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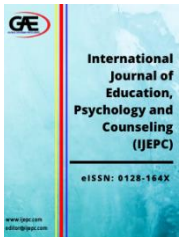

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EXAMINING PREVALENCE OF INSOMNIA AND PREDICTORS OF SLEEP QUALITY AMONG UNDERGRADUATE STUDENTS

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Abstract:

Poor sleep is highly prevalent among university students, yet it is rarely assessed systematically or addressed through early intervention. This study aimed to investigate the prevalence of insomnia within a non-clinical sample of Malaysian undergraduate students and to examine the predictive roles of sleep hygiene, daytime sleepiness and maladaptive sleep beliefs on sleep quality. Using a cross-sectional survey design, 220 undergraduate students (74.1% female, mean age = 21.6 years) completed a set of self-report questionnaires assessing sleep hygiene, insomnia severity, sleepiness, sleep quality and demographic information including self-reported height and weight. Pearson correlation analysis was conducted to examine relationships among variables and hierarchical multiple regression was used to examine predictors of sleep quality. Results showed that 70% of participants were classified as poor sleepers, with an average Pittsburgh Sleep Quality Index score of 7.44. Sub-threshold insomnia was reported by 41.8% of participants, while 35.5% and 2.7% reported moderate and severe clinical insomnia, respectively. Poor sleep quality was significantly associated with insomnia severity (r = .56), poor sleep hygiene (r = .41), daytime sleepiness (r = .13), maladaptive sleep beliefs (r = .19), and body mass index (r = .19). Among these factors, sleep hygiene was the strongest predictor of sleep quality in this sample (β = .198, p = .003). The findings indicate the need for early intervention, such as sleep education promoting healthy sleep hygiene given the high prevalence of as sub-threshold insomnia among students with poor sleep quality. Future research should explore within-person relationships between daily sleep hygiene behaviours and sleep quality.

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Keywords:

Sleep Quality, Insomnia, Sleep Hygiene, Students, Maladaptive Belief About Sleep, Sleepiness

Introduction

Advancements in university education have made learning more flexible, allowing students the freedom to manage class schedules and activities according to their own preferences. While this flexibility offers benefits, students are still expected to have a regular daily schedule and perform academic and social responsibilities effectively. However, research shows that young adult university students often experience poor sleep quality, irregular sleep patterns and excessive daytime sleepiness (Albasheer et al., 2020; Seoane et al., 2020; Sivertsen et al., 2019). Poor sleep has been associated to a wide range of negative outcomes, including reduced well-being and impaired academic performance (Liu et al., 2021; Seoane et al., 2020). Furthermore, increased academic pressure and high stress levels can further disrupt students' sleep patterns by reducing the priority given to sleep. Moreover, socializing late into the night specifically among first year students, has been shown to contribute to declining sleep quality (Foulkes et al., 2019). These environmental changes may precipitate the onset of insomnia (Espie, 2002).

Insomnia is a predominantly complaint of dissatisfaction with sleep quality and/or sleep quantity associated with an ongoing difficulty initiating sleep, maintaining sleep and/or early morning awakening with inability to return to sleep, despite having adequate opportunity to sleep (American Psychiatric Association, 2022; Krystal et al., 2019). Studies have shown that approximately 6 to 10% of the general population meet the diagnostic criteria for insomnia (Chung et al., 2020; Ohayon, 2002; Perlis et al., 2020). In Malaysia, a community-based study involving 1,611 adults aged 30 to 70 years across four states (i.e., Perlis, Penang, Kuala Lumpur & Kelantan) found that 33.8% experienced insomnia symptoms, with 12.2% meeting the criteria for chronic insomnia (Zailinawati et al., 2008). Poor sleep quality can lead to increased daytime sleepiness, as it increases homeostatic sleep pressure (Moorcroft, 2013). Approximately 50% of university students (aged 20 – 27 years; M = 21.5) reported experiencing daytime sleepiness at a higher rate than both adolescents (aged 14 – 16 years old; M = 14.8) and adults (aged 30-45 years old; M = 38.0), with females more affected than males (Oginska & Pokorski, 2006). This daytime sleepiness might lead to serious consequences including impaired concentration and drowsy driving (Maestri et al., 2019).

