ORIGINAL ARTICLE

Sociodemographic, Clinical and Health-related Behavioural Determinants of Sleep Quality: A Cross-sectional Study Among Malaysian Adults

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ABSTRACT

Introduction: Sleep quality has become a public health concern due to serious impacts on individual's health outcomes. Thus, this cross-sectional study aimed to determine the sleep quality and its associated factors among adults living in the province of Terengganu, Malaysia. **Materials and Methods:** Socio-demographic information was self-reported whilst anthropometric measurements were measured by trained researchers. Sleep quality was assessed using the validated Pittsburgh Sleep Quality Index (PSQI) whilst eating behavior was measured using the Dutch Eating Behavior Questionnaire (DEBQ). Descriptive statistics and multivariable linear regression models were employed using IBM SPSS version 25.0. **Results:** A total of 580 participants were enrolled (mean age = 29.1 ± 10.0 years; 51.2% female), of which 74.7% (n = 433) had poor sleep quality (PSQI global score > 5) with a total sleep duration per night of 6.2 ± 1.6 hours. Gender (p-value=0.044), educational level (p-value=0.001), emotional level (p-value=0.005) and external eating (p-value=0.026) were significantly associated with poorer sleep quality. **Conclusion:** This study underscored the high prevalence of poor sleep quality among adults living in Terengganu, Malaysia. The findings could serve as a basis for developing sleep education strategies that are tailored to improve sleep quality among adults.
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Keywords: Sleep quality, Pittsburgh sleep quality, Health outcomes, Adults, Associated factors

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INTRODUCTION

Sleep, a vital physiological process, plays a crucial role in the maintenance of an individual's well-being and health status [1]. For healthy adults, the recommended sleep time is seven to nine hours per night on a regular basis to promote optimal health [2]. Literature suggests that individuals with good sleep quality (i.e., sufficient total sleep time, shorter sleep latencies, wakefulness after sleep onset and daytime sleepiness) have more energy, healthier immune systems, better cognitive function and performance throughout the day [1,3,4]. On the other hand, inadequate sleep (sleeping ≤ 7 hours per night) has been associated with a range of health problems, including increased risk of non-communicable diseases (NCDs) such as obesity, diabetes and cardiovascular diseases [5-7]. Impaired performance and cognitive functions such as memory, attention and decision-making as well as eating disorders also appear to be associated with poor sleep quality [8-10].

Poor sleep quality is a significant issue in the modern world, with a third of United States adults reporting sleeping less than the recommended amount11. Similarly, a meta-analysis involving 45 studies with 231,542 participants from twenty low-and middle-income countries (LMICs) revealed a pooled prevalence of poor sleep quality of 46.0% [12]. A study by Chan and colleagues [13] revealed that 54.7% of working adults in Malaysia were suffering from sleep problems, with an average of six hours of sleep daily. These observations underscore the importance of addressing sleep quality

issues globally.
There are various factors that impact the quality of sleep including demographic characteristics, lifestyle, health conditions and environmental factors [14,15]. Previous study in Korea had identified that there is an association between age, gender and smoking with poor sleep quality among Korean adults [16]. Some studies showed that women slept shorter duration and had poorer sleep quality than men [17,18]. Similarly, body weight status and dietary intake were reported to have an association with sleep problems [15, 19-20]. Nevertheless, most previous studies on sleep performed in Western countries and focused on the sleep duration of individuals; whilst the factors associated with poor sleeping patterns, including those related to weight status, are limited in Malaysia. Moreover, study that comprehensively investigated sociodemographic and lifestyle factors associated with sleep deprivation among adults have been rarely conducted in Asian countries. The aim of this study is to determine the prevalence of sleep quality and its associated factors in a sample of adults from the province of Terengganu, Malaysia.

MATERIALS AND METHODS

Study design
This cross-sectional study was conducted in four districts of Terengganu; Kuala Terengganu, Kuala Nerus, Setiu and Marang, from February 6, 2023 until September 29, 2023. The sample size determination was estimated via Raosoft software using 95% confidence interval, 5% margin of error and total number of adults in the population studied [21]. Considering a 20% dropout rate, at least 452 participants was considered adequate and conveniently recruited for this study.

