Caffeine Consumption, Sleep Quality and Mental Health Outcomes Among Malaysian University Students

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A B S T R A C T

Background: Recognizing the scarcity of data on caffeine consumption among university students in Malaysia, this study was designed to first characterize the habitual caffeine intake within this group. This study further investigated the potential association between these caffeine consumption patterns and sleep quality and mental health status.

Methodology: The study employed an online self-administered questionnaire to assess habitual caffeine intake from various products. Sleep quality and mental health were evaluated using the Pittsburgh Sleep Quality Index (PSQI) and the Depression, Anxiety, and Stress Scale-21 (DASS-21), respectively.

Results: 78% of the respondents consumed caffeinated products daily within the safe level recommended by the European Food Safety Authority (≤400mg/day). Only 2.6% of the students consumed caffeine exceeding the recommended limit. The median total daily caffeine intake was 100mg/day. Most students had poor sleep quality (77.3%), with 43.5%, 49.5%, and 33.0% reporting varying levels of depression, anxiety, and stress, respectively. Odds ratio calculations revealed respondents consuming less than or more than 400 mg/day of caffeine did not show significantly different odds of poor sleep quality, depression, anxiety, or stress compared to non-consumers.

Conclusions: This study highlights the need for further localized research on caffeine's effects among Malaysian university students regarding caffeine consumption, sleep, and mental health.

Key-words: Caffeine overdose, depression, anxiety, university students, south-east Asia

A R T I C L E   I N F O

INTRODUCTION

Caffeine (1,3,7-trimethylxanthine), a widely consumed psychoactive substance found in various foods, beverages, and drugs, has garnered attention due to its potential positive and negative effects on performance and well-being.[1,2] In particular, university students represent a vulnerable population, often experiencing poor sleep quality and mental health issues, both of which can be affected by caffeine consumption.[3,4] Yet, the research landscape remains relatively uncharted when it comes to understanding habitual caffeine consumption among Malaysian university students and its implications for sleep quality and mental health in this group.[5,6,7]

Unveiling the current patterns of caffeine consumption, sleep quality, and mental health among Malaysian university students is a critical undertaking to bridge these knowledge gaps.[8-13] Furthermore, the relationship between caffeine intake and its impact on sleep quality and mental health remains underexplored in this specific population.[14-18]

Consequently, this study aims to address these gaps by determining the habitual consumption of caffeinated products among Malaysian university students, evaluating sleep quality and mental health status, and investigating the potential association between caffeine consumption, sleep quality, and mental health in this population. By addressing these objectives, this research will contribute to a more comprehensive understanding of the role caffeine plays in the lives of university students in Malaysia, ultimately informing tailored recommendations and interventions to promote well-being and academic success.

METHODOLOGY

Research design: This cross-sectional study employed an online platform, specifically a Google Form, to gather data from university students across Malaysia. A comprehensive list of public universities in the country was acquired from the Ministry of Higher Education and subsequently categorized into six zones: north (Perlis, Kedah, Penang, Perak), east (Kelantan, Terengganu, Pahang), central (Selangor, Federal Territories of Kuala Lumpur, and Putrajaya), southern (Negeri Sembilan, Melaka, and Johor), and one state from either Sarawak or Sabah. Sample size determination utilized Cochran's formula[19], incorporating a 95% confidence interval, 5% margin of error, and an expected proportion of 65.3% of university students with a high caffeine intake exceeding the daily safe consumption level[20], accounting for a 20% dropout rate.[21] A total of 418 respondents completed the survey. Inclusion criteria comprised Malaysian citizenship, being aged 18 years or older, and currently pursuing tertiary education at one of the selected Malaysian public universities.

Research instrument: A self-administered questionnaire consists of four sections as follow:

Section A - socio-demographic data, i.e. gender, age, year of study, ethnicity, household income, marital status, Cumulative Grade Point Average (CGPA) and sponsorship of study;

Section B - modified caffeine intake (MCI) questionnaire[22]

Section C – Pittsburgh Sleep Quality Index (PSQI) that measured sleep quality[23]

Section D - Depression, Anxiety and Stress 21 Scale (DASS-21).

