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Factors Associated with Sleep Quality Among Malaysian Undergraduate Students During the COVID-19 Pandemic

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ABSTRAK

Kualiti tidur terganggu telah menjadi satu isu kesihatan masyarakat disebabkan oleh perkaitannya dengan pelbagai jenis risiko kesihatan. Kebelakangan ini kajian telah menunjukkan pelajar universiti mempunyai kualiti tidur yang teruk semasa pandemik COVID-19. Justeru, kajian ini bertujuan untuk mengenal pasti faktor yang berkaitan dengan kualiti tidur dalam kalangan pelajar sarjana di Malaysia semasa pandemik COVID-19. Kajian keratan rentas ini telah melibatkan 377 pelajar sarjana dari universiti awam dan swasta di Malaysia. Kajian ini dijalankan dari 16 Jun 2021 hingga 31 Julai 2021. Responden telah melengkapkan soal selidik dalam talian mengenai sosiodemografi, kualiti tidur, corak kronotaip, sindrom makan malam, sekuriti makanan, aktiviti fizikal, ketagihan internet serta berat badan dan tinggi. Kajian ini menunjukkan 62.3% daripada responden mempunyai kualiti tidur yang teruk. Responden berbangsa Melayu (AOR = 3.84, 95% CI =2.07-7.11), dalam aliran seni (AOR = 2.55, 95% CI = 1.20-5.42) dan mengalami ketagihan internet (AOR = 2.14, 95% CI = 1.22-3.77) mempunyai risiko tinggi dalam menangani kualiti tidur yang teruk. Responden yang tinggal di rumah sewa (AOR = 0.38, 95% CI = 0.16-0.88), pelajar tahun kedua (AOR = 0.49, 95% CI = 0.25-0.99) dan mempunyai kronotaip jenis pagi (AOR = 0.35, 95% CI = 0.17–0.72) berisiko lebih rendah untuk kualiti tidur yang teruk. Kajian ini menunjukkan prevalens kualiti tidur teruk yang tinggi dalam kalangan pelajar sarjana semasa pandemik COVID-19. Hasil kajian ini mencadangkan bahawa pencegahan ketagihan internet dan kronotaip jenis petang dapat meningkatkan kualiti tidur pelajar universiti.

Kata kunci: corak kronotaip, COVID-19, kualiti tidur, ketagihan internet, pelajar universiti

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ABSTRACT

Poor sleep quality has become a public health concern due to its association with several health risks. Recent studies had shown that university students had poor sleep quality during the COVID-19 pandemic. Thus, this study aimed to determine the factors associated with sleep quality among undergraduate students in Malaysia during the COVID-19 pandemic. This cross-sectional study involved 377 undergraduates from public and private universities in Malaysia. The study ws conducted between 16 June 2021 to 31 July 2021. Respondents completed an online survey reagarding to their sociodemographic background, sleep quality, chronotype pattern, night eating syndrome, food security, physical activity, internet addiction and self-reported body weight and height. There was poor sleep quality in 62.3% of the respondents. Respondents who were Malay (AOR = 3.84, 95% CI =2.07-7.11), in the arts stream (AOR = 2.55, 95% CI = 1.20-5.42) and internet-addicted (AOR = 2.14, 95% CI = 1.22-3.77) had higher risk of poor sleep quality. Respondents who lived in a rented house (AOR = 0.38, 95% CI = 0.16-0.88), were sophomores (AOR = 0.49, 95% CI = 0.25-0.99) and were the morning chronotype (AOR = 0.35, 95% CI = 0.17-0.72) had lower risk for developing poor sleep quality. This study underscored the high prevalence of poor sleep quality among undergraduate students during the COVID-19 pandemic. The findings suggested that by preventing internet addiction and the evening chronotype can improve sleep quality.

Keywords: chronotype, COVID-19, internet addiction, sleep quality, university students

INTRODUCTION

Sleep is part of a person's daily routine and is regulated by homeostasis and circadian rhythms (Dijk & Von Schantz 2005). As poor sleep quality has been associated with gastrointestinal problems (Slavish et al. 2019), type 2 diabetes mellitus (Anothaisintawee et al. 2016), cognitive impairment (Pistollato et al. 2016) and abuse of addictive substances (Angarita et al. 2016), it has become a public health concern. University students are vulnerable to poor sleep quality (Wang & Bíró 2021). They tend to change their sleep habits when they start university life due to the need of coping new challenges, such as disorganised lifestyle, dormitory life and social obstacles (Afandi et al. 2013). The packed academic routine, assignments and extracurricular activities can deteriorate sleep quality and affect learning (Saat et al. 2020).