Previous studies have also identified sleep hygiene as a modifiable factor influencing of sleep quality (Batten et al., 2020; Gellis & Lichstein, 2009; Irish et al., 2015; Toscano-Hermoso et al., 2020). Sleep hygiene refers to behavioural practices such as maintaining regular sleep schedule, minimizing consumption of caffeine, ensuring a conducive sleep environment that help to regulate the natural sleep-wake cycle (Hamilton et al., 2020; Riedel, 2014). Using structural equation modelling, Li et al. (2016) found that sleep hygiene practices directly affect sleep quality. Similarly, Morin's model (Morin et al., 1993) highlights how maladaptive behaviours such as irregular sleep schedule, spending excessive time in bed and frequent daytime napping contribute to poor sleep outcomes. Voinescu and Szentagotai-Tatar (2015) found that overall sleep hygiene awareness was moderate with young adults (aged 18-25) showing significantly lower awareness than middle aged and older adults. Additionally, poor

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sleepers scored significantly lower on sleep hygiene awareness than good sleepers. However, Gellis and Lichstein (2009) suggested that actual sleep hygiene practices were generally comparable between both groups.

In addition to sleep hygiene, there have been substantial studies looking at the influence of maladaptive sleep beliefs on sleep quality particularly among individuals with insomnia (Carney et al., 2010; Chung et al., 2020; Morin et al., 2002). Maladaptive sleep beliefs (i.e., dysfunctional sleep belief such as getting eight hours of sleep is a must to ensure a good night sleep) has been found to be a perpetuating factor in individuals with insomnia (Morin et al., 2002; Nielson et al., 2023). Later studies have also found that these beliefs may serve as risk factors for stress-related transient sleep disturbances, even among individuals without chronic insomnia (Yang et al., 2011). Despite these findings, little research has been conducted on maladaptive sleep beliefs among Malaysian young adults with and without insomnia symptoms.

Taken together, existing literature indicate the importance of identifying sleep-related factors and their associated variables in adult populations. Therefore, the present study investigated the presence of insomnia among non-clinical sample of Malaysian undergraduate students using an established validated insomnia questionnaire. The study also sought to identify the subgroup comparisons on the insomnia severity and examine the correlations among variables of interest. Finally, the present study further sought to identify predictors of sleep quality in this population, focusing on key factors previously identified in past studies, namely, maladaptive sleep hygiene, daytime sleepiness and maladaptive sleep belief.

Methods

A cross-sectional survey design was employed in the present study. The target population comprised undergraduate students at a local university in Perak, Malaysia. Using convenience sampling, a total of 220 undergraduate students participated in the study. The required sample size was estimated using G*Power, which suggested approximately 107 participants to obtain a medium effect size (.15) for multiple regression analysis. The inclusion criteria were (1) current enrolment in an undergraduate programme, (2) aged 18 years or older, (3) ability to read and understand English, (4) generally good health with no known severe illness. Prior to participation, all potential participants were provided with the information sheet. Those who agreed to take part proceeded to complete informed consent form. The study received full ethical approval from Human Research Ethics Committee Universiti Pendidikan Sultan Idris (Reference number: 2019-0025-01).

Questionnaires

A set of standardized questionnaires was administered in the survey. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) , which contains 19 ietms and yields a global score ranging from 0 to 21, with higher scores indicating poorer sleep quality. A total score of six or above on the PSQI is commonly used as the clinical cut-off for sleep disturbance. Insomnia symptoms were assessed using the Insomnia Severity Index (ISI; Bastien et al., 2001). Total score ranges from 0 to 28, with severity classified as: “0-7 = no clinically significant insomnia”, “8-14 = sub-threshold insomnia”, “15-21 = clinically moderate insomnia” and “22-28 = clinically severe insomnia”. To examine potential predictors of sleep quality, the following additional instrument were used: (i) the Sleep Hygiene Index (SHI; Mastin et al., 2006) was used to assess sleep hygiene behaviours, higher scores indicate more

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maladaptive practices, (ii) the Epworth Sleepiness Scales (ESS; Johns, 1992) was used to assess daytime sleepiness, the total score ranges from 0 to 24 which score over 10 suggesting significant daytime sleepiness, (iii) the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16; Morin et al., 2007) was used to assess maladaptive beliefs and attitudes toward sleep. Total scores range from 0 to 10 with higher scores on DBAS-16 suggests more dysfunctional beliefs. All the scales have good psychometric properties. Participants also self-reported their body weight (in kilograms) and height (in meters), from which body mass index (BMI) was calculated.

