

## ORIGINAL ARTICLE

# Internet Addiction Among Undergraduate Students: Effect on Eating Behaviours and Sleep Quality

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## ABSTRACT

**Introduction:** Internet addiction is one of the major issues among university students which affected not only their academic performance but also their sleep quality and eating behaviours. Thus, this study aims to investigate the association between internet addiction and eating behavior, with sleep quality among undergraduate students at Universiti Sains Malaysia (USM). **Method:** A cross-sectional study was conducted among 107 university students to obtain data regarding their internet addiction, eating behaviour, and sleep quality through a series of validated questionnaires. The Chi-square test, Mann-Whitney, and Kruskal-Wallis test had been used for the univariate analysis while binary logistic regression was the multivariate analysis. Significance was set as a p-value less than 0.05. **Results:** A total of 54.2% of the participants showed mild internet addiction and 59.8% of them had poor sleep quality. Severe internet addiction was significantly associated with highest scores in all the eating behaviour. Individuals who were overweight had the highest score for emotional eating. Furthermore, no association was found between internet addiction and eating behavior with sleep quality in both the univariate and multivariate analysis. **Conclusion:** Internet addiction may affect an individual's eating behaviour and may potentially lead to several health complications in the future. Those who were overweight tend to be emotional eaters. Although, no significant factors were associated with sleep quality, future research should be done involving other parameters such as physical activity level, biochemical data and comorbidities.

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## INTRODUCTION

The internet has become an important necessity for university students. The prevalence of internet addiction among university students is high across the world. The more worrying fact is that almost 28% of those with global depression rely on internet to find solace (1). Internet is seen as a medium for obtaining social support and platform to release stress by depressed individuals with lack of parental love (2, 3). Internet addiction may impact an individual's dietary habits, sleep pattern, physical activity, and may contribute to other unhealthy behaviour such as smoking, alcohol and drug abuse (4). University students often have inappropriate eating habits due to lack of awareness of healthy eating which may contribute to weight gain (5). A study conducted among Pakistani youth has revealed that those addicted to the internet have unhealthy dietary habits such as increased meal skipping frequency, consuming inappropriate portion size of food, and have poor choices such as

dependency on fast food, carbonated beverages as well as deep-fried food (6). Similarly, another study done among 440 students in a public university in Malaysia demonstrated that meal skipping is common due to body shape concerns and body dysmorphia. Health conscious students tend to consume healthy meals and avoid excessive snacking especially sweetened and high fat snacks to maintain ideal body shape (6).

In addition, 27.8% of the Inner Mongolia Medical University students have reported high prevalence of low sleep quality which was associated with poor academic performance, poor mutual interaction, breakfast skipping, and lack of physical activity (7). Similarly, study among 28,202 Chinese rural participants aged 18 to 79 years old showed that 27.4% have poor sleep quality during the COVID-19 outbreak (8). Among the factors that affected sleep quality are poverty due to excessive work burden to make ends meet (9). Besides, female students are at 4.1 times higher risk of developing bad-quality sleep. Students who practice less than seven hours of sleep are 8.4 times higher to have a poor quality of sleep (10). Moreover, use of mobile phones for more than one hour prior to bedtime increases risk of poor sleep quality (10). A study conducted at the Government Doon Medical College of India showed that university students

tend to have poor sleep quality because students were unable to manage their stress and depression levels (11). Considering the negative effect of internet addiction, the current study aims to identify the association between internet addiction with sleep quality, eating behaviour, and body mass index among undergraduate students in a public university in Malaysia.

## MATERIALS AND METHODS

### Research design

A cross-sectional study had been conducted among 107 undergraduate students enrolled in the health campus of one of the public universities in Malaysia. Sample size was calculated using the one proportion formula with the values of precision  $\Delta = 0.1$ , confidence level (CI) = 95%, Z-score = 1.96 and prevalence of 63.9% (12). This study had been conducted from March 2022 to November 2022. Subject recruitment had been done via convenience sampling method by distributing online posters and telephone messages about the study. This study obtained permission from the ethical committee of the university and was awarded an approval number of USM/JEPeM/21060454. Informed consent had been obtained from all participants before recruitment. Subjects aged 18 to 30 years old who had smartphones, laptops, iPad, or computers with Internet access were recruited. Postgraduate students were excluded from the study.