Caffeine intake was estimated using MCI. Daily caffeine intake was calculated from total coffee consumption per day (125 mg/cup), total tea consumption per day (50 mg/cup), caffeinated beverage taken per day (32 mg/can) and total consumption of energy drink per day (50 mg/can). Caffeine consumption questionnaire gave good reliability based on Kappa coefficient of 0.84 to 0.94.[22] Total amount of caffeine taken per day were calculated and the respondent were classified as having caffeine intake meet or exceed the daily safe levels for caffeine consumption (400 mg/day or greater than 400 mg/day).[24]

Sleep quality was determined using Pittsburgh Sleep Quality Index (PSQI). Pittsburgh Sleep Quality Index (PSQI) is a useful tool for the assessment of subjective sleep quality in non-clinical and clinical settings.[25] Evidently, PSQI has good psychometric properties (good reliability and validity) and is consistent with previous research.[26,27] The Malay version of PSQI was translated by MAPI Research Trust which gave a good reliability based on Kappa Coefficient of 0.79 to 0.94. Pittsburgh Sleep Quality Index (PSQI) measures the quality of sleep over the previous four weeks and includes 19 self-rated questions within seven components as follow: 1) subjective sleep quality 2) sleep latency 3) sleep duration 4) sleep efficiency 5) sleep disturbance 6) use of sleep medication 7) daytime dysfunction. Each component contains a score from 0 to 3, which resulting a total PSQI score of 21. A PSQI <5 and PSQI ≥5 was considered as "Good SQ" and "Poor SQ", respectively.[23]

Negative emotional states of depression, anxiety, and stress was determined using Depression, Anxiety and Stress 21 Scale (DASS-21).[28] Internal consistency reliability for subscale scores has been reported to be high in both clinical and nonclinical samples, with alpha coefficients ranging from $\alpha = .82$ to $.97$.[28] This instrument has been widely accepted around the world as a reliable, easy-to-use, and simple-to-administer screening instrument for the general population that does not require any special training.[28] DASS-21 has also been translated into a number of languages and validated in a variety of populations, including Malaysians.[29] The questionnaire consists of three self-reported scales used to assess the negative emotional states of depression, anxiety and stress. Each scale has seven items, each of which is

scored on a four-point Likert scale. The depression scale assesses dysphoria, hopelessness, self-deprecation, and boredom. The anxiety scale measures autonomic arousal and the effect of skeletal muscles. The stress scale rates the difficulty of relaxing, nervous arousal, and being easily agitated.[30] Subjects were asked to rate the severity of various symptoms they had experienced over the previous week.[31]

Data collection: Data collection occurred between July and October 2021, enrolling respondents who met the specified criteria. Incomplete questionnaires and those submitted by non-Malaysian citizens were excluded from the study. Survey invitations were disseminated through the official social media accounts of each selected university. Additionally, questionnaire links in both Malay and English, formatted as Google Forms, were forwarded to student representatives from the selected universities via WhatsApp® and Telegram® messaging platforms. To ensure the integrity of our data by preventing duplicate responses, we employed a multi-faceted approach during the survey administration process. Each potential participant was provided with a unique access link that became inactive after the survey was completed and submitted. This was achieved through a token system, which generated individualized access codes that were invalidated upon the completion of the survey. Furthermore, we monitored IP addresses to identify and prevent multiple submissions from the same source. We also required all participants to authenticate themselves via a secure login process. This necessitated the use of institutional or personal accounts for verification purposes. Through this login process, we were able to confirm the identities of our respondents while maintaining their anonymity. These measures ensured that each participant could only submit the survey once, thereby preserving the singularity of the data. Completed questionnaires were securely stored in the investigator's Google Drive. Participation in the survey was entirely voluntary, with student consent obtained before initiating the survey process. Participants were assured of the confidentiality of their responses. Ethical approval for this study was granted by the Human Ethics Board of Committees of Universiti Malaysia Terengganu (UMT/JKEPM/2021/72, dated 20th September 2021).