Participant's selection
This study was approved by UniSZA Human Research Ethics Commitee (UniSZA/UHREC/2022/436). The participants was provided with a verbal briefing regarding the study, and any queries they had were answered. Written consent was obtained from participants prior to the enrolment. The inclusion criteria of this study were adults aged 18 to 60 years old, reside in Terengganu and able to understand and write in Malay or English language. Those who clinically diagnosed with sleep disorders, psychological problems and cognitive impairment, pregnant women and had suffered from any chronic illness such as haemodialysis or organ failures were excluded.

Sociodemographic data
A self-administered questionnaire consisted participants' sociodemographics such as gender, age, ethnicity, occupation, income, educational level, smoking and alcohol consumption status.

Anthropometric and blood pressure measurements
Anthropometric measurements were conducted with participants in light clothing and without shoes by trained researchers. Height and weight measurements were taken in an upright standing position to the nearest 0.1 cm and 0.1 kg using Seca 213 portable stadiometer (Seca, Germany) and TANITA Model BC-583 digital weighing scale (TANITA, Japan), respectively. The body weight and height were used for body mass index (BMI) calculations using the formula BMI = weight (kg) / height2 (m2), and was classified into underweight, normal, overweight or obese based on the standard BMI cut-off points [22]. Meanwhile, systolic and diastolic blood pressure measurement were measured using an automated ROSSMAX blood pressure monitor (Rossmax Swiss GmbH, Switzerland) and were categorised according to the Clinical Practice Guideline Management of Hypertension [23]. All measurements were taken twice and the average values were used in the analysis.

Pittsburgh Sleep Quality Index (PSQI)
The Malay version of PSQI was used to assess the sleep quality and disturbances of participants within the past month [24-25]. It consisted of 19 items with seven components: sleep duration, sleep disturbance, sleep latency, daytime dysfunction due to sleepiness, overall sleep quality, sleep efficiency and the use of sleeping medications. Each component has a score that ranges from 0 to 3 and the summed of PSQI global score ranging from 0 to 21. Participants with a global score greater than five were categorised as "poor sleep quality", while those with a score of five or less were classified as "good sleepers" [24].

International Physical Activity Questionnaire (IPAQ)
The Malay validated short version of IPAQ was utilised to assess participants' physical activity status [26]. It comprised of six items designed to produce scores for walking, moderate-and vigorous-intensity activity, and also one additional item on time spent sitting in the previous seven days. The metabolic equivalent (METs) values were calculated as minutes of activity per day x days per week x METs level. The total METs then were used to classify the participants as either high, moderate or low physical activity level [26].

Dutch Eating Behaviour Questionnaire (DEBQ)
The Malay validated version of DEBQ was used to assess eating behaviour among participants [27]. It consisted of three domains with a total of 33 questions; emotional eating (13 items), external eating (10 items) and restrained eating (10 items). The questions were scored using five-point Likert scale as follows; 1 = never, 2 = seldom, 3 = sometimes, 4 = often, and 5 = very often, with the exception for Item 21 which requires reverse scoring [27].

Data collection procedure
Upon recruitment, eligible participants with written consent were briefed about this study. Participants were

first asked to complete a set of questionnaire consisting sociodemographic information, the PSQI, IPAQ and DEBQ. Then, their anthropometric measurements (height, weight, body fat percentage and blood pressure) were measured by trained researchers using a standard protocol. The BMI was calculated by dividing the body weight (kg) by squared measured height (m2) and was classified into underweight, normal, overweight or obese based on the standard BMI cut-off points [28].

Data analysis

The data were analyzed using the statistical software package IBM SPSS Statistics for Windows, version 25.0 (Armonk, NY: IBM Corp). The sociodemographic characteristics, anthropometric measurements, prevalence of sleep quality were presented as descriptive statistics such as frequencies (n) and percentages (%), or as mean with standard deviation (SD). Simple linear regression was used to identify univariable associations between sleep quality and sociodemographic, body weight status, blood pressure, physical activity and eating behaviors. Stepwise multivariable linear regression analysis was conducted to determine the independent relationships between the mean PSQI Global Score and its related factors. The level of significance was set at p-value < 0.05.