The data collection had been done by distributing an online questionnaire via Google form. The questionnaire had several sections namely the sociodemographic data, anthropometry, internet addiction, eating behaviour, and sleep quality. Sociodemographic data consisted of age, gender, and race, while anthropometric data included self-reported weight, height, and body mass index (BMI).

Internet addiction had been assessed using the Malay version of the Internet Addiction Test (IAT) which had 20 items and a Cronbach alpha of 0.91 (13, 14). Each item had a Likert scale response from one (never) to five (always), and a higher score indicated an increased risk of internet addiction. The scores were divided into four categories namely normal (zero to 30), mild (31 to 49), moderate (50 to 79), and severe (80 to 100) (15).

In addition, the eating behavior was assessed using the Malay version of the Dutch Eating Behavior Questionnaire (DEBQ) which consisted of 30 items (16). A total of three questions had been removed from the original English version with 33 items for improving the reliability of the Malay version of DEBQ. DEBQ measured three components which were the emotional (13 items), external (eight items), and restrained eating behavior (nine items). The Cronbach's alpha values for emotional eating, external eating, and restrained eating were 0.894, 0.851, and 0.901 respectively (17). Each

item in DEBQ had a five-point Likert scale from 1=never, 2=seldom, 3=sometimes, 4=often, and 5=very often. Reverse scoring was applied to item 21. The total score for each domain was calculated by adding the score for each item in the respective domains and a higher score indicated the increasing severity of each behaviour.

On the other hand, sleep quality was assessed using the Malay version of the Pittsburgh Sleep Quality Index (PSQI) questionnaire (18). It consisted of 19 questions with seven major domains namely the subjective sleep quality (1 item), sleep latency (2 items), sleep duration (1 item), habitual sleep efficiency (3 items), sleep disturbances (9 items), the use of sleeping medication (1 item), and daytime dysfunction (2 items). The reliability coefficient of PSQI was 0.73. The global score of PSQI ranged from zero to 21 and was divided into two categories namely the good ( $\leq$ five) and poor ( $>$ five) sleep quality (19). Scoring for each domain were categorized into four groups namely 'very good' (0), 'fairly good' (1), 'fairly bad' (2), and 'very bad' (3). The scoring for each domain were as following:

1. Subjective sleep quality: Very good was awarded with score 0, 1 fairly good, 2 fairly bad and score 3 for very bad subjective sleep quality.
2. Sleep latency: This score was calculated by adding the sum of question 2 and question 5a in PSQI. Answers  $\leq$ 15 minutes was given score 0,  $>$ 15 minutes and  $\leq$ 30 minutes score 1,  $>$ 30 and  $\leq$ 60 minutes score 2, and  $>$ 60 minutes score 3.
3. Sleep duration: Sleep duration of  $>$ 7 hours were given score 0, 6-7 hours score 1, 5-6 hours score 2 and  $<$ 5 hours score 3.
4. Sleep efficiency was calculated using the formula of: (number of hours slept/number of hours spent in bed)  $\times$  100. Habitual sleep efficiency of  $>$ 85% had score of 0, 75-84% score 1, 65-74% score 2, and  $<$ 65% score 3.
5. Use of sleeping medication: Individuals reporting not using sleeping medications for the past months were given score 0, 'less than once a week' score 1, once or twice a week was given score 2 and three or more times a week were given score 3.
6. Daytime dysfunction was calculated by adding question 8 and 9. Sum 0 was given score 0, 1-2 score 1, 3-4 was given score 2 and 5-6 score 3.
7. Sleep disturbance was calculated by adding question 5b to 5j in PSQI. Score 0 was given for sum of 0, score 1 for sum of 1-9, sum of 10-18 score 2 and sum of 19-27 score 3.

### Statistical analysis

IBM SPSS Statistic version 26.0 was used for data analysis. The socio-demographic data were summarized using descriptive statistics. The categorical data were presented in the form of frequency (%), while numerical data as mean(standard deviation) or median(interquartile range). The Chi-Square test was used to determine the association between internet addiction and sleep quality. On the other hand, Mann-Whitney test was employed

for determining the median differences between sleep quality and each domain of eating behavior. Besides that, Kruskal Wallis Test was performed to analyze the median differences between internet addiction and each domain of eating behaviors as well as eating behaviour domain with body mass index. Further, binary logistic regression analysis had been employed for analysing the factors associated with poor sleep quality. The regression model had been adjusted for age, gender and body mass index. The significance value was set at  $p < 0.05$ .

