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Sleep Habits and Academic Performance, a Study Amongst Medical Students in University of Cyberjaya, Malaysia

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ABSTRACT

Humans are, as a rule, diurnal species. However, there are interindividual differences where people have different perspectives and preferences on their time of day to be most productive and effective, or to sleep which is closely related to a concept called "Chronotype". Chronotype is divided into two groups: morningness and eveningness. Hence, this study aims to explore how morningness and eveningness are associated with medical students' GPA, thus providing valuable insights regarding chronotype-specific academic interventions for medical students. This cross-sectional study involved 253 medical students among University Of Cyberjaya from Year 1 to Year 5 (aged 19-35). The morningness-eveningness questionnaire (MEQ), the sociodemographic background questionnaire (NHMS), and the supplementary GPA requirement were all included in the online questionnaire that was used to collect the data. Among the 253 participants, the majority were females (59.3%), predominantly aged between 21-22 years old (39.5%) with most from the ethnic group of Malay (55%). Based on the result, the majority of the medical students were characterized as intermediate chronotype (64.4%), followed by evening type (23.3%) and morning type (12.3%). Moreover, the findings indicate that sleep habits and academic achievement are correlated, with a p-value of less than 0.001, a chi-square value of 47.73, and a degree of freedom (df) of 4. Therefore, these findings have significant ramifications for initiatives aimed at enhancing students' sleep patterns in order to improve their academic performance.

Keywords: Chronotype, University of Cyberjaya, Morningness-Eveningness Questionnaire (MEQ), Sociodemographic Background Questionnaire (NHMS), GPA.

1. INTRODUCTION

There are two types of individuals in this world; those who enjoy listening to birds singing the first thing in the morning as well as those who sigh and wish birds have a mute button. These highlight how people have different perspectives and preferences on their morning routine. This is closely related to a concept named "Chronotype", a specific time of the day where people tend to be most effective and productive. It is divided into two groups namely morningness and eveningness (Adan & Almirall, 1991). The first category is morning people or also called as larks which are individuals that go to bed and manage to wake up early in the morning while displaying their peak performance during the early hours. Meanwhile, night

people or "night owls" are another categorization for people who prefer to stay up past bedtime and sleep in during the morning instead since they tend to be effective during late hours (Roenneberg et al., 2007). Previous research done by Trocker et al. (2000) aiming to evaluate health related variables on academic performance found that sleep had the largest effect on semester GPA compared to the other health related variables such as physical activity, nutrition consumption, mental health, time and stress management. The findings reflect that there is a correlation ($p<0.001$) between sleep routines and high GPA level. Long sleepers that sleep 9 or more hours a day were found to achieve higher GPA's than short sleepers who sleep 6 or fewer hours daily (Kelly et al. 2001).

Compared to other academic programs, students who pursue their studies in the medical field are said to be at a higher risk of having poor sleep quality due to their packed schedule and extensive academic workload (Cardoso et al.2009). This is supported by previous research reporting that medical students experienced more disturbed sleep patterns in contrast to non-medical students (Anjum et al. 2011). Furthermore, another prior study conducted in a university in Saudi Arabia also highlighted a high prevalence of poor sleep quality among medical students (Mahfouz et al. 2013). Thus illustrates the prominent issue of inadequate sleep that mainly occurs among medical students. Due to medical students' hectic schedules and high academic pressure, study habits and learning efficiency can be affected through their varying chronotypes (BaHammam et al., 2014). Preckel (2011) states that morningness is commonly linked with better academic performance as this type of individuals who are naturally inclined towards mornings usually find it easier to adjust to conventional school timetables. On the other hand, students who are leaning towards eveningness might face difficulties with hectic schedules in the morning and may lead them to perform poorly in their academic performance (Van der Vinne et al., 2015).

It is crucial to understand the relationship between chronotype and Grade Point Average (GPA) among medical students in order to develop strategies in elevating their academic success (Roeser et al., 2012). Hence, this study aims to explore how morningness and eveningness are associated with medical students' GPA. Thus, it helps in providing valuable insights regarding chronotype-specific academic interventions for medical students (Wittmann et al., 2006).

2. LITERATURE REVIEW

Association between academic performance and sleep schedule A study was conducted to determine the factors associated with sleep quality among undergraduate students at a Malaysia public university. In their study they studied the association between academic performance and sleep quality among the students.