Statistical Analysis

The data was analysed using IBM Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics, including means, standard deviations and percentages were calculated to summarize participants' demographic and sleep-related characteristics. The prevalence of insomnia was reported based on the proportion of participants falling into each severity category. Pearson correlation analysis was conducted to examine the correlations between sleep quality and other variables such as body mass index, insomnia severity, sleep hygiene, daytime sleepiness and dysfunctional beliefs and attitudes about sleep. To identify predictors of sleep quality, a hierarchical multiple regression analysis was conducted after controlling the influence of insomnia severity and BMI. Insomnia severity and BMI were entered in the initial step, followed by maladaptive sleep hygiene behaviour, daytime sleepiness and maladaptive sleep belief in subsequent steps.

Results

Participant Characteristics

Table 1 presents the demographic and sleep characteristics of the participants. A total of 220 undergraduate students were recruited in the study, comprising 57 males and 163 females with a mean age of 21.6 years (SD = 2.06), ranging from 18 to 39 years. More than half of the participants were currently studying bachelor's degree programme (73.2%). On average, the body mass index (BMI) was 23.48 (SD = 5.34) suggesting within normal weight. The distribution of ethnic groups in the sample were found to be disproportionate, with Malays constituting the majority (76.8%) followed by Chinese (9.5%), others (7.7%) and Indians (5.9%). Findings also indicate that participants experienced poor sleep quality, as reflected by a mean global PSQI scores of 7.44 (SD = 3.01) with 70.4% classified as poor sleepers. The average total sleep time was 5.68 hours (SD = 1.42). The daytime sleepiness, as measured by ESS scores was 9.52 (SD = 3.83) close to the clinical cut-off score of significant daytime sleepiness (≥ 10). Meanwhile the mean SHI score was 37.70 (SD = 7.06) indicating suboptimal sleep hygiene practices. The average score on the DBAS-16 was 6.21 (SD = 1.46) suggesting the presence of maladaptive sleep beliefs.

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Table 1: Participants' Demographic and Sleep Characteristics

Variables	Level	Mean	SD	*n*	%
Age (in years; 18-39 years)		21.60	2.06		
BMI		23.48	5.34		
Sex	Female			163	74.1
	Male			57	25.9
Ethnicity	Chinese			21	9.5
	Indian			13	5.9
	Malay			169	76.8
	Others			17	7.7
Current programme	Diploma			59	26.8
	Bachelor's degree			161	73.2
Sleep characteristics					
TST (in hours)		5.68	1.42		
SHI (13-65)		37.70	7.06		
ESS (0-24)		9.52	3.83		
DBAS-16 (0-10)		6.21	1.46		
ISI (0-28)		12.28	5.11		
	No clinically significant insomnia			44	20.0
	Sub-threshold insomnia			92	41.8
	Moderate clinical insomnia			78	35.5
	Severe clinical insomnia			6	2.7
PSQI (0-21)		7.44	3.01		
	Good sleepers			64	29.6
	Poor sleepers			152	70.4

Notes. TST = Total sleep time. BMI = Body mass index. ISI = Insomnia Severity Index. SHI = Sleep Hygiene Index. PSQI = Pittsburg Sleep Quality Index. ESS = Epworth Sleepiness Scale. DBAS-16 = Dysfunctional belief and attitude about sleep-16 items.

Prevalence of Insomnia

As shown in Table 1, on average, the ISI score was 12.28 (SD = 5.11), indicating that the participants were having sub-threshold insomnia. Specifically, 41.8% of the participants reported sub-threshold insomnia (ISI = 8-14), 35.5% had moderate clinical insomnia (ISI = 15-21) and 2.7% reported severe clinical insomnia (ISI = 22-28). Table 2 presents the subgroup comparisons on the insomnia severity. Within female group, 46.6% had sub-threshold insomnia while within male group, 43.96% exhibited moderate clinical insomnia. A significant proportion of participants studying bachelor's degree (43.5%) and diploma (37.3%) programme fell within sub-threshold insomnia. Of 119 healthy BMI participants, 42.9% were showing symptoms of sub-threshold insomnia and 31.9% were suffering from moderate severity of insomnia. Meanwhile within overweight group, 40.9% were experiencing sub-threshold insomnia and moderate severity insomnia. However, the statistical analysis revealed no significant differences in insomnia severity based on gender, academic programme or BMI category.