RESULTS

Participants' characteristics

A total of 580 participants were enrolled and analyzed in this study after excluding those who did not meet the inclusion criteria (Table I). About half of the participants were female (51.2%), with a mean age of 29.1 years (SD = 10.0). The majority of them were Malays (90.2%), had lower income level (77.4%), and mostly classified as students (38.8%) or working on the private sector (36.7%). Nearly half (49.1%) of the participants had a healthy BMI and reported moderate physical activity level (42.4%). Overall, mean blood pressure was 124/78 mmHg, with 38.8% participants categorized as having optimal (38.8%) blood pressure readings. In addition, most of them were not smoking (75.7%) and not consuming alcohol (96.0%). Regarding eating behavior, the mean score was 2.19 ± 0.91 in emotional eating, 2.89 ± 0.88 in external eating and 2.48 ± 0.89 in restrained eating, which demonstrated moderate behaviour among participants.

Table I: Socio-demographic, clinical and health-related behaviour characteristics of the participants (n = 580). (CONT)

Characteristics	n (%)
Age (years); Mean ± SD	29.1 ± 10.0
Gender	
Male	283 (48.8)
Female	297 (51.2)
Marital status	
Single	393 (67.8)
Married	179 (30.9)
Others	8 (1.4)
Race	
Malay	523 (90.2)
Chinese	25 (4.3)
Indian	6 (1.0)
Others	26 (4.5)
Educational level	
No formal education	9 (1.6)
Primary education	9 (1.6)
Secondary education	176 (30.3)
STPM/Diploma/Asasi/Matriculation/Pre-university	143 (24.7)
Tertiary education	243 (41.8)
Occupation	
Government sector	132 (22.8)
Private sector	213 (36.7)
Self-employed	4 (7)
Retired	1 (0.2)
Not working	5 (0.9)
Student	225 (38.8)
Individual income level[a]	
Low (≤ RM2,500 – RM4,849)	449 (77.4)
Medium (RM4,850 – RM10,959)	88 (15.2)
High (≥ RM10,960)	43 (7.4)
Smoking status	
Non-smoking	440 (75.7)
Cigarette smoker	86 (14.8)
Vape smoker	20 (3.4)
Both cigarette and vape smoker	5 (0.9)
Ex-smoker	29 (5.0)

CONTINUE

Table I: Socio-demographic, clinical and health-related behaviour characteristics of the participants (n = 580).

Characteristics	n (%)
Alcohol consumption status	
No	557 (96.0)
Yes	23 (4.0)
Anthropometric measures; Mean SD	
Weight (kg)	64.29 ± 16.9
Height (m)	1.61 ± 0.1
Body mass index categories[b]; Mean SD	24.58 ± 5.8
Underweight (≤18.4 kg/m²)	56 (9.7)
Normal (18.5-24.9 kg/m²)	285 (49.1)
Overweight (25.0-29.9 kg/m²)	141 (24.3)
Obese I (30.0-34.9 kg/m²)	61 (10.5)
Obese II (35.0-39.9 kg/m²)	27 (4.7)
Obese III (≥ 40.0 kg/m²)	10 (1.7)
Body fat percentage (%)[c]; Mean SD	
Men (cut-off points ≥25%)	21.06 ± 7.6
Women (cut-off points ≥35%)	31.86 ± 9.1
Blood pressure (mmHg); Mean SD	
Systolic	124.56 ± 15.4
Diastolic	78.19 ± 10.65
Blood pressure categories[d]	
Optimal	225 (38.8)
Normal	166 (28.6)
At risk	92 (15.9)
Hypertension stage I	85 (14.7)
Hypertension stage II	12 (2.1)
Physical activity level	
Total METs; Mean ± SD	1910.0 ± 2178.9
Low-intensity	200 (34.5)
Moderate-intensity	246 (42.4)
Vigorous-intensity	134 (23.1)
Dutch Eating Behaviour Questionnaire	
Emotional eating	2.19 ± 0.91
External eating	2.89 ± 0.88
Restrained eating	2.48 ± 0.89

Data are presented in mean ± standard deviation (SD) or frequency (%); higher score indicates better outcomes;
[a]Income level categories based on Department of Statistics Malaysia, 2019; [b]World Health Organization (WHO) cut-off, WHO (2000); [c]WHO cut-off, WHO (1995); [d]Blood pressure categories based on Clinical Practice Guideline Management of Hypertension (2018); [d]Physical activity level categories based on International Physical Activity Questionnaire (IPAQ) 2005;
STPM, Sijil Tinggi Pelajaran Malaysia; RM, Ringgit Malaysia; BMI, body mass index; METs, metabolic equivalents.

