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Cleveland Adolescent Sleepiness Questionnaire (CASQ): Sleep Pattern among Undergraduates in Malaysia

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ABSTRACT

Daytime sleepiness among adolescents is nearly universal; the sleep/wake rhythm in humans is regulated by the circadian timing system that makes people sleepy at certain times of the day. Research suggests academic performance is affected by lack of sleep may influence hence the importance of this study at tertiary level. A survey of 707 full-time undergraduates at a local university in Malaysia was conducted using a modified Cleveland Adolescent Sleepiness Questionnaire. The modified CASQ was found to be reliable and significant and thus suitable to be used to measure students daytime sleepiness. Results showed that male students (n=237) reported significantly higher daytime sleepiness. There is a significant difference between academic performance and sleepiness. Science stream students are more likely to record higher sleepiness compared to non-science students. There is a need to increase the awareness of this problem in the education and to further research on this issue in the Malaysian context.

Keywords: Daytime sleepiness, academic performance, undergraduate students
SAPJ Code: 2040,2050,4030

INTRODUCTION

Akerstedt (1998 in Cluydts, De Valck, Verstraeten, & Theys, 2002) considered sleepiness to be an attempt to turn the central nervous system on to sleep and thus it reflects an effort to resist sleep. This would imply that someone who does not fight back sleep will not experience any sleepiness. Daytime sleepiness of students in university can be caused by their lifestyle in campus itself, including the role of early school starting times and the role of various biological and social influences (Dahl, 2007). This includes increased freedom, self-responsibility, disorganized lifestyle, variable schedules, repeated deadlines, dormitory living, and social and academic obligations (Doghramji, 2009).

The two-process model of sleep regulation, developed by Borbely (1982), implies a basic model of sleepiness that is still broadly adhered to (in Cluydts et al., 2002). The processes involved in the regulation of waking and sleeping and stipulate that arises from the combined action of two components: a homeostatic–monotonic and a circadian rhythmic component. The circadian component, process C, leads to a dip in alertness in the early morning hours. The homeostatic

component, process S, represents the amount of prior wake and the amount of prior sleep. As prior wake time increases and prior sleep time decreases, sleepiness augments. A third factor, process W, has been proposed to be added to the original two-process model of sleep regulation (Folkard & Akerstedt, 1987 in Cluydts et al., 2002). It represents sleep inertia or the drop in alertness in the first few hours after awakening and is considered to be a significant contributing factor to sleepiness. The sleep–wake rhythms in humans regulated by the circadian timing system are daily cycles that make people more likely to be sleepy at certain times of the day, and with wakefulness peaking at some point in the late morning and again in the afternoon (Dills & Hernandez-Julian, 2007).

Carskadon (1990 in Lee, Mcenany, & Weekes, 1999) identified several social influences on adolescent sleep problems, including parental values and supervision (or lack thereof), curfews, and work schedules complicating the schedule already imposed by school demands. Sleepiness among college students frequently is observed in university classrooms, particularly in classes with large enrolments where drowsiness and even "nodding off" are common (Eden, 2006). Students often feel sleepy during certain periods of a day, for example during classes, during low stimulation activities, and during cars or bus rides. Students in campus may have more freedom compared to being at home with parents' control (Brand, Hatzinger, Beck, & Holsboer-Trachsler, 2009).

While the biological need for sleep is increasing among university students, psychosocial pressures of homework, sports, jobs, social activities, and decreases in parental control over bedtime, combine to reduce the amount of time adolescents spend sleeping. The most direct cause of sleepiness is sleep deprivation; it manifests itself most significantly in the relevance of getting up late for classes and falling asleep in class (Dahl, 2007). Sleep deprivation causes feeling of sleepiness and that is most problematic during periods of low stimulation, such as in classroom, when reading or driving, or when doing repetitive activities. Students who are busy with classes and increasing work load as the semester progresses, usually experience attention lapse and fail to notice important stimuli. Millman (2005) also stated that one of the effects of sleep deprivation is falling asleep in quiet settings, especially in class.