Coronavirus disease 2019 (COVID-19) is a worldwide pandemic and has detrimental effects on human health and economics. Other than direct infection, the pandemic has

indirect influences such as university closures and the shift from physical to online learning. At the peak of the pandemic, university students in different countries had worsened sleep quality (Du et al. 2021; Marelli et al. 2021; Martínez-Lezaun et al. 2020; Saadeh et al. 2021). Nonetheless, studies on sleep quality among university students in Malaysia is limited. Only a few studies had focused on Malaysian university students' sleep quality during the COVID-19 pandemic (Du et al. 2021; Kwan et al. 2021; Zuki et al. 2021). The prevalence of poor sleep quality of Malaysian university students during the pandemic had ranged from 45.2% (Kwan et al. 2021) to 57.3% (Zuki et al. 2021). Thus, there is a crucial need to identify the underlying factors of poor sleep quality.

University students tend to have misaligned circadian rhythms due to irregular study schedules, preparation for examinations and night-time internet surfing (Wang et al. 2016). Nonetheless, the association between chronotype (time preference of an individual to carry out activities) and sleep issues has remained unclear (Ng & Samir 2019). Other than that, food insecurity also has a substantial impact on university students. Although food insecurity is commonly linked to poor physical and mental health, researchers had paid little attention to its relationship with sleep quality. Furthermore, the COVID-19 pandemic restrained university students in their homes, which changed their lifestyle, such as being physically inactive, night eating and internet-addicted (López-Valenciano et al. 2021; Taeymans et al. 2021). These activities had been associated with poor sleep quality (Ercan et al. 2021; Mahfouz et al. 2020; Park & Suh 2020; Tahir et al. 2021). Nevertheless, most of these studies were conducted in Western societies and these behaviours may differ across ethnic populations. As young adults comprise the group that is vulnerable to these unhealthy lifestyle, it is imperative to investigate their associations with sleep quality among university students during the COVID-19 pandemic in Malaysia.

Following to that, understanding the value of sleep should be promoted and evaluation of sleep quality among university students is necessary to aid early detection and provide effective strategies during the post-lockdown period. Thus, this study aimed to determine the associations between personal and lifestyle factors with sleep quality among undergraduate students in Malaysia during the COVID-19 pandemic.

MATERIALS AND METHODS

PARTICIPANTS AND PROCEDURE

This was a web-based survey using Google Forms. The survey was distributed via social media from 16 June 2021 to 31 July 2021. Electronic informed consent was obtained from all respondents before participation. Ethical approval was obtained from the Universiti Putra Malaysia Ethics Committee for Research Involving Human Subjects (Reference No.: JKEUPM-2021-280). Undergraduate students who self-reported as pregnant

or lactating and had undergone treatment for chronic diseases such as heart disease and cancer were excluded from the study.

MEASURES

Sociodemographic Background

Respondents were asked to self-report their age, gender, ethnicity, monthly household income, current living arrangement, academic year of study, and field of study.

Sleep Quality

Sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al. 1989). The PSQI consisted of 19 self-rated items that form seven internal components: subjective sleep quality, sleep duration, habitual sleep activity, sleep disturbance, sleep delay, sleep medication use and daytime dysfunctions. Each component scored 0-3, contributing to a total score of 0-21. A total PSQI score of ≥5 indicated poor sleep quality. In this study, the PSQI had good internal consistency reliability (Cronbach's α = 0.827).

Food Security

Food security status was determined using the US Adult Food Security Survey Module (United States Department of Agriculture 2012). The survey encompassed 10 close-ended questions in which the responses 'often', 'sometimes', 'yes', 'almost every month' and 'some months but not every month' were coded as affirmative. The sum of affirmative responses to the 10 questions was calculated to classify the respondents into four food security categories (high, marginal, low, and very low). In this study, the survey showed good internal consistency reliability (Cronbach's α = 0.753).