Sleep quality

The mean PSQI global score of the participants was 6.53 ± 2.89, with 74.7% of the participants had a global PSQI score >5, indicating a disturbance in sleep quality (Table II). The average of total sleep duration per night was 6.20 ± 1.6 hours. Sleep disturbance scored the highest (1.23 ± 0.9), indicating the worst performance among the seven PSQI components.

Table II: PSQI sleep components of the participants (n = 580).

Item	Mean ± SD
PSQI Global score	6.53 ± 2.89
Good sleep quality, n (%)	147 (25.3)
Poor sleep quality, n (%)	433 (74.7)
C1: Subjective sleep quality	0.91 ± 0.7
C2: Sleep latency	1.06 ± 0.9
C3: Sleep duration	1.19 ± 0.9
C4: Sleep efficiency	1.18 ± 1.4
C5: Sleep disturbance	1.23 ± 0.9
C6: Sleep medication	0.42 ± 0.7
C7: Daytime dysfunction	0.56 ± 0.6
Total sleep duration (hour)	6.20 ± 1.6

PSQI, Pittsburgh sleep quality index; SD, standard deviation

Factors associated with sleep quality

Table III summarizes the univariable and multivariable analyses of the relationship between sleep quality and selected variables. In the univariate analysis, seven factors were significantly associated with sleep quality among the participants: age (p-value=0.032), gender (p-value=0.002), education level (p-value<0.001), income (p-value=0.027), smoking status (p-value=0.044), emotional (p-value=0.043) and external eating (p-value=0.031).

However, in the multiple linear regression model, only four variables; gender (p-value=0.044), education level (p-value=0.001), emotional (p-value=0.005) and external eating (p-value=0.026) remained independently associated with sleep quality. These results indicated that an increased emotional eating score and reduced external eating score would be significantly associated with a higher mean PSQI Global Score, indicating poorer sleep quality. In addition, women and lower educational level were associated with poorer sleep quality in the study population (Figure 1).