The results showed that most of those with poor sleep quality had a first and second upper class CGPA of 13.7% and 24.0% ($p\geq0.05$), respectively, and there was a statistical difference between student performance in the class, such as falling asleep ($p\leq0.05$) and skipping class ($p\leq0.05$). (Nurismadiana et al. 2018)

Another research also studies the sleep pattern and academic performances but towards the undergraduate medical students in Universiti Kebangsaan Malaysia. Among 234 medical students, the study revealed that there was no significant difference in the CGPA score between respondent with sleep <6 hours and respondent with sleep 6-8 hours and between respondents with sleep 6-8 hours and respondent with sleep >8 hours. However, on the weekend, there was a significant difference in CGPA score between respondents with <6 hours and respondents with sleep 6-8 hours ($p=0.033$) and more than 8 hours

(p=0.028). However, there was no significant difference between respondent sleep 6-8 hours and more than 8 hours (p=0.871). (Harlina et al. 2014)

A cross sectional study was conducted among 801 undergraduate students of University of Benin in 2015 in order to measure the perception of students towards studying at night. This study was conducted by distributing a questionnaire containing 20 items which was developed to measure the perception of students towards studying at night. Respondents also indicated the number of courses passed and the number of courses in which they had 'B' grades and above. Relationship between academic performance and level of perception towards studying at night and the various methods used by students to stay awake at night was determined by the use of students' t-test, one-way ANOVA tests as appropriate. The final data shows about 65% of students had a favorable perception towards studying at night (Udezi & Iniaghe, 2015).

In another cross-sectional study that was conducted to find the relationship between early birds and their academic performance among the undergraduates of Liberal Arts College. The data used for this research was data from a selective liberal arts college that assigns students randomly to different sections of the same course. According to this study which was conducted among 115,610 undergraduates, it was found that early birds showed weak academic performance (Diette & Raghav, 2016)

Besides, a cross sectional study was conducted among 139 college students from the University Center Herminio Ometto to evaluate sleeping patterns and the academic performance of students. A questionnaire was used to gather personal information and professional evaluation of sleep-wake cycle. The Programmed System of Assessment (PSA) was used to assess academic performance. The PSA is a tool developed internally by the academic institution, consisting of six questions on current issues, six questions on interdisciplinary topics and twenty-eight questions specific to each course. As for academic performance, students in the daytime period had higher mean values when compared with the group at night (Andreoli & De Martino, 2012).

Furthermore, a cross-sectional study was conducted to identify the relationship between the timing of sleep and wakefulness and academic performance by performing a questionnaire-based survey of college students in October 2007. The survey instrument asked students about their sleep habits (bed time, wake time, nap frequency and length, week day versus weekend sleep) and how satisfied they were with their sleep. The survey tool further queried about daytime alertness versus grogginess and early-morning versus late-night tendency. School performance was measured by self-reported grade point average (GPA), and students were asked to report their usual amount of study time (hours per day). Students also answered demographic questions, recorded their employment time outside of school (hours per week), and use of stimulants (caffeinated drinks, energy drinks, caffeine pills, and prescription stimulants). According to the research which includes 170 respondents, students with the highest performance had significantly earlier wake times (p= 0.008) (Eliasson et al., 2009).

A cross-sectional study was conducted among 407 undergraduate students aged 18-26 to examine the relationship between quality of sleep and academic performance among undergraduate students in Sabah. The data were obtained through a questionnaire survey, where participants were required to provide demographic information, cumulative grade point average (CGPA) and select Sleep Quality Scale (SQS). Respondents in this study were randomly selected from different faculties at one of the public universities in Sabah using the Krejcie and Morgan (1970) method. The findings show that there is a positive relationship between the quality of sleep and academic performance among undergraduate students in Sabah (Rathakrishnan et al., 2021).

3. MATERIALS AND METHODS

3.1 STUDY LOCATION

The study location was medical students in University of Cyberjaya (UOC).

3.2 STUDY DESIGN

The study design was cross-sectional study as we are able to study the prevalence of sleeping patterns with academic performance.

3.3 SAMPLING POPULATION

Our study targeted medical students of the University of Cyberjaya (aged 19-35) in Malaysia.

3.4 SAMPLING UNIT

3.4.1 Inclusion criteria

- Medical students in University of Cyberjaya (UOC).
- Aged 19-30
- Both Malaysian and international students are involved

3.4.2 Exclusion criteria

- unwillingness to participate in the study
- Participants not meeting the inclusion criteria

3.5 SAMPLE SIZE

3.5.1 Target Population

The target population of our study were medical students aged 19 - 35 years old studying in University of Cyberjaya (UOC)

3.5.2 Sampling Frame

List of all medical students of University of Cyberjaya were received from the student council.

3.5.3 Sample Size

n= sample size
Z=confidence interval set to 95%
P=prevalence (0.816) (prevalence of night owl (Say, 2013)
d=precision set to 5%
n= ((1.96) ^2) (0.816) (1-0.816) / (0.05) ^2
n= 230
taking into consideration of 10% non-respondent, total sample size will be 253

3.5.4 Sampling Method

Convenience Sampling
The easiest way to reach the target population was through social media. Online questionnaires were distributed through whatsapp group, telegram group and also links on official instagram accounts.