These attention lapses increase and are more frequent after a sleepless night. Inadequate sleep is a major cause of poor performance by college students (Kalat, 2009). The ability to concentrate and pay full attention is imperative for effective learning to take place. Therefore, daytime sleepiness may prove a hindrance to students' academic success as it can affect the students' ability to participate in class. If students are able to give their full attention during lectures and take part in classroom activities, they will be able to better comprehend and take in the essence of the day's lessons (Atan, Bahar, & Tajuddin, 2008). Consequently, daytime sleepiness affects students' academic performance as was proven by Rodrigues, Viegas, Abreu e Silva, and Tavares (2002); sleepy students did not achieve as well as the non-sleepy group on their final examinations.

A few studies have found that there is a difference between male and female adolescents older than 17 years, in daytime sleepiness. A study by Cortesi, Giannotti, Sebastiani, Bruni, and Ottaviano (2004) found that there was a significant prevalence of poor sleeping habits in boys, which causes daytime sleepiness and low performance at school and at work. Another research done by Nagai, Fischer, Moreno, Teixeira, Conceicao, Mussi, Luz, Soares, and Lowden (2009) found gender differences in sleep length, sleepiness, and performance. Females were sleepier than males, even though females sleep length was longer than males during the entire week. But even so, females seemed to be sleepier and showed poorer performance.

Wali, Krayem, Samman, Mirdad, Alshimemeri, and Almobaireek (1999) found that men experience more daytime sleepiness compared to women, especially when lying down to rest in the afternoon when circumstances permit. Whereas poor sleep quality had a more profound effect on women due to stress-related sleep troubles especially about school compared to men (Lund, Reider, Whiting, & Prichard, 2009). Tsai and Li (2004) showed that gender differences in sleep patterns and sleep difficulties were more prominent in the group of young college students. Jean-Louis, Zizi, Von Gizycki, Gaglio, Spielman, Manber, Fookson, and Taub (1997) also established that women had a higher daytime sleepiness compared to men.

In Malaysia, only a handful of studies have been conducted regarding daytime sleepiness. One of the studies is by Atan et al. (2008) among five cohorts of students in the Institute of Teacher Education. Their research found that male students experience less daytime sleepiness compared to female students, but gender difference are not significant. The overall study found that generally Cohort five students are moderately affected by daytime sleepiness. The study also found that a heavy breakfast, regular exercise, having health problems and going to sleep late at night are not major factors that cause students to succumb to daytime sleepiness.

Other than the lack of studies regarding gender difference in daytime sleepiness, there are even fewer studies regarding daytime sleepiness and class years. A study done in Islamabad on the sleep habits and their consequences among students aged 18-23 years old from Shifa College of Medicine (Khan, Pasha, Khokhar, & Rizvi, 2004). They found that first year and second year students had the least regular sleeping hours, which causes daytime sleepiness. While third and fourth years students had better regular sleep hours. Students' lack of sleep especially among first and second year students is due to their adjustment to university lifestyle. Whereby, students have to adjust to the university's class schedules, self-study methods, and various social activities available. In addition, sleep patterns (Gomes, Tavares, & Azevedo, 2002) was identified as one of the reasons why students experience daytime sleepiness

Because of the significant impact of daytime sleepiness on students' performance, research to identify the measurements of daytime sleepiness is very much in need. Even though the common scale such as Epworth Sleepiness Scale (ESS), Stanford Sleepiness Scale (SSS), and Paediatric Daytime Sleepiness Scale (PDSS) is often used, it does not assess the daytime sleepiness of university students with the average age of 18 to 24 years old. Bakar and Ismail (2004) research review some of the methods commonly used in tackling significant impact of fatigue and sleepiness on work performance. Problem of fatigue and sleepiness requires the use of reliable, validated and suitable methods to evaluate. Reviewed methods include Pupillography, Multiple Sleep Latency Test (MSLT), Maintenance of Wakefulness Test (MWT), Performance and Vigilance Introspective Sleepiness (PVIS), Profile of Mood States (POMS), encephalogram (EEG), and Epworth Sleepiness Scale (ESS) and Stanford Sleepiness Scale (SSS). The advantages of SSS is that it is a very brief test, easy to administer and can be repeated, but difficult to compare results between subjects (Bakar & lsmail, 2004). These scales do not accurately describe university students' lifestyle in campus as it is originally meant for occupational setting, therefore this current study will attempt to develop new scales to measure daytime sleepiness among local university students.