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Table 2: Subgroup Comparisons on Insomnia Severity

	No clinically significant insomnia (*n* = 44)		Sub-threshold insomnia (*n* = 92)		Moderate clinical insomnia (*n* = 78)		Severe clinical insomnia (*n* = 6)	
	n	%	*n*	%	*n*	%	*n*	%
Sex								
Female	28	12.7	76	34.5	53	24.1	6	2.7
Male	16	7.3	16	7.3	25	11.4	0	0.0
Current Programme								
Bachelor's degree	30	13.6	70	31.8	57	25.9	4	1.8
Diploma	14	6.4	22	10.0	21	9.5	2	0.9
*BMI**								
Underweight	10	4.6	17	7.8	14	6.4	1	0.5
Healthy	28	12.8	51	23.2	38	17.4	2	0.9
Overweight	5	2.3	18	8.2	18	8.2	3	1.4
Obese	1	0.5	4	1.8	6	2.7	0	0.0
Extremely obese	0	0.0	1	0.5	2	0.9	0	0.0

**n* = 219, due to missing value

Intercorrelation of Variables

Pearson correlation analyses were conducted to examine the relationship between insomnia severity and variables of interest and sleep quality among undergraduate students. Table 3 shows all correlations were positive and statistically significant except for BMI, which shows no significant relationship with both daytime sleepiness and maladaptive belief and attitude about sleep. Insomnia severity was significantly correlated with sleep hygiene (r = .44), daytime sleepiness (r = .20), maladaptive belief about sleep (r = .28) and sleep quality (r = .56). These results suggest that those undergraduate students who had more severe insomnia are also those who experienced maladaptive sleep hygiene, more daytime sleepiness, greater unhelpful sleep belief and poor sleep quality. The value of correlations among these variables indicated that multicollinearity was not a concern for the subsequent regression analyses (See *Predictors of Sleep Quality* section).

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Table 3: Intercorrelations of sleep quality and other variables among participants (*N* = 220)

	BMI	Insomnia severity	Sleep hygiene	Daytime sleepiness	Dysfunctional belief and attitude about sleep	Sleep quality
BMI	-	.17	.24**	.10	-.02	.19**
Insomnia severity		-	.44**	.20**	.28**	.56**
Sleep hygiene			-	.30**	.18**	.41**
Daytime sleepiness				-	.16	.13
Dysfunctional belief and attitude about sleep					-	.19
Sleep quality						-

**$p < .01$. BMI = Body mass index.

Predictors of Sleep Quality

Hierarchical multiple regression analysis was conducted to examine predictors of sleep quality (i.e., maladaptive sleep hygiene behaviour, daytime sleepiness, maladaptive sleep belief), while controlling for the effect of insomnia severity and BMI. Prior to the analysis, assumptions for hierarchical multiple regression were assessed. The assumptions of hierarchical multiple regression were (1) independence, (2) normality, (3) linearity, (4) multicollinearity, and (5) homoscedasticity. Observations in the data was assumed to be independent. The skewness of sleep hygiene, daytime sleepiness, maladaptive sleep belief, insomnia, and sleep quality reported within the ±2 range which indicates that the normality assumption was met. Scatterplot was used to assess the linear relationship between independent variables (sleep hygiene, daytime sleepiness, maladaptive sleep belief) and dependent variable (sleep quality). Visual inspection of the scatterplot indicates a linear relationship between the independent and dependent variables.

The assumption of multicollinearity was met, as VIF scores for sleep hygiene, daytime sleepiness and maladaptive sleep belief were well below 10. The correlation coefficient between sleep hygiene and daytime sleepiness was .29, sleep hygiene and maladaptive belief was .18, daytime sleepiness and maladaptive belief was .16 and is below .80, the cut-off value to flag collinearity in the data. Results from VIF and correlation coefficient indicates that the assumption for multicollinearity was met satisfactorily. The plot of standardised residuals vs. standardised predicted values showed no obvious signs of funnelling and suggesting that the assumption of homoscedasticity has been met (Figure 1). The inspection of P-P plot for the model showed the dots was arranged on the diagonal line and indicates that the residuals were normally distributed. Therefore, the assumption for normality of the residuals was met (Figure 2). Finally, Cook's distance was computed to identify any influential cases in the model. The

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Cook's distance values for entire observation were reported under 1, suggesting individual cases were not unduly influencing the model.