ETHICAL APPROVAL

This study has been ethically approved by the Cyberjaya Research Ethics Committee, Faculty of Medicine, University of Cyberjaya (CRERC).

3.6 DATA COLLECTION AND STUDY TOOL

3.6.1 Data Collection

The data was collected using questionnaires given through google form and shared to medical students studying in UOC. Students participating in this survey need to answer the questions in the form. All participants remain anonymous, and no personal information was collected as part of this study. Only researchers, including students and lecturers, have access to the study data, which will be destroyed after five years.

3.6.2 Study Tools

In this study, the study instruments used are questionnaire and google form.

The google form consists of 3 sections:

1. Descriptions of our research and the terms and conditions of respondents and informed consent forms. The data collected are strictly confidential where the respondents are required to fill in only their initials.
2. In the Sociodemographic section of our google form, the respondents filled in their year of study, age range, gender and ethnicity. Respondents also filled in the average hour of sleep and any medication used to help to sleep. Academic performance will be based on CGPA. And to protect the confidentiality of the CGPA, participants' identities were hidden by using their initials as a method of identification in this study.

Morningness-Eveningness Questionnaire (MEQ) (refer to Appendix B) (Horne JA and Östberg O. 1976). This questionnaire is to determine whether the students are morning birds or night owls. Its main purpose is to measure whether a person's circadian rhythm (biological clock) produces peak alertness in the morning, in the evening, or in between. The original study showed that the subjective time of peak alertness correlates with the time of peak body temperature; morning types (early birds) have an earlier temperature peak than evening types (night owls), with intermediate types having temperature peaks between the morning and evening chronotype groups. (Jankowski KS, 2013) The standard MEQ consists of 19 multiple-choice questions, each having four or five response options. Responses to the questions are combined to form a composite score that indicates the degree to which the respondent favors morning versus evening. For the scoring, the score from all 19 questions will be added up. Scores can range from 16-86. Scores of 41 and below indicate “evening types”. Scores of 59 and above indicate “morning types”. Scores between 42 and 58 indicate “intermediate types”.

3.7 DATA ANALYSIS

Data from the questionnaire were cleaned and coded using Microsoft Excel and a data dictionary was designed. Afterwards, statistical analysis was conducted using JASP. Descriptive analysis of the data and Chi-square analysis were conducted to determine the relationship between sleep habits and academic performance. And a set of data were analyzed to determine whether sociodemographic factors have an influence in the sleep habits, hours of sleep and academic performance of the respondents.

4. RESULTS

TABLE 4.1 SOCIODEMOGRAPHIC FACTORS

Socio-Demographic factors		Population	
		Frequency	**Percentage (%)**
Gender	Male	103	40.7
	Female	150	59.3
Age	18- 20 years	30	11.9
	21 – 22 years	100	39.5
	23 – 24 years	86	34.0
	>25 years	37	14.6
Race	Malay	148	55.5
	Indian	61	29.3
	Chinese	39	13.1
	Others (Maldivian, Arab)	5	2.1

Sociodemographic Factors		Population	
		Frequency	**Percentage (%)**
Year Of Study	1st Year	26	10.3
	2nd Year	46	18.2
	Third Year	52	20.6
	Fourth Year	51	20.2
	Fifth Year	78	30.8
CGPA	0-0.99	0	0
	1.00-1.99	0	0
	2-2.99	79	31.2
	3-3.99	171	67.6
	4	3	1.2

TABLE 4.2 HOURS OF SLEEP

	Population	
	Frequency	Percentage

Hours of sleep	0-2 Hours	1	0.4
	2-4 Hours	15	5.9
	5-6 Hours	161	63.6
	7-8 hours	63	24.9
	8-10 hours	12	4.7
	>10 hours	1	0.4
		Frequency	Percentage
Are you taking any sleep medication?	Yes	3	1.2
	No	250	98.8

TABLE 4.3 MORNING-EVENINGNESS QUESTIONNAIRE

		Population	
		Frequency	Percentage
What time would you get up if you were entirely free to plan your day?	5:00 – 6:29 am	11	4.3
	6:30 – 7:44 am	23	9.1
	7:45 – 9:44 am	74	29.2
	9:45 – 10:59 am	74	29.2
	11:00 – 11:59 am	58	22.9
	Midday – 5:00 am	13	5.1
		Frequency	Percentage
What time would you go to bed if you were entirely free to plan your evening?	8:00 – 8:59 pm	3	1.2
	9:00 – 10:14 pm	31	12.3
	10:15 pm – 12:29 am	57	22.5
	12:30 – 1:44 am	112	44.3
	1:45 – 2:59 am	40	15.8
	3:00 am – 8:00 pm	10	4

