet addictions and sleep quality (18, 19). We do not have a definitive explanation for this discrepancy. Still, it may be that the connection between internet addiction and sleep disturbances may become more pronounced with long-term, chronic use (18). Given that the IAT does not directly measure the exact amount of time spent online (34), this could explain our findings. Several studies have suggested that protective factors, such as coping mechanisms (42) and resilience (43), may reduce the likelihood of an individual suffering from internet addiction, thereby modifying its outcomes. Hence, future studies should examine additional factors that might counteract the adverse effects of internet addiction on sleep quality. Another possible explanation for the insignificant effect may be that various internet activities (e.g., gaming, social media, browsing) and their purposes may affect sleep quality differently (44, 45). For example, browsing the internet may be less engaging and stimulating than gaming, making it less disruptive to sleep. Additional studies are needed to broaden the scope to other problematic online activities, such as online sex, social media use, and online shopping, which fall under the internet addiction umbrella.

In line with the hypothesis, the results of our study suggest that game addiction significantly predicts sleep disturbances in our university student sample. This finding aligns with other studies that have also found higher adverse psychological outcomes among game addicts compared to internet addicts (45). There are several tentative explanations for these findings. Gaming is highly addictive (46), leading students to prioritise it over other activities, including sleep. Research has also proposed that excessive gaming serves as a form of avoidance coping to reduce these negative emotions, creating a vicious cycle (47) wherein students stay up late or play through the night, directly affecting their sleep schedules. Extended gaming sessions typically involve prolonged exposure to screens emitting blue light. Blue light exposure before bedtime can interfere with melatonin production, impairing sleep quality (48). It has been documented that excessive gaming can also lead to a sedentary lifestyle (49), which is associated with poorer sleep quality. Further investigation into the associations between game addiction and sleep disturbances is warranted to gain insights into the

observed patterns in this study. Another avenue for future research is to study the extent to which the relationship between gaming addiction and sleep problems is related to physical and mental health outcomes.

While not a primary focus of the research, gender differences were also investigated. Similar to prior studies (7, 40, 41), we found no significant gender differences in sleep disturbances based on a cut point >5 in student samples. However, gender differences were based on the total PSQI scores, indicating that males reported higher sleep disturbances. Such results may be explained by the fact that the cut-off score of >5 is a binary classification that may not capture subtle differences in sleep quality. In contrast, the total PSQI score is a continuous measure that can detect more detailed gradations. This allows for identifying smaller but significant differences in sleep problems between males and females. Nonetheless, a meta-analysis (31) reported inconsistencies in gender differences across various populations, particularly outside student populations and in clinical settings. Regarding digital dependencies, in line with prior work (32), our findings indicate that males are more susceptible to moderate and severe dependence on internet addictions and are more likely to exhibit pathological gaming behaviours compared to females. This suggests a need for gender-specific interventions and support services aimed at mitigating the impact of digital addictions.

This study has several limitations. Due to its cross-sectional nature, the study cannot establish causal relationships between the measured variables. Future longitudinal studies would offer more detailed evidence regarding the potential long-term effects of internet and game addiction on sleep health. Our study utilized a convenience sample, which may not represent the broader population. Additionally, the sample exhibited demographic imbalances, with a disproportionate number of female participants compared to males and over 90% identifying as Malay. These imbalances may introduce gender and ethnic biases, potentially limiting the generalizability of the findings to populations with more diverse demographic profiles. Future research should aim to recruit a more balanced and diverse sample to enhance representativeness and address potential gender and ethnic biases. Furthermore, the reliance on self-report measures introduces potential biases, including social desirability and recall bias, which could impact the accuracy of the data. To provide more accurate and reliable data, future research should incorporate objective measures to complement self-reported information. Furthermore, we did not include control variables that may influence the variables in this study, particularly sleep. Factors such as Body Mass Index (BMI), mental health conditions (e.g., stress, anxiety), the timing of academic sessions, and academic workload should be considered in future work to provide a more comprehensive understanding of the

relationships examined.

From a practical standpoint, our results suggest the need for educational programs that emphasise reducing the risks and potential harm of excessive gaming on sleep and overall health. Additionally, developing policies or regulations to address problematic gaming is crucial. Such measures could include limiting gaming during exam periods or creating designated gaming-free zones on campus. Our study highlights the need for assessing digital addiction and providing support services for students with digital-related addictions. Several treatment modalities identified in the literature, including cognitive behavioural therapy (CBT), have shown promise in addressing gaming-related addiction (50). CBT typically involves modifying maladaptive cognition related to gaming behaviour to help reduce withdrawal symptoms and unpleasant mood states (50). Interventions may also benefit from fostering adaptive coping strategies, developing social skills, and establishing healthier behavioural habits, such as incorporating physical and outdoor activities instead of gaming (50). We also concur with Lim et al. (1) that more attention needs to be devoted to promoting sleep health at community and campus levels. Relevant efforts include sleep-health educational programs and awareness campaigns that promote a healthier lifestyle.

CONCLUSION

Our primary goal in this paper was to ascertain the roles of digital dependencies on sleep quality in a campus population. Several key observations emerged from our study. The results showed that 37% of participants experienced moderate to severe internet addiction, with 59.1% categorised as pathological gaming addicts. Contrary to prior research, we found that internet addiction is not a significant predictor of sleep disturbances, highlighting the need for further investigation into specific conditions influencing this relationship. In contrast, our analyses indicate that gaming addiction is a salient predictor of sleep disturbances. Such findings emphasize the importance of fostering well-regulated and beneficial digital behaviours, particularly in relation to gaming, to ensure good sleep health. These insights call for incorporating sleep health into policy-making and intervention programs at the university level.

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