The first stage of this present study will look at the reliability and structure of CASQ in Malaysian context. The second stage will investigate whether differences exist between types of sleepiness based on demographics characteristics of the undergraduates. This study hypothesizes that there is a significant difference between demographic characteristics of the undergraduates (gender, class year, C.G.P.A and courses) and their scores on CASQ. In addition, this study also predicts that respondents' sleeping pattern (time and duration) may also affect their scores on CASQ.

METHODOLOGY

Respondents

The data from this study were obtained from a questionnaire completed by 707 full-time undergraduates (f=470) with the age range of 20 to 24 years old. The questionnaire was administered at a local university in Sabah, Malaysia.

Instruments

The questionnaire consisted of respondents' demographic information (gender, class year, grade points, courses), sleep pattern (sleep time, duration of sleep) and Cleveland Adolescent Sleepiness Questionnaire (CASQ). CASQ was adapted from Spilsbury, Drotar, Rosen, & Redline (2007) designed to measure adolescents' daytime sleepiness. Previous studies have shown that CASQ consisted of four subscales; For the purpose of this study and taking into consideration the target group (university students as opposed to adolescents), the word 'school' was replaced by 'campus' and class replaced by 'lecture'. All 16 items were scored on a five-point scale ranging from (1) Never to (5) Almost every day.

Table 1
Demographic and Sleep Pattern of Participants

Gender	Frequency	Percentage (%)
Male	237	33.5
Female	470	66.5
Class year		
Year one	348	49.2
Year two	142	20.1
Year three	170	24.0
Year four	47	6.6
CGPA*		
2.00-2.50	81	11.5
2.51-3.00	346	48.9
3.01-3.50	223	31.5
3.51-4.00	39	5.5
Course		
Science	229	32.4
Non-Science	478	67.6
Sleep Duration		
Less than 5 hours	136	19.2
6 -7 hours	357	50.5
7-8 hours	154	21.8
More than 8 hours	60	8.5

*There were 18 missing scores for this variable

Procedure

The survey was carried out among students inside the university lecture halls after getting permission from respective lecturers, before the lectures started. Instructions were given before respondents answered the questionnaire. The approximate time to fill up the questionnaire was 15-20 minutes, and the questionnaires were then collected immediately after they were filled in.

RESULT

Descriptive Statistics

The distribution of respondents' demographic characteristics and sleep patterns are cross-tabbed as shown in Table 2 and Table 3. For Table 4, respondents' demographic characteristics and sleep pattern are cross-tabulated with CASQ. The score from CASQ for this analysis was divided into three categories (low, medium and high) equally based on the existing data.

Table 2 Cross-tabulation of Respondents' Demographic Characteristics and Sleep Pattern (Sleep Time)

		Sleep time			
		> 10 pm	10-12pm	12-2am	< 2am
Gender	Male	2.1	24.5	58.6	14.8
	Female	2.3	32.3	56.8	8.5
Class	Year 1	0.6	28.2	59.8	11.5
	Year 2	4.2	24.6	60.6	10.6
	Year 3	2.9	32.4	55.3	9.4
	Year 4	6.4	46.8	38.3	8.5
CGPA	2.0-2.5	1.2	22.2	63.0	13.6
	2.51-3.0	1.7	29.5	59.5	9.2
	3.01-3.50	2.2	30.5	56.5	10.8
	3.51-4.0	5.1	35.9	46.2	12.8
Course	Science	2.6	36.7	47.2	13.5
	Non-science	2.1	26.4	62.3	9.2
	Average	**2.3**	**29.7**	**57.4**	**10.6**

The summary suggests that the normal sleep pattern for the majority of students was between twelve to two o'clock in the morning.