Chronotype

Chronotype was measured using the Morningness and Eveningness Questionnaire (MEQ) (Horne & Östberg 1977). The questionnaire contains 19 items with Likert-type responses to obtain respondents' preferred time for different activities. The MEQ yields a total score of 16–86. The respondents were categorised into definitely evening type, moderately evening type, intermediate type, moderately morning type, or definitely morning type. It had good internal consistency reliability (Cronbach's α = 0.743) in this study.

Night Eating Syndrome

Night eating syndrome was assessed with the Night Eating Questionnaire (NEQ) (Allison et al. 2008). The questionnaire contained 14 questions by a 5-point Likert scale, with a total score of >25 was set as the threshold for classifying respondents as night eaters. In the present study, the NEQ showed acceptable internal consistency reliability (Cronbach's α = 0.620).

Physical Activity

Physical activity was evaluated using

the short-form International Physical Activity Questionnaire (IPAQ) (Craig et al. 2003). The respondents' level of physical activity was measured in metabolic equivalent of task (MET) in minutes per week. Physical activity level was classified as inactive, minimally active, and health-enhancing physical activity (HEPA).

Internet Addiction

Internet addiction was assessed using the Internet Addiction Test (IAT) (Young 1998). The IAT contained 20 items for self-rated with a 5-point Likert scale. The total score ranged from 0 to 100. A higher score indicated a higher severity of internet addiction. In this study, the IAT showed excellent internal consistency reliability (Cronbach's α = 0.911).

Self-reported Body Weight and Height

The respondents were required to self-report their current weight and height. Body mass index (BMI) was calculated and the respondents' body weight status was categorised according to World Health Organisation cut-off points.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics 26 (IBM Corp., Armonk, NY). Categorical variables were expressed in frequencies and percentages. Continuous variables were recorded as the means and standard deviations (SD). The associations between categorical factors and sleep quality were determined using the chi-square test. The risk factors of poor sleep quality were determined using multiple logistic regression. Data with $p<0.25$ in simple logistic regression were analysed in multiple logistic regression. The significance level was set at $p<0.05$.

RESULTS

A total of 377 undergraduate students participated in the study (Table 1). The mean respondent age was 21.85 $\pm$ 1.59 years. Most of the respondents were female (78.6%), Chinese (63.2%), from low-income families (64.8%), currently living at home (58.2%) and in the science stream (71.9%). About one in five of the respondents (20.6%) were underweight, while 15.6% of them were overweight or obese. Furthermore, 21.2% of the respondents were food-insecure, 22.8% were evening-type, 33.2% were physically inactive and 78.3% were internet-addicted. Only a small proportion (4.0%) were night eaters.

Table 2 showed that 62.3% of the respondents were poor sleepers. The mean PSQI score was 5.91 $\pm$ 3.06. The mean of usual bedtime was 1:16 am (SD = 88 min). The earliest and latest bedtime were 9:00 pm and 6:00 am, respectively. The mean of usual wakeup time was 8:24 am (SD = 101 min). The earliest and latest wakeup time were 1:00 am and 3:00 pm, respectively. The total sleep duration was 6.48 $\pm$ 1.54 hours. Sleep latency scored the highest (1.22 $\pm$ 0.96), indicating the worst performance among the seven

Table 1: Personal and lifestyle characteristics of university students by sleep quality (n=377)