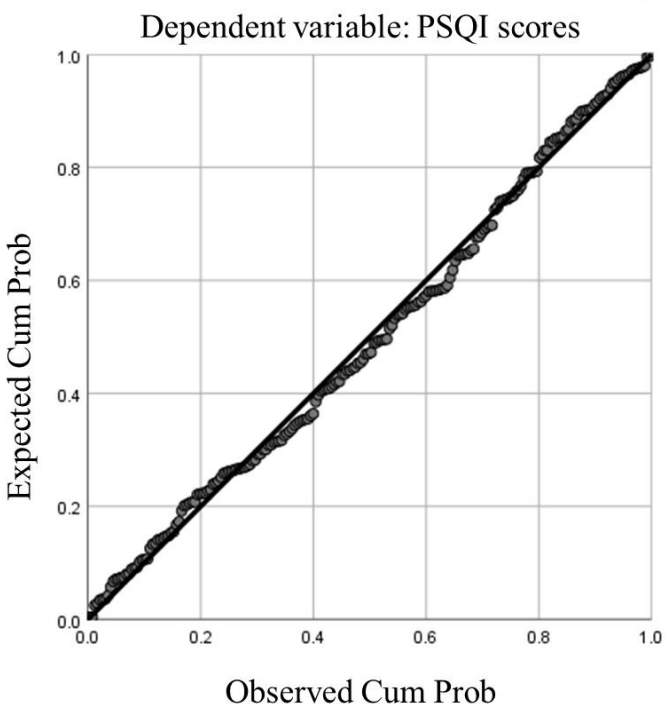

Figure 1: Normal P-P Plot of Regression Standardized Residual

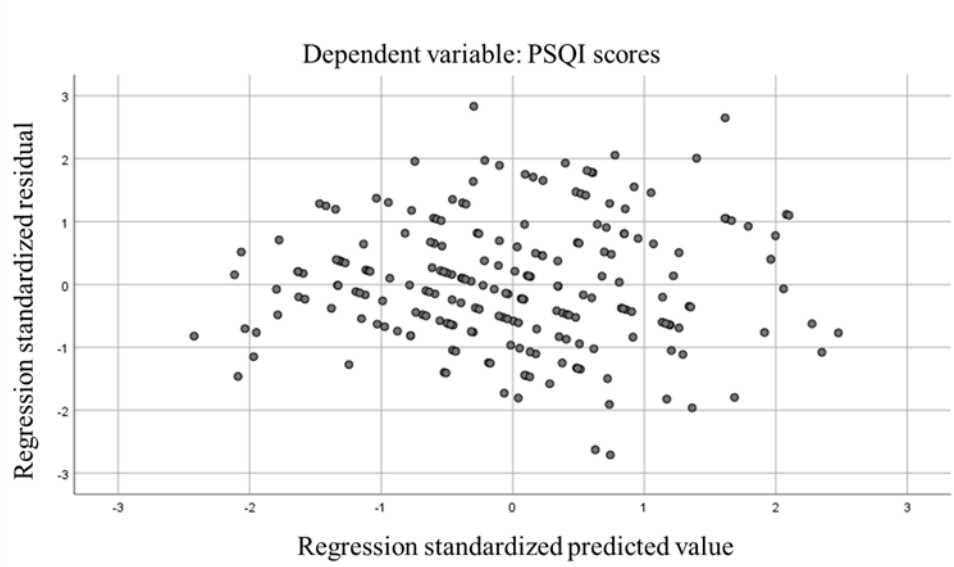

Figure 2: Scatterplot: Standardized Residual vs. Standardized Predicted Values Assessing Homoscedasticity

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BMI and insomnia symptoms were entered at Step 1, explaining 31.8% of the variance in sleep quality. After entry of the sleep hygiene, daytime sleepiness and maladaptive sleep belief at Step 2, the total variance explained by the model as a whole was 34.9%, $F(5, 209) = 22.37$, $p < .0005$. Sleep hygiene, daytime sleepiness and maladaptive sleep belief explained an additional 3.1% of the variance in sleep quality, after controlling for BMI and insomnia symptoms, R squared change = .031, F change (3, 209) = 3.32, $p < .021$. In the final model, only sleep hygiene was statistically significant, with sleep hygiene shows a beta value (β = .198, p = .003). The findings show that sleep hygiene has significant influence in student's sleep quality.

Discussion

This cross-sectional study investigated the presence of insomnia and predictors of sleep quality in a non-clinical sample of Malaysian undergraduate students. Using the Insomnia Severity Index (ISI), a validated insomnia assessment measure, the findings revealed that 38.2% of the participants were suffering from moderate to severe clinical insomnia that might require early intervention of clinical treatment. This prevalence is alarming as it happens in a generally healthy young adults of non-seeking treatment and unreported cases. The findings indicate that insomnia among undergraduate students warrant clinical attention given that the rate of insomnia prevalence among university students (18.5%) is higher than general population of 7.4% and 10.0% reported by Jiang et al. (2015) and Morin and Jarrin (2022), respectively.