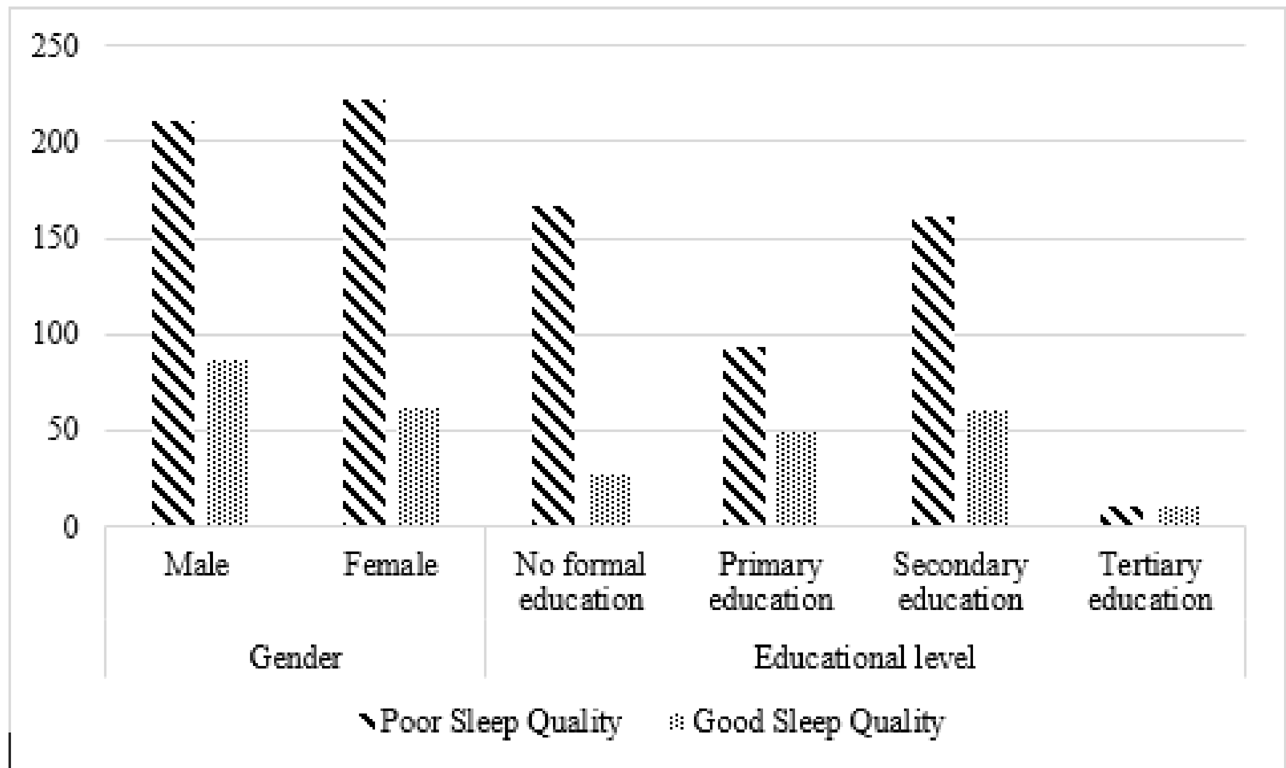

Figure 1: Prevalence of sleep quality versus gender and educational level (n=580).

Table III: Relationship between sleep quality and selected characteristics (n=580).

Variable (s)	Simple Linear Regression		Multiple linear regression	
	β (95% CI)	p-value	*β (95% CI)*	p-value
Age	-0.026 (-0.049, -0.002)	0.032*	-0.023 (-0.055, 0.008)	0.145
Gender (0=Female; 1=Male)	-0.750 (-1.219, -0.282)	0.002*	-1.064 (-2.100, -0.028)	0.044*
Marital status (0=Single, 1=Married)	-0.442 (-1.113, 0.228)	0.195	-0.457 (-1.085, 0.171)	0.154
Race (0=Malay, 1=Chinese, 2=Indian, 3=Others)	0.294 (-0.058, 0.646)	0.101	-0.047 (-0.469, 0.375)	0.827
Education level (lower/higher)	-0.558 (-0.810, -0.307)	<0.001*	-0.581 (-0.908, -0.254)	0.001*
Occupation (0=Government, 1=Private, 2=Self-employed, 3=Retired, 4=Not working, 5=Student)	0.039 (-0.070, 0.148)	0.485	0.110 (-0.039, 0.259)	0.149
Income (lower/higher)	-0.443 (-0.836, -0.050)	0.027*	-0.184 (-0.602, 0.233)	0.387
Smoking status (0=Not smoking, 1=Smoker)	0.180 (0.005, 0.354)	0.044*	0.013 (-0.187, 0.213)	0.895
Alcohol consumption status (0=No, 1=Yes)	1.164 (-0.043, 2.370)	0.059	0.359 (-1.091, 1.809)	0.627
BMI	0.007 (-0.033, 0.048)	0.720	-0.022 (-0.125, 0.081)	0.672
Body fat %	--0.019 (-0.042, 0.005)	0.121	0.035 (-0.036, 0.107)	0.333
Blood pressure				
Systolic	0.006 (-0.009, 0.021)	0.436	-0.002 (-0.025, 0.021)	0.856
Diastolic	-0.011 (-0.033, 0.011)	0.327	-0.009 (-0.039, 0.021)	0.548
Total IPAQ	4.105 (0.000, 6.770)	0.457	5.325 (0.000, 0.719)	0.925
DEBQ				
Emotional eating	0.103 (-0.156, 0.362)	0.043*	0.508 (0.155, 0.861)	0.005*
External eating	-0.296 (-0.565, -0.027)	0.031*	-0.456 (-0.858, -0.054)	0.026*
Restrained eating	-0.145 (-0.408, 0.118)	0.280	-0.024 (-0.336, 0.288)	0.880
Constant			11.157 (7.258, 15.056)	<0.001
R^2			0.910	
Adjusted R^2			0.630	

*Simple and Multiple linear regression was applied. Significant levels, $p < 0.05$.

DISCUSSION

The public health burden of sleep disturbances is increasing, especially among adults. The present study found that about 74.7% of study participants had poor sleep quality in the preceding month, represented by a PSQI Global Score greater than five, and a total sleep duration per night of about 6.2 hours, which is below the recommended amount of between seven to nine hours per night. Several individual characteristics such as female sex, lower educational level as well as emotional and external eating were found to be independent predictors of poorer sleep quality.