Variables	Sleep quality n (%)			p
	Total (n=377)	Good (n=142)	Poor (n=235)	
Personal Factors				
Age (years)				0.464
< 21	75 (20.1)	25 (17.6)	50 (21.3)	
≥ 21	302 (79.9)	117 (82.4)	185 (78.7)	
Gender				1.000
Male	81 (21.4)	31 (21.8)	50 (21.3)	
Female	296 (78.6)	111 (78.2)	185 (78.7)	
Ethnicity				<0.001*
Malay	113 (29.9)	19 (13.4)	94 (40.0)	
Non-Malay	264 (70.1)	123 (86.6)	141 (60.0)	
Monthly household income (RM)#				0.091
Low (< 4,850)	244 (64.8)	99 (69.7)	145 (61.7)	
Middle (4,850–10,959)	100 (26.5)	36 (25.4)	64 (27.2)	
High (> 10,959)	33 (8.7)	7 (4.9)	26 (11.1)	
Current living arrangement				0.035*
On-campus	114 (30.2)	37 (26.1)	77 (32.8)	
Rented house	44 (11.6)	24 (16.9)	20 (8.5)	
Own house	219 (58.2)	81 (57.0)	138 (58.7)	
Year of study				0.135
1	80 (21.4)	28 (19.7)	52 (22.1)	
2	83 (22.0)	41 (28.9)	42 (17.9)	
3	164 (43.4)	54 (38.0)	110 (46.8)	
4	40 (10.6)	16 (11.3)	24 (10.2)	
5	10 (2.6)	3 (2.1)	7 (3.0)	
Field of study				0.310
Science	271 (71.9)	104 (73.2)	167 (71.1)	
Art	52 (13.8)	15 (10.6)	37 (15.7)	
Technical	54 (14.3)	23 (16.2)	31 (13.2)	
Food security				0.228
High	297 (78.8)	117 (82.4)	180 (76.6)	
Low	80 (21.2)	25 (17.6)	55 (23.4)	
Body Mass Index (BMI)				0.011*
Underweight	78 (20.6)	33 (23.2)	45 (19.1)	
Normal weight	240 (63.8)	97 (68.3)	143 (60.8)	
Overweight/obese	59 (15.6)	12 (8.5)	47 (20.1)	
Lifestyle Factors				
Night eating syndrome				0.087
Normal eater	362 (96.0)	140 (98.6)	222 (94.5)	
Night eater	15 (4.0)	2 (1.4)	13 (5.5)	
Physical activity				0.712
Inactive	124 (33.2)	49 (34.8)	75 (32.3)	
Active	249 (66.8)	92 (65.2)	157 (67.7)	
Chronotype				0.001*
Evening type	86 (22.8)	21 (14.8)	65 (27.7)	
Intermediate type	246 (65.0)	95 (66.9)	151 (64.3)	
Morning type	45 (12.2)	26 (18.3)	19 (8.0)	
Internet addiction				0.001*
Normal user	82 (21.7)	44 (31.0)	38 (16.2)	
Internet addicted	295 (78.3)	98 (69.0)	197 (83.8)	

#Classification of monthly household income according to the Department of Statistics Malaysia, 2019
*Chi-square test at $p < 0.05$ showed significant value.

Table 2: Distribution of university students by sleep quality (n=377)

Item	Mean ± SD	n (%)
PSQI score	5.91 ± 3.06	
Good (≤ 5)		142 (37.7)
Poor (≥5)		235 (62.3)
Usual bedtime (hours and minutes)	1:16 ± 1:28	
Usual wakeup time (hours and minutes)	8:24 ± 1:41	
Total actual sleep time (hours and minutes)	6.48 ± 1.54	
PSQI components		
Subjective sleep quality	1.10 ± 0.71	
Sleep latency	1.22 ± 0.99	
Sleep duration	1.07 ± 0.96	
Habitual sleep efficiency#	0.00 (0.00 ~ 1.00)	
Sleep disturbances	1.00 ± 0.52	
Use of sleep medication	0.06 ± 0.34	
Daytime dysfunction	1.07 ± 0.82	

#Reported as the median and interquartile range due to skewed data.

PSQI components.

Ethnicity, current living arrangement, year of study, field of study, chronotype and internet addiction were significant predictors of sleep quality (Table 3). Malay respondents had 3.84 times higher risk of poor sleep quality [adjusted odds ratio (AOR) = 3.84; 95% CI = 2.07-7.11, p<0.001] compared to non-Malays. Respondents who lived alone in rented houses were less likely to have poor sleep (AOR = 0.38, 95% CI = 0.16-0.88, p = 0.024) compared to those on campus. Sophomore students were less likely to have poor sleep quality (AOR = 0.49, 95% CI = 0.25–0.99, p = 0.046) compared to junior students. In comparison to science stream students, art stream students had a higher tendency to be at risk of poor sleep quality (AOR = 2.55, 95% CI = 1.20-5.42, p = 0.015). Morning-type students were less likely to have poor sleep quality (AOR = 0.35, 95% CI =

0.11-0.99, p = 0.004) than intermediate-type students. Lastly, respondents who were internet-addicted had twice the risk of poor sleep quality (AOR = 2.14, 95% CI = 1.22-3.77, p = 0.008) than normal internet users.