## RESULTS

### Demographic characteristic

A total of 107 undergraduate students participated in this study. The majority of the students were female (72%), of Malay ethnicity (79.4%), and were between the age group of 21-23 years old (72%) (Table I).

**Table I: Sociodemographic Data of Participants (n=107)**

Socio-demography	Category	Frequency	Percent (%)
Gender	Female	77	72.0
	Male	30	28.0
Age	18-20	21	19.6
	21-23	77	72.0
	24-26	7	6.5
	27-30	2	1.9
Race	Malay	85	79.4
	Chinese	8	7.5
	Indian	6	5.6
	Others	8	7.5

### Body mass index, internet addiction and eating behaviour

Male had higher weight (66.67(12.7) kg) as compared to female, 56.26(12.6) kg ( $p < 0.001$ ). Majority of the students (59.8%) had normal BMI category. A total of 54.2% of the students had mild internet addiction, followed by 34.6% in the moderate internet addiction domain. Only 3.7% of students were reported to have severe internet addiction. Analysis showed that there was no significant age and gender differences in the internet addiction (data not shown in table) (Table II).

### Sleep quality of study participants

Most of the students (59.8%) had poor sleep quality. Analysis had been done for all the seven domain of PSQI. Subjective sleep quality and sleep duration were reported to be good among 62.6% and 28.0% of the participants respectively. The 28.0% of the participants reported to have sleep duration of more than 7 hours. On the other hand, sleep latency, habitual sleep efficiency and daytime function were reported to be bad among 42.1%, 71.0% and 56.1% of the students. Meanwhile, almost 15.9% of the students reported having very bad sleep disturbances. For the sleep medication category, 95.3% did not take any sleep medication during the past months. (Table III).

**Table II: Anthropometric Parameters, Internet Addiction, and Eating Behaviour of Subjects**

Indicator	Mean(SD)	p-value
<b>Weight (kg)<sup>a</sup></b>		
Female	56.26(12.6)	$p < 0.001$
Male	66.67(12.7)	
<b>Height (cm)<sup>a</sup></b>		
Female	157.99(6.8)	$p < 0.001$
Male	169.22(7.6)	
<b>Body Mass Index (BMI)</b>		
Underweight	17(15.9)	
Normal	64(59.8)	
Overweight	18 (16.8)	
Obese	8(7.5)	
<b>Internet Addiction Test</b>		
Normal	8(7.5)	
Mild	58(54.2)	
Moderate	37(34.6)	
Severe	4(3.7)	
<b>Eating Behaviour<sup>a</sup></b>		
<b>Emotional Eater</b>		
Female	33.23(10.3)	0.191
Male	36.87(13.8)	
<b>External Eater</b>		
Female	28.52(5.6)	0.285
Male	27.37(7.2)	
<b>Restrained Eater</b>		
Female	24.25(8.7)	0.862
Male	24.50(7.4)	

Abbreviation: BMI: Body Mass Index; SD: Standard Deviation

<sup>a</sup>Independent T-test

### Association between internet addiction with body mass index, eating behaviour and sleep quality

The association between internet addiction with body mass index and sleep quality revealed no significant association. However, all the three eating behaviour domains were significantly related to internet addiction. Subjects with severe internet addiction had the highest score (indicating worsening eating behaviour) for all three eating behaviour domains; emotional eating (41.0(37.0)), restrained eating (32.0(21.0)), and external eating (33.5(13.0)) ( $p < 0.05$ ) (Table IV).

### Association between eating behaviour with body mass index and sleep quality

No significant associations were obtained for associations between sleep quality and the three eating behavior domains. On the other hand, association between restrained eating and body mass index was significant with the highest score reported among those who were overweight (26.4(9.0)) as compared to other BMI groups (Table V). Regression analysis which had been adjusted for age, gender and BMI showed no significant factors affecting sleep quality (Table VI).