		Population	
		Frequency	Percentage
If there is a specific time at which you have to get up in the morning, to what extent do you depend on being woken up by an alarm clock?	Not at all dependent	12	4.7
	Slightly dependent	80	31.6
	Fairly dependent	79	31.2
	Very dependent	82	32.4
		Frequency	Percentage
How easy do you find it to get up in the morning (when you are not woken up unexpectedly)?	Not at all easy	17	6.7
	Not very easy	106	41.9
	Fairly easy	110	43.5
	Very easy	20	7.9
		Frequency	Percentage
How alert do you feel during the first half hour after you wake up in the morning?	Not at all alert	9	3.6
	Slightly alert	94	37.2
	Fairly alert	125	49.4
	Very alert	25	9.9

		Population	
		Frequency	Percentage
How hungry do you feel during the first half-hour after you wake up in the morning?	Not at all hungry	41	16.2
	Slightly hungry	138	54.5
	Fairly hungry	51	20.2
	Very hungry	23	9.1
		Frequency	Percentage
	Not at all tired	16	6.3

During the first half-hour after you wake up in the morning, how tired do you feel?	Slightly tired	98	38.7
	Fairly refreshed	122	48.2
	Very refreshed	17	6.7
		Frequency	Percentage
If you have no commitment the next day, what time would you go to bed compared to your usual bedtime?	Seldom or never later	35	13.8
	Less than one hour later	47	18.6
	1-2 hours later	137	54.2
	More than two hours later	34	13.4

		Population	
		Frequency	Percentage
You have decided to engage in some physical exercise. A friend suggests that you do this for one hour twice a week and the best time for him/her is between 7:00 – 8:00 am. Bearing in mind nothing but your own internal "clock", how do you think you would perform?	Would be in good form	46	18.2
	Would be in reasonable form	114	45.1
	Would find it difficult	80	31.6
	Would find it very difficult	13	5.1
		Frequency	Percentage
At what time of day do you feel you become tired as a result of needing to sleep?	8:00 – 8:59 pm	11	4.3
	9:00 – 10:14 pm	39	15.4
	10:15 pm – 12:44 am	102	40.3
	12:45 – 1:59 am	86	34
	2:00 – 8:00 am	15	5.9

		Population	
		Frequency	Percentage
You want to be at your peak performance for a test that you know is going to be mentally exhausting and will last for two hours. You are entirely free to plan your day. Considering only your own internal "clock", which ONE of the four testing times would you choose?	6:00 – 10:59 am	76	30.0
	11:00 am – 2:59 pm	105	41.5
	3:00 – 6:59 pm	28	11.1
	7:00 – 11:59 pm	38	15.0
	12:00 – 5:59 am	6	2.4
		Frequency	Percentage
If you got into bed at 11:00 pm, how tired would you be?	Not at all tired	79	31.2
	A little tired	90	35.6
	Fairly tired	71	28.1
	Very tired	13	5.1

		Population	
		Frequency	Percentage
For some reason, you have gone to bed several hours later than usual, but there is no need to get up at any particular time the next morning. Which ONE of the following are you most likely to do?	Will wake up at usual time, but will NOT fall back asleep	38	15
	Will wake up at usual time and will doze thereafter	80	31.6
	Will wake up at usual time but will fall asleep again	74	29.2
	Will NOT wake up until later than usual	61	24.1
		Frequency	Percentage

One night you have to remain awake between 4:00 – 6:00 am in order to carry out a night watch. You have no commitments the next day. Which ONE of the alternatives suit you best?	Would NOT go to bed until watch was over	69	27.3
	Would take a nap before and sleep after	108	42.7
	Would take a good sleep before and nap after	65	25.7
	Would sleep only before watch	11	4.3

		Population	
		Frequency	Percentage
You have to do two hours of hard physical work. You are entirely free to plan your day and considering only your own internal "clock" which ONE of the following times would you choose?	6:00 – 10:59 am	41	16.2
	11:00 am – 3:59 pm	55	21.7
	4:00 – 8:59 pm	115	45.5
	9:00 pm –1:59 am	36	14.2
	2:00 am – 5:59 am	6	2.4
		Frequency	Percentage
You have decided to engage in hard physical exercise. A friend suggests that you do this for one hour twice a week and the best time for him/her is between 10:00 – 11:00 pm. Bearing in mind nothing else but your own internal "clock", how well do you think you would perform?	Would be in good form	67	26.5
	Would be in reasonable form	89	35.2
	Would find it difficult	80	31.6
	Would find it very difficult	17	6.7

		Population	
		Frequency	Percentage
Suppose that you can choose your school hours. Assume that you went to school for five hours per day and that school was interesting and enjoyable. Which five consecutive hours would you select?	5 hours starting between 3:00 – 8:00 am	9	3.6
	5 hours starting between 8:00 – 1:00 pm	148	58.5
	5 hours starting between 1:00 – 5:00 pm	46	18.2
	5 hours starting between 5:00 – 10:00 pm	44	17.4
	5 hours starting between 10:00 pm – 3:00 am	6	2.4