Data analysis: Data are present as percentage and median (IQR). Data analyses were done using SPSS version 25 (IBM, Illinois Chicago). A normality test was used to check data distribution prior to data analysis. The demographic data, total daily caffeine intake, frequency of caffeinated product consumption, sleep quality and mental health status were analysed using descriptive analysis. Chi square test was used to determine the association between habitual caffeine intake, sleep quality and mental health status. A p-value less than 0.05 was considered significant.

RESULTS

Table 1 shows sociodemographic characteristics of the subjects.

Table 1: Sociodemographic characteristics, daily caffeine intake, and sleep quality of respondents (n=418)

Demographic characteristics	Respondent (%)
Gender	
Male	70 (16.7)
Female	348 (83.3)
Age	
18 – 20 years	72 (17.2)
21 – 23 years	327 (78.2)
24 – 26 years	18 (4.3)
27 and above	1 (0.2)
Ethnicity	
Malay	348 (83.3)
Chinese	42 (10)
Indian	23 (5.5)
Others	5 (1.2)
Marital status	
Single	417 (99.8)
Married	1 (0.2)
Year of study	
Year 1	74 (17.7)
Year 2	166 (39.7)
Year 3	139 (33.3)
Year 4	39 (9.3)
CGPA[a]	
3.50 – 4.00	225 (53.8)
3.00 – 3.49	160 (38.3)
2.50 – 2.99	20 (4.8)
2.00 – 2.49	5 (1.2)
<2.00	8 (1.9)
Study Sponsors	
Self-sponsored	77 (18.4)
JPA[b]	52 (12.4)
PTPTN[c]	258 (61.7)
Others	31 (7.4)
Part-time job	
Yes	39 (9.3)
No	379 (90.7)
Household family income[d]	
Less than RM 4,850	301 (72)
RM 4,850 – RM 10, 959	93 (22.2)
More than RM 10,960	24 (5.7)
Total daily caffeine intake (mg)	100 ± 125 (m±sd)
Categorization of daily caffeine intake	
0 mg/day[e]	93 (22.2)
≤ 400mg/day	314 (75.1)
> 400mg/day	11 (2.6)
Sleep quality	
Good[f]	95 (22.7)[h]
Poor[g]	323 (77.3)[i]

[a]CGPA = Cumulative Grade Point Average
[b]JPA = *Jabatan Pekhidmatan Awam*
[c]PTPTN -*Pinjaman Perbadanan Tabung Pendidikan Tinggi Nasional*
[d]Monthly family income is based on data from the Malaysian Department of Statistics (2020), and it is divided into three categories = Bottom 40 (less than RM4,850), Middle 40 (RM4,850 – RM10,959), and Top 20 (More than RM10,960); 1 USD = 4.80 RM
[e]0 mg indicated that respondents did not consume any caffeinated product listed on the questionnaires per day.
[f]Global PSQI score for good sleep quality: minimum=0, maximum=4 (mean ± SD for Good SQ was 3.32 ± 0.48)
[g]Global PSQI score for poor sleep quality: minimum=5, maximum=15 (mean ± SD for Good SQ was 7.68 ± 2.48)

Based on the findings presented, majority of participants were female, within the 21-23 age range, and predominantly Malay. Most respondents were single, had a CGPA between 3.5 and 4.0, and were sponsored by the National Higher Education Fund Corporation (PTPTN - *Pinjaman Perbadanan Tabung Pendidikan Tinggi Nasional*). A considerable percentage of participants did not have part-time jobs while studying, and a majority belonged to the B40 income category (the Bottom 40% of the Malaysian household income). These findings provide insight into the demographic characteristics of the study population, which can be useful in understanding and interpreting the results of the research. Additionally, the information can help inform future studies targeting similar populations or addressing related research questions. Median of total daily caffeine intake among respondents was 100 mg/day. Majority of respondents consumed less than or equal to 400 mg of caffeine per day (75.1%). Majority of respondents showed poor sleep quality with 77.3% while 22.7% showed good sleep quality. The results indicates that,

there is a high prevalence of poor sleep quality among Malaysian university students as majority of them experienced poor sleep quality.