**Table III: Sleep Quality of Participants**

Sleep Quality	Frequency	Percentage
Poor sleep quality	64	59.8
Good sleep quality	43	40.2
<b>Subjective sleep quality</b>		
Very good	13	12.1
Fairly good	67	62.6
Fairly bad	24	22.4
Very bad	3	2.8
<b>Sleep latency</b>		
0 (Very bad)	29	27.1
1 (Fairly bad)	45	42.1
2 (Fairly good)	18	16.8
3 (Very good)	15	14.0
<b>Sleep duration</b>		
>7 hours (Very good)	30	28.0
6-7 hours (Fairly good)	19	17.8
5-6 hours (Fairly bad)	29	27.1
<5 hours (Very bad)	29	27.1
<b>Habitual sleep efficiency</b>		
>85% (Very bad)	76	71.0
75-84% (Fairly bad)	18	16.8
65-74% (Fairly good)	6	5.6
<65% (Very good)	7	6.5
<b>Sleep disturbance</b>		
0 (Very good)	10	9.3
1-9 (Fairly good)	80	74.8
10-18 (Fairly bad)	16	15.0
19-27 (Very bad)	1	0.9
<b>Sleep medication</b>		
Not during the past months (Very good)	102	95.3
Less than once a week (Fairly good)	3	2.8
Once or twice a week (Fairly bad)	1	0.9
Three or more times a week (Very bad)	1	0.9
<b>Daytime function</b>		
0 (Very bad)	29	27.1
1-2 (Fairly bad)	60	56.1
3-4 (Fairly good)	16	15.0
5-6 (Very good)	2	1.9

**DISCUSSION**

This study aimed to investigate the relationship between internet addiction with sleep quality and eating behaviour. The findings of this study revealed that more than half of the study participants (54.2%) had mild internet addiction. There were no significant gender and age differences in the internet addiction score. This resembles a study conducted among 176 undergraduate students in a local university in Pakistan which found that 46.6% of them had mild internet addiction. In addition, another study that was conducted at Universiti Malaysia Sarawak, Malaysia also found reported that 52% of the students had mild internet addiction (20). On the other hand, the study conducted by Hassan et.al.,(2020)

**Table IV: Association between Internet Addiction with Sleep Quality and Eating Behaviour**

	Internet Addiction			
	Normal	Mild	Moderate	Severe
<b>Sleep Quality*</b>				
Poor	3(37.5)	27(46.6)	11(29.7)	2(50.0)
Good	5 (62.5)	31(53.4)	26(70.3)	2(50.0)
<b>Body Mass Index*</b>				
Underweight	0(0.0)	12(20.7)	3(8.1)	2(50.0)
Normal	7(87.5)	35(60.3)	21(56.8)	1(25.0)
Overweight	1(12.5)	7(12.1)	10(27.0)	0(0.0)
Obese	0(0.0)	4(6.9)	3(8.1)	1(25.0)
<b>Eating Behaviour</b>				
Emotional eating**	23.0(15.0)	30.0(13.0)	35.0(21.0)	41.0(37.0)
Restrained eating**	18.5(9.0)	24.0(11.0)	26.0(11.0)	32.0(21.0)
External eating**	23.5(14.0)	27.0(8.0)	30.0(9.0)	33.5(13.0)

\*Not significant using Pearson Chi-Square test  
\*\* p<0.05 using Kruskal-Wallis test

**Table V: Association between Eating Behavior with Sleep Quality and Body Mass Index**

Eating Behavior Domain	Sleep Quality (Median (IQR))*			p-value	
	Good Sleep Quality	Poor Sleep Quality			
Emotional	30.0(20.0)	34.0(14.0)		0.587	
External	28.0(8.0)	29.0(8.0)		0.841	
Restrained	26.0(10.0)	24.0(12.0)		0.232	
<b>Body Mass Index (Median (IQR))</b>					
	Under-weight	Normal	Over-weight	Obesity	
Emotional	31.0(11.0)	34.5(17.0)	30.5(14.0)	32.5(12.0)	0.381
External	29.0(10.0)	29.0(8.0)	26.0(12.0)	28.0(9.0)	0.612
Restrained	16.0(9.8)	24.0(10.0)	26.4(9.0)	26.0(17.0)	0.025*

\*Not significant using the Mann-Whitney test.  
\*Significant using Kruskal Wallis test  
Abbreviation: IQR: Interquartile Range

**Table VI: Factors Associated with Sleep Quality**

Parameters	B	SE	Odd Ratio	95% CI	p-value
Emotional eating	-0.009	0.024	0.991	0.946,1.039	0.991
External eating	0.013	0.041	1.013	0.935,1.098	1.013
Restrained eating	0.052	0.031	1.054	0.992,1.119	1.054
<b>Internet addiction</b>					
Normal	Ref				
Mild	0.267	0.818	1.306	0.263,6.488	1.306
Moderate	-0.587	0.894	0.556	0.096,3.210	0.556
Severe	-0.332	1.367	0.717	0.049,10.455	0.717