		Frequency	Percentage
At what time of the day do you think that you reach your "feeling best" peak?	5:00 – 7:59 am	8	3.2
	8:00 – 9:59 am	68	26.9
	10:00 am – 4:59 pm	98	38.7
	5:00 – 9:59 pm	35	13.8
	10:00 pm – 4:59 am	44	17.4

		Frequency	Percentage
One hears about "morning" and "evening" types of people. Which ONE of these types do you consider yourself to be?	Definitely a "morning" type	56	22.1
	Rather more a "morning" type than an "evening" type	88	34.8
	Rather more an "evening" type than a "morning" type	64	25.3
	Definitely an "evening" type	45	17.8

TABLE 4.4 SLEEP PATTERNS IN RELATION WITH SOCIODEMOGRAPHIC FACTORS

TABLE 4.4.1 Sleep patterns in different age groups

Sleep pattern	Age (years old)	Frequency	Percent n(%)
Morning type	18-20 years old	1	3.22 %
	21-22 years old	14	45.16 %
	23-24 years old	16	51.6 %
	>25 years old	0	0.00 %
Intermediate	18-20 years old	18	11.04 %
	21-22 years old	60	36.81 %
	23-24 years old	50	30.68 %
	>25 years old	35	21.47 %
Evening type	18-20 years old	11	18.64 %
	21-22 years old	26	44.07 %
	23-24 years old	20	33.90 %
	>25 years old	2	3.39 %

From Table 4.4.1, we can conclude that the highest density of sleep chronotype across all the age groups is the intermediate type with the highest number of respondents in each age category.

Another important finding is the higher prevalence of evening type rather than morning type amongst these medical students.

TABLE 4.4.2 SLEEP PATTERN OF DIFFERENT ETHNICITIES

Sleep pattern	Ethnicity	Frequency	Percent n(%)
Morning type	Malay	16	51.6 %
	Chinese	2	6.45 %
	Indian	13	41.94 %
	Others	0	0.00%
Intermediate	Malay	102	62.58 %
	Chinese	27	16.56%

	Indian	32	19.63%
	Others	2	1.23%
Evening type	Malay	30	50.85 %
	Chinese	10	16.95%
	Indian	16	27.12 %
	Others	3	5.09 %

With the data from Table 4.4.2, all ethnicities are predominantly the intermediate type. However, there are 163 participants out of the 253 that are listed as the intermediate chronotype with "Malay" being the highest density.

TABLE 4.4.3 SLEEP PATTERN OF DIFFERENT GENDER GROUP

Sleep pattern	**Ethnicity**	**Frequency**	**Percent n(%)**
Morning type	Male	13	41.94 %
	Female	18	58.07 %
Intermediate	Male	69	42.33%
	Female	94	57.67 %
Evening type	Male	21	35.60%
	Female	38	64.41 %

The result from Table 4.4.3 shows that both male and female are predominantly an intermediate chronotype with 67% of the male respondent being the intermediate chronotype and 63% of the female respondent also being the intermediate chronotype. However the evening type is more prevalent than the morning type for both gender groups.

TABLE 4.5 HOURS OF SLEEP AMONG MEDICAL STUDENTS IN UNIVERSITY OF CYBERJAYA (UOC)

Hours of of sleep	**Frequency**	**Percentage (%)**
0-2 Hours	1	0.36 %
2-4 Hours	15	5.43 %
5-6 Hours	161	58.33 %

7-8 Hours	63	24.90 %
8-10 Hours	12	4.35 %
More than 10 Hours	1	0.36 %

This data suggests that the majority of people (58.33%) are getting 5-6 hours of sleep, followed by 7-8 hours (24.90%), and then 2-4 hours (5.43%). Very few people seem to be getting less than 2 hours or more than 10 hours of sleep according to this data.