The high prevalence of poor sleep quality reported here seems to corroborate the previously observed prevalence ranges between 45 – 84% in other studies among Malaysian adults [13,19,23,28]. The different sample population backgrounds and geographic settings between these studies could explain the differences in the prevalence range of poor sleep quality observed among adults. The average of total sleep duration at night in our study participants was 6.20 ± 1.6 hours, which was similar to previous studies among Malaysian adults in studies conducted during the COVID-19 pandemic [19,30]. Another study among working Malaysian adults reported a total sleep duration of 6.49 ± 1.1 hours, a finding which was very similar to the present study. According to Jha [31], insufficient sleep could be due to several factors such as long working hours, family responsibilities, usage of electronic devices late at night and medical conditions.

The present study also seems to corroborate previous findings which suggests a link between gender and poor sleep quality [6,17]. Specifically, women were more likely to experience sleep deprivation compared to men. According to Morssinkhof et al. [18] several factors may contribute to these observed differences including biological, lifestyle and societal factors. The quality and duration of sleep among women also tend to worsen with age, likely due to hormonal transitions during menstruation, pregnancy and menopause stage [6,18].
A lower educational level was also found to be an independent predictor of poor sleep quality, consistent with previous research [6]. Adults with lower education levels tend to have irregular work schedules and multiple jobs, leading to disturbances in sleep [32]. They are often associated with higher levels of stress and increased health risks such as cardiovascular diseases and chronic diseases [15, 33-34]. Meanwhile, those with higher education levels may have more knowledge regarding

the importance of good sleep and afford to create a sleep-conducive environment (e.g., a convenience room, comfortable pillows and bedding materials). Education about good sleep hygiene and policies to promote work-life balance should be emphasized. For instance, napping for about 30 minutes per day could be implemented in the workplace to counter short sleep duration as it has been found to reduce coronary mortality, improve cognition and immune functions [35].

Our study also reported an association between emotional eating and sleep quality. The result was in line with a study by Kelmanson [35], which found that poor sleep quality promotes emotional eating habits among individuals due to emotional distress such as sadness, anger, fear or anxiety. Other literature has suggested that individuals with insufficient sleep are more likely to have negative emotions that leads to increased hunger, overeating and greater consumption of comfort food which are mostly high in calories, fat and sugar [35-37]. Although external eating often co-occurs with emotional eating, this study indicated an inverse relationship between external eating behavior and sleep quality. These discrepancies were expected, considering the characteristics of our study population which predominantly comprised students and individuals from low-income background, that are often characterized by limited accessibility and affordability to palatable foods. These findings suggest that sleep quality and eating behavior may cluster together, hence affecting individuals' health condition. Nonetheless, it is critical to caution against overinterpretation of this finding. The cross-sectional design of the study precludes any causal inferences, and the operationalization of external eating may differ across cultural and socioeconomic settings. Moreover, there may be unmeasured confounders, such as stress levels, physical health status, or other lifestyle behaviours (e.g., exercise frequency, alcohol use), that could influence both eating behaviours and sleep quality.

The present findings identified some important factors that are linked with sleep quality. It is indicative that government and health authorities work on appropriate interventions to increase sleep quality and wellbeing of individuals, especially among woman. Several limitations should be noted in this study. An important limitation is the generalization because our study population mostly young people and students, hence not representing the population of Malaysian adults. Thus, future studies should consider employing random or stratified sampling methods to achieve a more representative demographic profile. The self-reported questionnaires were prone to recall bias, hence an objective and comprehensive sleep assessment using the polysomnogram may give more accurate information. However, the quality of data obtained was strengthen by using validated and reliable questionnaire. This is also a cross-sectional study thus the observed associations do not allow to make clear conclusions about cause-and-effect relationships. Further prospective and intervention studies also in needs to allow for clear verification of the results obtained.

CONCLUSION

In conclusion, the present study revealed a significant prevalence of poor sleep quality among adults in Terengganu, with approximately seven out of ten adults being affected by poor sleeping patterns. The findings have further suggested an association between poor sleep quality and certain demographic and behavioral factors, including being women, having a lower level of education, and exhibiting emotional and external eating behaviors. This warrant further studies to confirm the relationship of these factors with sleep quality in the Malaysian population and targeted interventions amongst these specific groups to tackle their poorer sleeping habits. It is also imperative to have regular assessments of sleep quality among adults to help improve sleep quality, overall health and wellbeing of individuals. Besides, public health interventions should include community-based peer support networks, health campaigns and skill-building workshops to effectively support at-risk groups such as women and individuals with lower education.

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