Daily caffeine intake of university students

Table 2 shows individual beverage and caffeine intake. Majority of students consumed at least one type of caffeinated products on a daily basis (i.e. tea). Most of the respondents were non-coffee drinker (59.6%). Almost half (42.6%) of the respondents consumed 1 cup of tea a day. Apart from that 90.0% of the respondents were non-energy and 77.8% were non-carbonated drinkers.

Mental health status of university students

The data in Table 3 indicates that more than half of the Malaysian university students surveyed report a normal mental health status, with no indications of depression (56.5%), anxiety (50.5%), or stress (67.0%). However, a not insignificant portion exhibit mild symptoms, including 14.4% for depression, 6.9% for anxiety, and 8.9% for stress.

Table 2: Frequency of daily beverage and caffeine intake (n=418)

Frequency of caffeine intake	0 time a day (%)	1 time/day (%)	2 times/day (%)	3 times/day (%)	4 time/day (%)
Coffee	249 (59.6)	132 (31.6)	25 (6.0)	11 (2.6)	1 (0.2)
Tea	163 (39.0)	178 (42.6)	61 (14.6)	11 (2.6)	5 (1.2)
Energy drinks	376 (90.0)	39 (9.3)	3 (0.7)	0 (0.0)	0 (0.0)
Carbonated drinks	325 (77.8)	79 (18.9)	9 (2.2)	5 (1.2)	0 (0.0)

Table 3: Prevalence of depression, anxiety and stress (n=418)

DASS Component	Normal (%)	Mild (%)	Moderate (%)	Severe (%)	Extremely severe (%)	Score (Mean ± SD)
Depression	236 (56.5)	60 (14.4)	56 (13.4)	18 (4.3)	48 (11.5)	10.48 ± 10.74[a]
Anxiety	211 (50.5)	29 (6.9)	77 (18.4)	30 (7.2)	71 (17.0)	10.07± 9.90[b]
Stress	280 (67.0)	37 (8.9)	31 (7.4)	41 (9.8)	29 (6.9)	12.80 ± 10.81[c]

[a]Total score for depression: minimum=0, maximum=42, higher score (more than 9) indicates depressed.

[b]Total score for anxiety: minimum=0, maximum=42, higher score (more than 7) indicates anxiety.

[c]Total score for stress: minimum=0, maximum=42, higher score (more than 14) indicates stressed.

Table 4: Association of daily caffeine intake with sleep quality and mental health status (n=418)

Coffee consumption	Sleep quality		Odds Ratio	95% Confidence Interval	P value
	Poor (%)	Good (%)			
0 mg/day	66 (15.8)	27 (6.5)	Ref		
<400 mg/day	247 (59.1)	67 (16.0)	0.244	0.03 – 2.004	0.189
>400 mg/day	10 (2.4)	1 (0.2)	0.376	0.047 – 2.988	0.355
	Depression				
	No (%)	Yes (%)			
0 mg/day	55 (13.2)	38 (9.1)	Ref		
<400 mg/day	172 (41.1)	142 (34)	1.195	0.747 – 1.911	0.457
>400 mg/day	9 (2.2)	2 (0.5)	0.322	0.066 – 1.572	0.161
	Anxiety				
	No (%)	Yes (%)			
0 mg/day	53 (12.7)	40 (9.6)	Ref		
<400 mg/day	153 (36.6)	161 (38.5)	1.394	0.875 – 2.223	0.162
>400 mg/day	7 (1.7)	4 (1)	0.757	0.207 – 2.765	0.674
	Stress				
	No (%)	Yes (%)			
0 mg/day	87 (20.8)	6(1.4)	Ref		
<400 mg/day	277 (66.3)	37 (8.9)	1.937	0.791 – 4.743	0.457
>400 mg/day	10 (2.4)	1 (1.2)	1.450	0.066 – 1.572	0.161

More concerningly, a combined total of 29.2% experience moderate to extremely severe depression, 42.6% face similar levels of anxiety, and 24.1% encounter comparable stress intensities. These findings suggest a substantial prevalence of mental health challenges, as nearly one-half of the participants are affected by mild to extremely severe symptoms of stress, anxiety, and depression.