Table 3
Cross-tabulation of Respondents' Demographic Characteristics and Sleep Pattern (Sleep Duration)

		Sleep duration			
		< 6 hours	6-7 hours	7-8 hours	> 8
Gender	Male	22.4	48.5	19.0	10.1
	Female	17.7	51.5	23.2	7.7
Class	Year 1	21.3	54.0	19.3	5.5
	Year 2	23.2	50.7	16.9	9.2
	Year 3	14.7	48.8	25.9	10.6
	Year 4	8.5	29.8	40.4	21.3
CGPA	2.0-2.5	18.5	53.1	25.9	2.5
	2.51-3.0	22.3	53.5	19.9	4.3
	3.01-3.50	15.7	47.5	23.8	13.0
	3.51-4.0	15.4	38.5	12.8	33.3
Course	Science	15.7	48.9	23.1	12.2
	Non-science	20.9	51.3	21.1	6.7
	Average	19.2	50.5	21.8	8.5

The summary suggests that around half of the students managed a sleep duration of between six to seven hours per day.

Table 4
Respondents' Demographic Characteristics and Level of Sleepiness

		CASQ Level		
		Low	Medium	High
Gender	Male	24.9	33.8	41.4
	Female	42.1	23.8	34.0
Class	Year 1	41.1	26.7	32.2
	Year 2	30.3	29.6	40.1
	Year 3	33.5	25.9	40.6
	Year 4	29.8	27.7	42.6
CGPA	2.0-2.5	24.7	30.9	44.4
	2.51-3.0	41.3	28.0	30.6
	3.01-3.50	34.1	25.1	40.8
	3.51-4.0	30.8	23.1	46.2
Course	Science	26.6	27.5	45.9
	Non-science	41.0	27.0	32.0
	Average	36.4	27.1	36.4

Exploratory factor analysis and reliability

Since previous studies have shown CASQ to be multi-dimensional, an exploratory factor analysis specifically Principal Component Analysis (PCA) with Varimax Rotation was performed and loadings under .40 were suppressed. The resulting factor solutions with sixteen items accounted

for 55.2% of the total variance explained, with Cronbach's alpha of .77 as an overall scale. The items in the factors that emerged clearly fit into the four fold factor of the original CASQ study. All items load into the expected component that represents sleep in campus alert in campus, sleep in the evening sleep in transport respectable Cronbach's alpha coefficients of .82, .67, .63 and .66 respectively (see Table 5). The means for each subscale are shown in Table 6.

Table 5: Exploratory factor analysis and reliability score for CASQ

Items	Loadings
Factor 1: Sleep in Campus (α = .82)	
I fall asleep during the last lecture of the day	0.80
I fall asleep at campus during my afternoon lecture	0.79
I fall asleep during my morning lectures	0.77
During lecture days, there are times when I realize that I have just fallen asleep	0.70
In the morning when I am in campus, I fall asleep	0.61
Factor 2: Alert in Campus (α = .67)	
I feel alert during my lectures	0.77
When I am in lectures, I feel wide awake	0.76
I feel wide awake the whole day	0.75
I feel wide awake the last lecture of the day	0.57
I go through the whole campus day without feeling tired	0.43
Factor 3: Sleep in evening (α = .63)	
I feel sleepy when I do my assignment in the evening after lectures	0.77
I feel sleepy in the evening after lectures	0.73
I fall asleep when I do assignments at home in the evening	0.66
Factor 4: Sleep during transport (α = .66)	
I feel drowsy if I ride in car for longer than five minutes	0.80
I fall asleep when I ride in a bus, car, or train	0.68
I feel sleepy when I ride in a bus to campus events like a field trip or sports game	0.63
Total Percentage of Variance Explained	55.2%

Table 6: Means of subscale

	Mean	Std. Deviation
Sleep in campus	2.2571	.82008
Alert in campus	2.6495	.63387
Sleep in the evening	3.0717	.73892
Sleep in transport	2.3272	.81077

CASQ and Gender

An independent samples *t*-test is used to determine the daytime sleepiness difference between male and female with CASQ as dependent variable. Findings show that there is a highly significant difference in score between males (M=2.86, SD=.49) and females (M=2.72, SD=.48) CASQ score, t (705)=3.78, p=.005. This result suggests that males have a higher reported daytime sleepiness compared to females.