DISCUSSION

In the present study, a higher prevalence of poor sleep quality was observed as compared with the results of previous local studies during the COVID-19 pandemic, which ranged from 45.2% to 57.3% (Du et al. 2021; Kwan et al. 2021; Zuki et al. 2021). A reasonable explanation for the higher prevalence reported in the present study might attribute to this study was conducted after Malaysia had been under 1.5 years of lockdown, which was since March 2020. Sleep quality is believed to deteriorate as the duration of confinement/lockdown

Table 3: Univariate logistic regression and multiple logistic regression of factors associated with sleep quality

Variable	Univariate logistic regression		Multiple logistic regression	
	OR (95% CI)	p	Adjusted OR (95% CI)	p
Age groups				
< 21	Reference			
≥ 21	1.27 (0.74, 2.16)	0.388	-	-
Gender				
Male	Reference			
Female	1.03 (0.62, 1.71)	0.899	-	-
Ethnicity				
Non-Malay	Reference		Reference	
Malay	4.32 (2.49, 7.47)	<0.001*	3.84 (2.07, 7.11)	<0.001*
Monthly household income				
Low	Reference		Reference	
Medium	1.21 (0.75, 1.97)	0.430	0.97 (0.56, 1.68)	0.904
High	2.54 (1.06, 6.07)	0.037*	1.98 (0.70, 5.54)	0.196
Current living arrangement				
On-campus	Reference		Reference	
Rented house	0.40 (0.20, 0.82)	0.012*	0.38 (0.16, 0.88)	0.024*
Own house	0.82 (0.51, 1.32)	0.412	0.78 (0.43, 1.41)	0.422
Year of study				
1	Reference		Reference	
2	0.55 (0.29, 1.04)	0.064	0.49 (0.25, 0.99)	0.046*
3	1.10 (0.63, 1.93)	0.748	0.91 (0.47, 1.74)	0.765
4	0.81 (0.37, 1.77)	0.592	0.86 (0.35, 2.09)	0.736
5	1.26 (0.30, 5.24)	0.754	1.02 (0.20, 5.17)	0.985
Field of study				
Science	Reference		Reference	
Art	1.54 (0.80, 2.94)	0.194	2.55 (1.20, 5.42)	0.015*
Technical	0.84 (0.46, 1.52)	0.562	1.26 (0.64, 2.50)	0.504
Food security				
High	Reference		Reference	
Low	1.43 (0.84, 2.42)	0.183	1.14 (0.61, 2.13)	0.688
BMI				
Normal weight	Reference		Reference	
Underweight	0.93 (0.55, 1.55)	0.768	0.94 (0.53, 1.68)	0.838
Overweight/obese	2.66 (1.34, 5.27)	0.005*	2.12 (0.96, 4.66)	0.063
Night eating syndrome				
Normal eater	Reference		Reference	
Night eater	4.10 (0.91, 18.44)	0.066	2.36 (0.46, 12.02)	0.302
Physical activity				
Active	Reference			
Inactive	0.90 (0.58, 1.40)	0.630	-	-
Chronotype				
Intermediate type	Reference		Reference	
Evening type	1.95 (1.12, 3.39)	0.019*	1.78 (0.94, 3.34)	0.075
Morning type	0.46 (0.24, 0.88)	0.018*	0.35 (0.17, 0.72)	0.004*
Internet addiction				
Normal user	Reference		Reference	
Internet addicted	2.33 (1.42, 3.83)	0.001*	2.14 (1.22, 3.77)	0.008*

$\chi^2 = 77.017$, p<0.001, Cox and Snell $R^2 = 0.187$, Nagelkerke $R^2 = 0.255$ in multiple logistic regression
*Significant value at p<0.05

is prolonged. A quasi-experimental study by Martínez-Lezaun et al. (2020) involving Spanish students showed that the PSQI score increased from 6.44 (at 20 days of confinement) to 6.59 (at 40 days of confinement). Another possible explanation is that the strict and prolonged confinement overwhelmed the students, leading to higher anxiety levels that eventually worsened their sleep quality.

When focusing on foreign countries, the present study substantiated the previous studies on the sleep quality of university students during the COVID-19 pandemic. The prevalence of poor sleepers was 60.7% in South Korea, 64.7% in Ireland (Du et al. 2021), 64.6% in Egypt (Mahmoud et al. 2022), 70.7% in Spain (Martínez-Lezaun et al. 2020), 73.3% in Italy (Marelli et al. 2021) and 76% in Jordan (Saadeh et al. 2021). This phenomenon suggested that university students were vulnerable to the effect of lockdowns worldwide due to the COVID-19 pandemic.