Association between daily caffeine intake, sleep quality and mental health status among university students

Table 4 presents the results of chi-square tests examining the associations between daily caffeine intake and sleep quality, as well as the associations between daily caffeine intake and mental health status. The analysis revealed those who consumed less than 400 mg/day of caffeine had 0.244 times the odds of reporting poor sleep quality compared to non-consumers, but this was not statistically significant (p-value 0.189). Those who consumed more than 400 mg/day had 0.376 times the odds, which also was not statistically significant (p-value 0.355). Respondent's consuming less than 400 mg/day had 1.195 times the odds of being depressed compared to non-consumers, not statistically significant (p-value 0.457). Those consuming more than 400 mg/day had lower odds of depression (OR 0.322), but again, this was not statistically significant (p-value 0.161). For those with caffeine intake less than 400 mg/day, the OR was 1.394, indicating a higher odd of anxiety, which was not statistically significant (p-value 0.162). For those above 400 mg/day, the OR was 0.757, suggesting a lower odd of anxiety compared to non-consumers, not statistically significant (p-value 0.674). Those who consumed less than 400 mg/day had 1.937 times the odds of being stressed, not statistically significant (p-value 0.457). Respondents consuming more than 400 mg/day had an OR of 1.450, which was not statistically significant (p-value 0.161). None of the ORs are statistically significant, as indicated by p-values greater than 0.05. This means there is no strong evidence to suggest that the observed differences in mental health outcomes are due to caffeine consumption rather than chance. The confidence intervals (CIs) for all ORs include 1, which further suggests that the association could be due to chance. Based on these results, the study does not provide evidence to support a clear association between the levels of caffeine intake examined and sleep quality, depression, anxiety, or stress among the respondents.

DISCUSSION

The participant demographics in this study were predominantly characterized by female students, the majority of whom identified as Malay. In addition, most participants were single, reflecting the transformative nature of university life as a period marked by substantial personal growth, self-discovery, exploration, and independence.[32] The data also highlighted a considerable portion of students belonging to the Bottom 40 Percent (B40) socioeconomic group, with the majority relying on PTPTN funding to support their academic pursuits. This investigation revealed that tea emerged as the predominant caffeinated beverage consumed by participants, with coffee, carbonated beverages, and energy drinks following suit. This observation echoes previous findings that indicated a majority of medical students at Melaka Manipal Medical College similarly favoured caffeinated beverages.[6] Among these, tea was the primary choice, consumed by 70.9% of participants, while coffee accounted for 68.5%, and soft drinks or energy drinks made up 43.3%. This preference can be attributed to Malaysia's unique position as both a tea-producing nation and a country with deep cultural ties to tea consumption.[33] In Malaysia, the custom of serving tea spans the entire day, accompanying breakfast, morning and afternoon tea breaks, lunch, dinner, and supper (Liew, 2019).

The current study demonstrates that a significant proportion of students (78.0%) consumed a minimum of one caffeinated product daily, a finding consistent with previous research.[34,35] This outcome can be attributed to the easy accessibility of caffeinated products for students.[36] Moreover, the results indicate that the consumption of caffeinated products derived from carbonated and energy drinks was less prevalent among Malaysian university students, with respective rates of 22.2% and 10.0%. Conversely, energy drink consumption containing caffeine is a widespread practice among college students in the United States (Mwape & Mulenga, 2019). Approximately 39–80% of undergraduate students in the US have reported consuming at least one energy drink in the past.[37] This discrepancy may be linked to the prevalent custom of consuming energy drinks in combination with alcohol in Western countries.