CASQ and Class year

A one-way ANOVA was used to test for CASQ score differences among four different class years. The result, F (3, 703) = 2.04, p = .107 indicated that there was no significant difference between class year and CASQ score. Thus, the result shows that there were no reported differences in terms of respondent year of study and daytime sleepiness.

CASQ and CGPA

A one-way ANOVA on CGPA results and CASQ score yield a significant result of F(3,685) = 5.33, p = .001. Post hoc analyses using the Tukey HSD indicated that respondents with CGPA of 2.0 to 2.5 (M=2.88, SD=.44) and CGPA of 3.01 to 3.5 (M=2.8, SD=.50) reported significantly higher level of sleepiness compared to respondents from the CGPA group of 2.51 to 3.0 (M=2.7, SD=.46).

CASQ and Course

An independent samples *t*-test between science based and non-science based course and CASQ found that students from science stream reported a significant difference in mean (M=2.87, SD=.5) compared to non-science (M=2.71, SD=.47), t(705)=4.14, p=.001. This suggests that science stream students reported a higher level of daytime sleepiness compared to non-science stream.

DISCUSSION

Findings show that male university students experience more significant daytime sleepiness compared to female university students which is similar to the findings by Wali et al. (1999) in Saudi Arabia. On the other hand, Jean-Louis et al. (1997) and Nagai et. al (2009) found that men were less sleepy than women, albeit using a different scale (SSS). Breslau et al. (1997, in Carskadon et al., 1998) identified hours of sleep as the main contributing factor and the trend from cross-tabulation in Table 2 and Table 3 on sleep pattern suggests that more male students sleep fewer hours and went to bed later than female students.

Previous research found that there is a significant difference between class years and sleepiness. Khan et al. (2004) found that one third of the students reported yes to being excessively tired during the daytime, and year-two students had the highest daytime sleepiness compared to year-one, year-three, and year-four students. Tsai and Li (2004) found that freshmen experience more daytime sleepiness due to different activity schedules and academic demands on weekdays. However in this study, although fourth year students reported a marginally higher daytime sleepiness, there is no significant differences among class years and thus the hypothesis presented was not accepted. Data from cross- tab indicated that the fourth year student had a longer sleep duration and most likely to go to bed early. However, the slightly higher mean although not significant statistically, was due to other factors, such as stress and course demand as compared to other year group may lead to an increased level of daytime sleepiness.

While studies (Eliasson, Eliasson, King, Gould & Eliasson, 2002; Flood, Brensinger & Cheek, 2008) found that there was no correlation between sleep time and academic performance, or daytime sleepiness negative effect on academic achievement (Gibson, Powles, Thabane, O'Brien, Molnar, Trajanovic, Ogilvie, Shapiro, Yan & Chilcott-Tanser, 2006), the finding in this study concurred with Eliasson, Lettieri, & Eliasson (2010) on sleepiness and academic performance whereby those with low academic performance (CGPA=2.0-2.5) reported higher level of sleepiness (M=2.88). Interestingly, the mean of sleepiness score reported is only marginally lower (.01) than the top academic performer (CGPA= 3.5-4.0, M= 2.89). One possible explanation is that while the top performers engaged in academic activities during nighttime, the low performer might be involved in non-academic activities. Thus, it is not about sleep time and academic performance, but the cause that led to sleep time (e.g. social networking or revising studies) which may affect academic performance.

Academic stream, either science or non-science background were found to be an important factor in daytime sleepiness. While this issue requires further investigation, perhaps monotony could play a part, whereby science students may spend more time in laboratory and thus, experience daytime sleepiness compared to the non-science students.

One of the challenges of this study is to find suitable scale to measure daytime sleepiness among university students. The modified CASQ was found to be suitable and the psychometrics property of the scale based on Principal Component Analysis shows that modified CASQ have a good reliability score and suitable to be used for university students. Based on the findings of this study, lack of sleep causes daytime sleepiness especially among students with an irregular bedtime schedule. Thus, they should be encouraged to maintain a regular bedtime and to increase their total sleep time. These changes might help to increase the sleep quality and daytime functioning, as well as reduce students' daytime sleepiness occurrence.

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