In the present study, ethnicity was significantly associated with sleep quality, where Malay respondents had four times greater risk of experiencing poor sleep quality. This contradicts previous studies that reported no significant association between ethnicity and sleep quality (Kesintha et al. 2018; Nurismadiana & Lee 2018). This relationship had lack of clarification and this findings should be confirmed with further studies. Another important predictor of sleep quality was current living arrangement, where living alone in a rented house promoted better sleep quality in comparison to staying in a dormitory. This refutes the findings that poor sleep was more prevalent among students living in rented homes in Yemen (Attal et al. 2021). A reasonable explanation for this contradiction was that the pandemic-prompted lockdowns which eliminated the negative factors influencing the sleep quality of students in a rented house, such as problematic roommates and cramped living space. These obstacles can be indirectly overcome as students reduced physical contact with others during the pandemic. This suggestion is supported by the results of Yildirim et al. (2020), who showed that students living alone had significantly better sleep quality than other groups of students ($p<0.001$).

Interestingly, the results suggested that second-year students had lower risk of impaired sleep than students in their first year of study, while art stream students had higher risk of poor sleep quality than science stream students. This could be due to the different courseworks leading to different academic schedules and daily routines of students. To the best of our knowledge, there was no previous investigation on the association between various fields of study and academic years with sleep quality. Previous studies commonly compared sleep quality between medical and non-medical students due to the concern that medical students might be more stressed. Nevertheless, Azad et al. (2015) suggested that both medical and non-medical students were vulnerable to impaired sleep quality. Thus, future research is necessary to

explore the mechanism between study field and sleep quality.

In terms of chronotype, the morning type exerted protective effects against poor sleep quality. Other studies had reported similar findings during the COVID-19 pandemic (Genta et al. 2021; Merikanto et al. 2022). These studies showed that the evening chronotype was associated with sleep disturbances, including shorter sleep duration, poorer sleep quality and daytime sleepiness. This could be explained by evening types had to adhere to their study and social schedules during the weekdays, which might misalign with their chronotype and they were only able to achieve comparable levels of sleep quality as morning types during the weekend (Vitale et al. 2015). The chronotype of university students tended to shift towards eveningness due to online classes, which began later than physical classes and the travelling time to university was reduced during the COVID-19 pandemic (Genta et al. 2021).

Another important finding here was that internet addiction was another risk factor of poor sleep quality. This result corroborated with previous studies during the COVID-19 pandemic (Ercan et al. 2021; Mahmoud et al. 2022; Tahir et al. 2021). The mechanism between internet addiction and poor sleep has been established, in which excessive use of gadgets online before sleep contributed to sleep latency, reduced sleep duration and affected sleep preparation (Ercan et al. 2021; Tahir et al. 2021). In addition, Ercan et al. (2021) suggested a biological pathway

where stimuli from gadget screens, including light and sound, might affect the secretion of sleep hormones such as melatonin. Consequently, this led to disrupted circadian rhythms and affected overall sleep quality.

This study had some limitations. The first limitation included the study design and sampling method. A cross-sectional design and convenience sampling were used, which might affect the representativeness of the study samples and limit the generalisability of the findings. This study could exist self-selection bias. Second, self-reported measures were used, which might lead to recall bias. Third, other important factors had not been included, such as psychological factors (stress, anxiety, and depression), diet quality and sleep environment, whereby future studies could consider.

CONCLUSION

The high prevalence of poor sleepers in the present study underlined the vulnerability of university students towards sleep disturbances during the COVID-19 pandemic. Thus, improving university students' sleep quality is important for good quality of life. In this study, respondents who were Malay, art students, and internet addicts had higher risk of poor sleep quality. Living in a rented house, being a second-year student and the morning chronotype had protective effects against poor sleep quality. Chronotype and internet addiction should be targeted as modifiable risk factors in enhancing sleep quality. Evening-type students were

encouraged to capitalise the flexibility of their academic schedule and then modify their sleep-wake behaviour. Furthermore, it is recommended that longitudinal research should be carried out in the future to examine the causal relationship between personal and lifestyle factors with sleep quality of university students.

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