An essential finding of this study revealed a median daily caffeine consumption of 100 mg/day among respondents. This figure is notably higher than the 67.98 mg/day median caffeine consumption reported in a study involving medical students.[34] However, higher average caffeine consumption rates have been documented among Bahraini university students (268.0 mg/day)[15], as well as among medical, science, and computer science and engineering students at Taibah University, Saudi Arabia, with 253.24 mg/day, 233.92 mg/day, and 252.33 mg/day, respectively.[38] In comparison, university students in the United States and the Netherlands registered caffeine intake estimates of 159 mg/day and 144 mg/day, respectively.[39,40] The observed discrepancies may result from differences in the questionnaires used to assess caffeine consumption and the range of caffeinated products listed. Moreover, the overall daily caffeine intake from all sources remained within the safe levels established by the European Food Safety Authority (EFSA).[24]

In the present study, approximately 2.6% of students

reported daily caffeine intake exceeding the European Food Safety Authority's (EFSA) safe threshold of 400 mg/day. This is in stark contrast to 35% of students at Zayed University in Dubai[41] and 18% of university students in Bahrain[15], both of which are situated in the Arab region. One plausible explanation for the higher rates of excessive caffeine consumption in these areas may be the cultural significance of caffeinated beverages, particularly tea and coffee, which are integral components of hospitality at social events and thus influenced by social norms.[15] A comprehensive systematic review investigating the potential adverse effects of caffeine on the cardiovascular system, bone health, reproductive health and development, and behaviour concluded that no evidence exists to suggest that a caffeine intake of up to 400 mg/day poses any risk of adverse effects in adults.[42]

The current study reveals that a considerable proportion of undergraduate students at a public university exhibit suboptimal overall sleep quality, with 77.3% of the 418 surveyed students classified as having poor sleep quality. This issue appears to be particularly pervasive among undergraduate students, as 50% of respondents were deemed poor sleepers according to the Pittsburgh Sleep Quality Index (PSQI) criteria, where a score of 5 or higher indicates poor sleep quality.[7] Additional research has corroborated these findings, uncovering a high prevalence of poor sleep quality among students, with a rate of 70.6%.[43] Similarly, a study examining the sleep quality of first- and final-year medical students found that approximately 64.7% of participants experienced poor sleep quality.[44]

A notable finding from this study is that approximately 39.3% of the surveyed students reported receiving only 6 hours or less of sleep per night, while the recommended average sleep duration for adults is 7 to 8 hours. In a similar vein, a mere 6.1% of pre-clinical medical students in Malaysia achieved over seven hours of sleep duration, with the majority (45.6%) sleeping fewer than five hours per night.[7]

Conversely, a study examining 2,254 higher education students across Asia (China, Taiwan, South Korea, and Malaysia), Europe, and North America, found that the majority (72.2%) adhered to the recommended minimum sleep duration of 7 hours per night.[45] This discrepancy could be attributed to varying sleep patterns practiced by students in different countries. Sleep is crucial for learning and memory processes, and sleep deprivation negatively impacts these functions. Moreover, poor sleep quality undermines the immune system, increasing vulnerability to infections such as the common cold or flu.[17] Sleep disorders are widespread among university students globally, with estimates suggesting that 9.4–13.1% of students worldwide meet diagnostic criteria for insomnia.[46] Consequently, health-related policies and educational initiatives should empower young adults to become cognizant of these issues, thereby fostering better self-regulation for improved

health, academic performance, and psychological well-being. Furthermore, interventions such as sleep hygiene, cognitive behavioral therapy (CBT), relaxation techniques, mindfulness, and hypnotherapy have demonstrated efficacy in enhancing sleep among college students.[47,48] Universities should consider implementing these strategies to optimize sleep quality among their student populations.