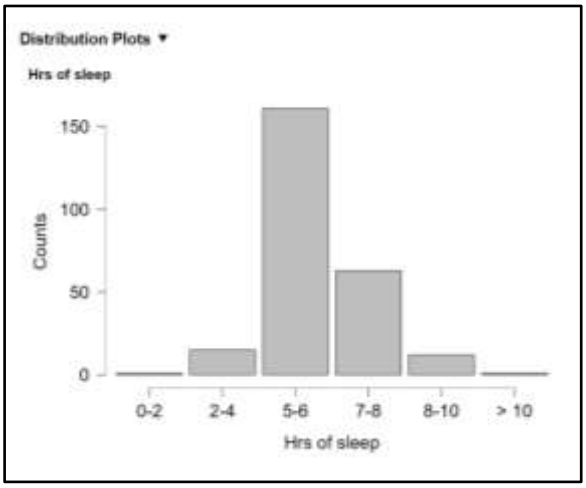

Fig 4.5.1 Distribution plot for hours of sleep amongst medical students in UOC

TABLE 4.6 FOR THE ASSOCIATION BETWEEN SLEEP PATTERN AND ACADEMIC PERFORMANCE

Variable						
Time Spent	**CGPA (last semester) (%)**			**Total**	**X^2 (df)**	**P value**
	2-2.99	3-3.99	4.00			
Morning Type	1 (3.22%)	30 (96.78%)	0 (0%)	31	47.73 (4)	<0.001
Intermediate type	41 (25.15%)	119 (73%)	3 (1.84%)	163		
Evening Type	37 (62.72%)	22 (37.28%)	0 (0%)	59		

The chi-square analysis shown in Table 4.6 indicates that there is a correlation between sleep patterns and academic performance with a p-value of (<0.001) with a chi-square value of (47.73) and a degree of freedom (df) of 4.

TABLE 4.7 CORRELATION BETWEEN AMOUNT OF SLEEP AND ACADEMIC PERFORMANCE

Variable				**Total**	**X^2 (df)**	**P value**
Hrs. of Sleep (hrs)	***GPA (last semester)* n(%)**					
	2-2.99	3 - 3.99	3.01 - 4			
0-2 hours	0 (0%)	1 (100%)	0	1	17.67 (10)	0.061
2 - 4 Hours	4 (26.7%)	11 (73.3%)	0 (0%)	15		
5 - 6 Hours	42 (26.1%)	118 (73.3)	1 (0.62%)	161		
7 - 8 Hours	30 (47.6%)	31 (49.2%)	2 (3.18%)	63		
8 - 10 Hours	2 (16.7%)	10 (83.3%)	0 (0%)	12		
More than 10 Hours	1 (100%)	0 (0%)	0 (0%)	1		

The result shows that hours of sleep have no correlation with academic performance based on the p-value of 0.061 (>0.05) which accepts the null hypothesis.

5. DISCUSSION

Age-related sleep chronotype prevalence was most dominant in the “intermediate type” respondents, comprising 163 respondents (64.42%), followed by “evening type” with 59 respondents (23.3%), and “morning type” with 31 respondents (12.25%). As a result, it can be concluded that the “intermediate type” respondents have the most sleep chronotype in all age groups, with the highest number of respondents in each age category.

During adolescence, there is a general shift towards eveningness, which peaks in late adolescence and early maturity. Even so, this shift was not experienced by all individuals in the same way. There is a significant number of university students who are still considered intermediate types (Roenneberg et al. 2007). A significant percentage of intermediate types, along with the more commonly discussed morning and evening types, were found in the distribution of chronotypes in adolescents and young adults, as found by Roenneberg et al. (2007). Sleep quality is often better for intermediate types compared to evening types, who are more susceptible to sleep disturbances and irregular sleep patterns (Tankova et al. 1994). According to research carried out by Tankova et al. in 1994, intermediate types generally have higher levels of sleep quality, with fewer complaints of insomnia and sleep disruptions than evening types. Their ability to adjust their sleep schedules leads to more restorative sleep.

163 out of 253 respondents were from the 'intermediate type' ethnicity, with Malay being the most prevalent at 62.58%. Malay respondents were the most frequent respondents in all three chronotypes, and 16.56% of Chinese respondents tend to fall under the 'intermediate type'. Whereas Indian ethnicity accounts for 27.12% of evening types.

In a study conducted by Lourenção Duarte et al. in 2021 , out of 253 respondents, 163 (64.3%) were identified as having an intermediate chronotype. Malay students made up the majority of intermediate types, accounting for 62.58% of them. The average number of intermediate chronotypes was 16.56% for Chinese students, while Indian students were less likely to be intermediate types, with 27.12% being evening types. The likelihood of being an intermediate type within different ethnic groups may be affected by cultural and genetic factors, according to these findings. The high frequency of intermediate types among Malay students may be due to specific cultural practices or genetic predispositions that favor balanced sleep-wake patterns (Lourenção Duarte et al. 2021).

In relation to gender, both male and female were predominantly an intermediate chronotype with 67% of the male respondent being the intermediate chronotype and 63% of the female respondent also being the intermediate chronotype. However, the evening type was more prevalent than the morning type for both gender groups.

The prevalence of intermediate-type sleep patterns may differ between males and females due to biological and sociocultural factors, despite both genders exhibiting intermediate-type sleep patterns (Randler, 2007; Adan & Natale, 2002). In a large-scale survey conducted by Merikanto et al. in 2013, it was found that females were more likely to identify as morning types, while males were more likely to identify as evening types. Also, despite having similar sleep durations, females were more likely to report poor sleep quality and daytime dysfunction than males, according to meta-analysis conducted by Zhang et al. in 2015.