Surprisingly, the average total sleep duration reported in the present study is less than six hours, which is lower compared to the recommended sleep duration for young adults (Hirshkowitz et al., 2015) and previous published studies among young adults (Gellis & Lichstein, 2009; Knufinke et al., 2018; Ramlee et al., 2017). These findings consistent with the PSQI scores which suggested that over 70% of the participants were poor sleepers. Furthermore, daytime sleepiness scores approached the clinical cut-off point suggesting chronic sleep reduction in this population (van der Heijden et al., 2018). These findings highlight the importance of early detection of sleep disturbances, specifically given the known association between poor sleep and various psychological disorders.

Additionally, participants in this study might have unhelpful belief about sleep as the mean score revealed above 3.8 (Carney et al., 2010). Maladaptive sleep belief is increasingly recognized as a key contributor in worsening poor sleep (Carney & Edinger, 2006; Harvey, 2002; Kloss et al., 2016) as well as predisposing factors for insomnia (Nielson et al., 2023; Yang et al., 2014). Previous studies have demonstrated that maladaptive sleep belief such as having dysfunctional thoughts about total sleep time ("my sleep was poor when I did not get 9 hours of sleep") (Carney et al., 2010; Harvey, 2002) or persistent preoccupation with sleep (Lee et al., 2022) may trigger arousal and aggravate insomnia symptoms.

This study also examined sleep quality and its correlations with BMI, insomnia, daytime sleepiness, maladaptive sleep belief, and sleep hygiene. Whilst significant positive correlations with sleep quality were found for all five variables, sleep hygiene emerged as the best predictor that has significant influence on sleep quality in this group of young adults. Consistent with this findings, previous study has shown that sleep hygiene affects sleep quality (Humphries et al., 2022; Li et al., 2016) and practising good sleep hygiene can be both motivational and volitional functions in improving sleep (Hamilton et al., 2021). Part of "Sleep 101 Program" was sleep hygiene which has shown that participants who had better sleep hygiene knowledge,

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low maladaptive beliefs and attitude about sleep also reported reduced sleep onset latency (Kloss et al., 2016). Irregular sleep-wake patterns and maladaptive beliefs and attitude about sleep may contribute to delayed bedtime. Any disturbances in circadian rhythms could influence the pathogenesis of mental disorders (Walker et al., 2020). Practising sleep hygiene such as regular sleep-wake patterns and avoiding activating behaviours close to bedtime has been found to optimize sleep quality among athletes (Knufinke et al., 2018). Therefore, sleep hygiene education could be among the first line of behavioural intervention components of sleep interventions for young adults studying at the university.

The present cross-sectional survey study recruited a relatively small participants of non-clinical sample drawn from a single public university in a state in Malaysia, was mostly female and Malay ethnicity. Therefore, the extent to which the present results can be generalised to other groups of undergraduate student remains to be investigated in future studies. Possibly future studies might need to recruit a more representative and bigger sample size that includes young adults studying at technical vocational college, private and public university. Another limitation of this study was that sleep hygiene and maladaptive belief were assessed using self-report measures in which lacking in identifying what kind of maladaptive sleep hygiene behaviour, the types and nature of unhelpful thoughts that students typically involve in. Future studies employing the use of actigraphy, sleep and thought diary for self-monitoring at individual's natural day to day living environment would elicit in depth understanding of sleep pattern, sleep quality and unhelpful thoughts (e.g., Fekedulegn et al., 2020; Liguori et al., 2023; Tian et al., 2025). Future studies should explore the association between daily sleep hygiene practices and sleep quality within-person association as there are fluctuations and variations at the within-person level.

Conclusion

In conclusion, the present study highlights a concerning prevalence of insomnia symptoms and poor sleep quality among Malaysian undergraduate students. The findings indicate that insomnia symptoms and sleep hygiene have significant influence in one's sleep quality. The findings also warranted the need for early sleep interventions, such as sleep hygiene education, as sub-threshold insomnia is common among young adults who demonstrate poor sleep quality. While insomnia and sleep hygiene play significant roles, there are other psychological and behavioural factors that contributes to young adults' sleep quality. Therefore, further investigation employing a more comprehensive and ecologically valid approach is necessary to better understand the underlying factors influencing students' sleep quality.

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