Model adjusted for age, gender and body mass index  
Abbreviation: SE: Standard error, 95% CI: 95% confidence interval

revealed that students aged 19-24 have a high tendency to develop internet addiction (21). This may be due to the proneness of developing mood swings, depression, anxiety, aggressive behaviours, and social isolation which may draw them to the internet as a way to escape (22). Besides, other contributing factors to this issue are good and free Internet access at university, ample time in university to access the internet as they are not burdened with household chores, and limited parental supervision in the university which enables them to use the internet without restrictions (23).

A total of 59.8% of the students participating in the

current study had poor sleep quality. Worsening sleep quality is influenced by various factors such as improper facilities in the university hostel, noise, poor lighting, or use of gadgets before sleep time (24-26). This study also found no significant association between internet addiction and sleep quality. A study at the University of Al-Azhar showed that students with moderate internet addiction had poor sleep quality (27). In addition, another study among medical students in Iran showed that male students had a high prevalence of internet addiction and poor sleep quality due to excessive screening time (28). Disturbed circadian rhythms among internet addicts are due to the emission of blue light through the screens which suppresses the secretion of melatonin from the pineal gland which is a sleep regulator (29).

Although multivariate regression analysis showed no significant factors associated with sleep quality, findings from univariate analysis revealed that severe internet addiction was related to worsening eating behaviours. The study by Talwar and colleagues found that internet addicts were unable to meet the daily requirement for vegetables and fruits but had a significant intake of fried food and meat (21). Similarly, another study conducted among 1000 Korean younger people found that individuals addicted to internet frequently skipped dinner due to heavy snacking of nutritionally poor food such as fast food, fried food, high sodium-containing food, and sugar sweetened foods. Moreover, internet addicts had lesser intake of fruits, vegetables, milk, dairy products, and fish as well as are more prone to smoking and drinking alcohol. Advertisement on internet is the main reason for the unhealthy lifestyle among younger people. Food, alcohol, and cigarette companies used the Internet as a main platform to advertise their products using themes and icons of youth popular culture (4). Emotional eating due to stress increases the consumption of comfort food which are mostly high in calories (23).

The current study found no significant association between eating behaviour and sleep quality. In contrast, poor sleep quality contributed to emotional eating behaviour among medical students in Guangzhou (30). Similarly, study conducted among female undergraduate students in Saudi Arabia showed positive correlation between sleep and emotional eating behavior especially among students from high-income families, experiencing stress and increased sitting time (23). A high intake of oily food and a low intake of carbohydrates and protein may cause a person to become emotional eater and have poor sleep quality (31).

Another interesting finding of this study reported that individuals who are overweight and obese had significantly higher emotional eating scores as compared to other BMI categories. Similarly, another study conducted among 506 adults demonstrated that weight gain among the subjects was due to emotional eating (32). Emotional eaters have negative emotional triggers

to food which may drive to overeating of high sugar and high fat food. Stress is one of the driving factors for emotional eating among obese and overweight individuals. After the Covid-19 pandemic, people face enhanced stress levels due to loss of loved ones, financial issues, and increased fear of infection (33). Stress among emotional eaters can trigger binge eating or uncontrolled eating which may lead to increased BMI.

The strength of this study is that it will be able to encourage the university management to establish intervention strategies to manage internet addiction issues among university students. This study is not without its limits. Most of the participants were females. This study was only conducted among students at USM Health Campus, and the results could not be generalized to the whole student population. Lastly, a cross-sectional study design may be subjected to recall bias and there is a need for future research.

## CONCLUSION

Findings of the present study demonstrated that the majority of the students had mild internet addiction (54.2%). Meanwhile, 59.8% of the undergraduate students had poor sleep quality with bad subjective sleep quality, sleep latency, sleep disturbance, habitual sleep efficiency, and daytime function. Severe internet addiction was associated with worsening of all the three eating behavior domains. In addition, overweight individuals demonstrated to be emotional eaters as compared to other BMI. Regression analysis showed no significant factors associated with sleep quality. Further research is recommended for determining the effect of internet addiction on circadian rhythm and gut microbiota.

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