Based on the results of our study, the majority of students (n = 163 (64.4%)} could be categorized as intermediate type, whereas about two-fifths (n = 90 (35.6%)} of the individuals belonged to the two extreme chronotypes which are morning and evening type. These results are consistent with earlier research. In their review, Adan A et al. (2012) found that the majority of people are of intermediate type, with roughly 40% of people falling into one of the two extreme chronotypes.

Furthermore, Montaruli A et al. discovered that for both the male and female subgroups, intermediate type was the most prevalent chronotype (65.5%), followed by evening type (24.3%) and morning type (10.2%). Similar findings were also reported by Adan A et al. 2002, where 67% of medical students were categorized as intermediate, followed by 23.8% as morning and 9.2 % as evening type. On the contrary, Arifuddin MK et al. found very higher prevalence of eveningness preference (47%) and only 9% were intermediate type. In addition, more recent studies found that university students increasingly report morningness preferences (Drezno et al., 2019; Hasan et al., 2022; Sharma & Kaushik, 2023).

The analysis of sleep duration among medical students at the University of Cyberjaya reveals significant insights into their sleep habits and potential impacts on their academic and personal lives. The majority of students (58.33%) report getting between 5-6 hours of sleep per night. This is followed by 24.90% of students who sleep for 7-8 hours, and 5.43% who sleep for 2-4 hours. Only a very small fraction of students get less than 2 hours or more than 10 hours of sleep.

***Sleep Deprivation*:**

With over half of the students sleeping only 5-6 hours per night, it is evident that a substantial portion of the student body may be experiencing chronic sleep deprivation. This amount of sleep is below the recommended 7-9 hours for young adults, potentially leading to negative consequences on cognitive function, mood, and overall health. Previous studies have shown that insufficient sleep can impair academic performance, decrease alertness, and reduce cognitive functions (Hershner & Chervin, 2014).

***Optimal Sleep*:**
About a quarter of the students (24.90%) are getting 7-8 hours of sleep, which falls within the optimal range. This group is likely to experience better concentration, memory retention, and overall well-being, positively impacting their academic performance and daily activities. Research indicates that students who maintain 7-8 hours of sleep tend to have higher GPAs and better mental health (BaHammam et al. 2014).

***Extreme Sleep Patterns*:**
The small percentages of students sleeping less than 2 hours or more than 10 hours indicate extreme sleep patterns that could be due to a variety of factors such as severe stress, mental health issues, or atypical schedules. Both ends of this spectrum can have detrimental effects. Insufficient sleep can lead to burnout and health problems, while excessive sleep might indicate underlying health issues or poor sleep quality. Eliasson et al. (2009) found that students with extreme sleep patterns often have irregular sleep schedules and lower academic performance.

Academic and Lifestyle Considerations
The demanding nature of medical education often leads to compromised sleep, as students juggle rigorous coursework, clinical duties, and personal commitments. The prevalent 5-6 hours of sleep among the majority of students reflects the high pressures and time constraints they face. This suboptimal sleep duration may impair their learning efficiency, clinical decision-making, and overall academic performance. A study by Cardoso et al. (2009) supports this, highlighting that medical students are at a higher risk for poor sleep quality due to their demanding schedules.
In conclusion, while a significant portion of UOC medical students are not getting the recommended amount of sleep, targeted interventions and support can help improve their sleep habits, leading to better academic outcomes and enhanced quality of life. This aligns with findings from Rathakrishnan et al. (2021), which emphasize the positive relationship between quality sleep and academic performance among undergraduate students.
In this study, there were 31 respondents who are categorized as “morning type”. Among these 31 “morning type” respondents, 96.78% managed to achieve a range of 3-3.99 for their GPA whereas only a small proportion obtained a GPA of 2-2.99 which is 3.22%. On the other hand, the study also revealed that none of the ‘morning type’ respondents accomplished a 4.00 GPA for their previous semester’s examination.
Next, a total of 163 respondents were characterized as “intermediate type”. The intermediate type has 3 respondents (1.84%) who got 4.00 for their GPA which is the only sleep habit group that achieved the highest number compared to the other two groups. 73% of the respondents obtained a GPA of between 3-3.99 while another 25.15% respondents got 2-2.99 for the last semester’s GPA.
As for “Evening Type” with a total of 59 respondents, 62.72% of respondents got a GPA of 2-2.99 while another 37.28% achieved 3-3.99 for their GPA. None of the “evening type” respondents are able to achieve a GPA of 4.00.
Morning types’ sleep habits are perfectly aligned with daily learning schedules which helps them to have a fixed study routine and be fully productive and longer attention span in classes (Randler & Frech, 2009). Research has shown that these individuals’ capabilities to begin their day early in the morning and spend it by doing academic-related work tend to achieve good academic performance (Escribano et al. 2012). Moreover, morning chronotype students face fewer issues regarding sleep deprivation which is prevalent among evening chronotype students. Hence leading towards the enhancement of cognitive development

along with academic achievements (Beşoluk et al. 2011). Furthermore, morning types are also most likely to have good self-regulation and acquire the skills of organizing their times in a wise and effective manner. These will then contribute to the improvement of their academic achievement (Digdon & Howell, 2008). This justifies how 96.78% of the morning types respondents achieved GPA between 3-3.99.