This study revealed that 43.5% of undergraduate students experienced depression, 49.5% experienced anxiety, and 33% experienced stress ranging from mild to extremely severe levels. These findings align with prior research.[8,43] For instance, a study involving first-year undergraduate students at the University of Malaya found that 35.7% of participants exhibited depression symptoms, 60.4% displayed anxiety symptoms, and 24.8% reported stress symptoms.[8] Similarly, the prevalence of depression, anxiety, and stress among public university students was reported as 46.3%, 77.6%, and 34.2%, respectively.[43] In contrast, a study conducted among medical students at Universiti Kebangsaan Malaysia showed lower prevalence rates of 9.2% for depression, 16.8% for anxiety, and 1.1% for stress.[34] The reduced incidence of depression, anxiety, and stress may be attributed to the Personal and Professional Development (PPD) module, which was integrated into the medical students' curriculum.[34] A local study examining the effectiveness of such modules demonstrated that intervention programs enhanced students' reflective skills, potentially leading to improved coping mechanisms for addressing mental health challenges.[49] It is evident that university students generally exhibit a higher prevalence of anxiety. The transition from secondary to tertiary education can be emotionally challenging and stressful, as students must adapt to new and unfamiliar environments.[50] This sudden change may trigger anxiety, particularly among younger university students, which may persist beyond the second week of classes. Although the DASS questionnaire is not diagnostic, the prevalence of moderate to severe depression, anxiety, and stress symptoms underscores the need for attention from healthcare professionals and university administrators. Early detection is vital in mitigating the potential morbidities associated with psychiatric disorders.

Caffeine consumption has been implicated in sleep disturbances, specifically poor sleep duration and quality, as well as excessive daytime sleepiness among university students.[14,15,18] Moreover, individuals consuming caffeine-containing energy drinks were more likely to experience poor sleep quality.[17] A study of Korean adolescents identified a positive association between caffeine consumption and the severity of both depression and insomnia.[16] Another investigation of 98 podiatric medical students at the New York College of Podiatric Medicine revealed a high prevalence of sleep deprivation, daytime sleepiness, and stress perception.[51] Coffee and energy drink consumption, as well as stress, increased the

likelihood of poor sleep quality. According to a review, substantial evidence documents caffeine's anxiogenic effects in both experimental and real-world settings.[52] This study anticipated a significant association between caffeine intake, sleep quality, and mental health status.

The influence of caffeine on mental health and sleep quality has been a subject of considerable discussion and divergent research findings. While some investigations have identified a connection between caffeine intake and these domains, our study did not uncover any significant associations. This is in line with previous research on medical students and students in Saudi Arabia, which likewise reported no correlation between caffeine consumption and mental health or stress levels.[34,38] However, it is crucial to recognize that the challenges in collecting accurate data on caffeine concentrations in food and beverages represent a significant limitation in these studies. This issue is further compounded by the fact that foods and beverages containing caffeine are not mandated to disclose caffeine content on their labels[53] and the Malaysian food composition database lacks information on caffeine content. Despite these constraints, our study offers valuable insights into the caffeine consumption habits of students and underscores the necessity for further research to establish evidence-based recommendations for caffeine intake. By acknowledging these limitations and persistently examining the impact of caffeine on our health, we can aspire to attain a more comprehensive understanding of how to achieve an optimal balance in our daily habits.

CONCLUSION

This study provides valuable insights into the caffeine consumption habits of students and their mental health and sleep quality. While the majority of students consumed caffeine within safe levels, there were still some who exceeded the recommended daily limit. By examining the potential association between habitual caffeine intake and sleep quality and mental health status among Malaysian university students, our research provides valuable insights into the risks and benefits of caffeine consumption in this population. Although no significant associations were found between daily caffeine consumption and mental health or sleep quality, the high prevalence of poor sleep quality and mental health issues among the students underscores the importance of further investigation and education regarding caffeine intake. Our findings highlight the need for localized research on caffeine's effects to better understand its implications for pharmacy practice and hospital pharmacy settings. Additionally, this study supports the call for tailored guidelines and increased awareness among university students in Malaysia concerning caffeine consumption, sleep, and mental health, ultimately promoting more effective and informed decision-making.

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