Many studies have concentrated solely on the two common chronotypes; morning and evening, there is also the intermediate type with flexible sleep schedule that gains accumulated interest in exploring its effects on various aspects such as academic performance (Jankowski, 2017). Randler (2013) believes that individuals who belong to the intermediate chronotypes might have advantages in adapting and handling intense schedules, especially those experienced by medical students. This is supported by Preckel (2011) where they propose that people with this type of sleep habit group have maintained balanced cognitive activities throughout the particular day which lead them to be consistent academically. In addition, according to Natale and Cicogna (2002), the intermediate chronotype also faces fewer sleeping issues and has better sleeping quality compared to the morning and evening types.

These factors are often linked with academic performance in a positive manner. Thus, these justify how 119 and 3 of the intermediate type respondents managed to achieve 3-3.99 and 4.00 for their GPA respectively.

On the other hand, evening chronotypes tend to undergo problems adjusting their sleep schedule with social cycle which causes problems called "social jetlag" (Wittmann et al. 2006). According to Gau (2004), poor sleep quality, low cognitive function and bad academic performance are closely related to the misaligned sleep schedule of evening type people. Research also has demonstrated that individuals with evening chronotypes are prone towards achieving lower GPA compared to morning chronotypes because of their inability to stay focused in morning classes, when academic classes are commonly conducted (Escribano et al. 2012). The issues of sleep deprivation as well as irregular sleeping routines may be experienced by the evening-oriented individuals which could negatively impact their academic performance (Hershner & Chervin, 2014). Thus, these justify how most of the evening type respondents (62.72%) achieved low GPAs of only 2-.299.

6. CONCLUSION, LIMITATION AND RECOMMENDATION

Conclusion

In conclusion, the findings of this research underscore the significant relationship between sleep patterns and academic performance. While the study reveals a clear association between various aspects of sleep patterns and academic success, such as sleep quality and consistency, it notably challenges the commonly assumed correlation between the number of hours slept and academic performance.

These results suggest that factors beyond mere duration, such as sleep quality, bedtime consistency, and perhaps even individual differences in circadian rhythms, play pivotal roles in determining how effectively sleep influences academic outcomes.

As teachers and policymakers work to improve student performance, it's crucial to fully grasp how different aspects of sleep affect thinking. Further research should explore these connections in more detail. This could help create specific plans and actions to improve both sleep habits and academic success for students.

Limitation

Time constraint: due to the limited amount of time to conduct the study, the study is narrowed down into

limited variables and decreasing the scope of study.

Sample of interest: Due to the time constraint, convenience sampling is done and although the sample size is statistically adequate, it may not be representative of the broader medical student population. The study may lack diversity limiting the generalizability of the findings.

Study design: The cross-section nature of the study captures the data within a specific time frame and does not account for changes in the variables over time.

Information bias: Our research relied on self-reported measures of sleep patterns and academic performance, which were susceptible to recall bias and inaccuracy.

Correlational effects: The relationship between sleep chronotype and academic performance has been observed, but other factors may also play a role in mediating or confounding the relationship.

Confounding factors : Socioeconomic status, stress levels, sleep quality, and sleep hygiene influenced both sleep patterns and academic performance. These variables posed a challenge and may not always be within reach.

Recommendation

Include Objective Measures: We can include additional data points for comparison. Validation can be obtained through objective measures, such as academic records as evidence.

Contextual Factors: A deeper understanding of how environmental factors impact sleep patterns and academic success can be gained by taking into account contextual factors like school schedules, workload, and extracurricular activities.

Comprehensive Assessments: We could conduct in-depth assessments that assess sleep quality and hygiene to gain a deeper understanding of the link between sleep and academic performance.

Promote Sleep Education: Raise awareness about the importance of adequate sleep and its impact on health and academic performance. Implement workshops and seminars to educate students on effective sleep hygiene practices.

Enhance Mental Health Support: Provide robust mental health support services to help students manage stress and anxiety, which are common contributors to sleep disturbances. Counseling services, stress management workshops, and mindfulness programs can be beneficial.

Encourage a Holistic Approach to Health: Promote a holistic approach to health, including regular physical activity, a balanced diet, and mindfulness practices. These can support better sleep quality and overall well-being.

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