Caffeine Consumption and Academic Performance: A Cross-Sectional Study among University Students in Malaysia

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DOI: https://dx.doi.org/10.47772/IJRISS.2024.8090229

Received: 13 September 2024; Accepted: 18 September 2024; Published: 17 October 2024

ABSTRACT

Caffeine consumption has increased globally due to its stimulating effects on the central nervous system (CNS), despite potential side effects and risks when consumed in excess. Among young adults, particularly university students, caffeine intake is often associated with efforts to enhance academic performance. This study aimed to identify the effect of caffeine consumption on academic performance among undergraduate university students in Malaysia. A cross-sectional design was employed, involving 220 respondents selected through convenience sampling. The results showed that students with a cumulative grade point average (CGPA) above 3.00 preferred coffee as their primary caffeinated beverage and consumed it less than five times a week. It also found a significant relationship between gender and academic year towards academic performance. However, there was no significant association between caffeine intake and academic performance. Additionally, this study demonstrates that the only variables influencing academic achievement are gender and part/semester. These findings highlight the importance of raising awareness among students about the potential risks of excessive caffeine consumption.

Keywords: Academic performance, caffeine consumption, cumulative grade point average (CGPA), university students, relationship

INTRODUCTION

Caffeine is a psychoactive substance naturally found in various plants and products such as coffee, tea, chocolate, and energy drinks [1]. Caffeine has stimulating effects on the central nervous system (CNS). People use it to enhance cognitive performance and reaction times while studying or working. Additionally, it can improve physical performance during sports and exercise by delaying fatigue and increasing endurance [2]. However, high caffeine intake can be associated with adverse effects on the central nervous system, such as anxiety, restlessness, confusion, muscle tremors, sleep quality, and impaired motor control [3, 4]. In addition, regular or excessive caffeine consumption may lead to caffeine dependence and withdrawal symptoms such as headaches and irritability when caffeine levels decrease.

People worldwide commonly consume caffeine-containing beverages, especially in the morning, to enhance alertness and maintain focus throughout the day. This habit is especially prevalent among university students, who often use caffeine to improve concentration and boost academic performance. A study by [5] reported that nearly 51% of university students in the United States consume caffeinated beverages. Similar consumption patterns have been observed in other developed countries, such as Italy, Canada, and Australia [6, 7]. According to [8], coffee (67.7%) is the most popular caffeine source among students, followed by tea (47.3%). Additionally, a study conducted in Puerto Rico found that 49% of students believe that caffeine helps them manage their demanding study schedules [9].

The local cultural tradition of drinking coffee has also become a habit in Malaysia. The rise of the Asian coffee market has accelerated the growth of Malaysia's coffee industry. Many international coffee shop chains and local cafes are growing here. Coffee is a popular beverage that is becoming more widely consumed, particularly among teenagers. Malaysia has also been named among the top 50 coffee-consuming countries [10]. The tendency of students in Malaysia and around the world to consume caffeinated drinks, especially during long study hours or at night when students prepare for exams [11]. However, caffeine intake should be

carefully monitored, as it is recommended not to exceed 400 mg per day to avoid serious health risks, including anxiety, insomnia, and cardiovascular problems. These side effects are increasingly noticed as detrimental to physical well-being and academic performance [12, 13].

Caffeine consumption among university students is frequently linked to its perceived benefits in enhancing academic performance due to its cognitive effects, such as increased alertness. Several studies have shown that university students cope with stressful academic situations by drinking a lot of caffeinated beverages [14]. Numerous studies have explored this relationship, though the findings have been mixed. For instance, [15] found that moderate coffee consumption was associated with potential improvements in academic performance and cognitive abilities among students in Saudi Arabia. Similarly, research by [16] on Croatian students revealed a weak positive correlation between higher caffeine intake and academic success. Conversely, a study conducted in the Makkah region reported no direct correlation between caffeine consumption and academic performance, despite its widespread use to boost mental alertness [17]. These studies indicate that while students often consume caffeine to enhance academic performance, the real impact of caffeine on learning outcomes may differ depending on how much is taken [15, 16, 17]. Additionally, a survey conducted in the United States found a negative correlation between energy drink consumption and academic performance, suggesting that certain caffeinated beverages might impair rather than improve academic success [18].

Many university students experience heavy academic workloads, often leading them to consume caffeinated beverages to enhance their academic performance. However, there is a notable gap in research concerning the relationship between caffeine consumption and academic performance, particularly within the Malaysian context. While studies in other regions have yielded mixed results, little is known about how caffeine intake impacts Malaysian students' learning outcomes. Therefore, this study aims to address this gap by examining the association between the frequency of caffeine consumption and academic performance among university students in Malaysia. The findings from this study will provide valuable insights into students' caffeine consumption habits and their effects on academic achievement, helping to inform students about safe caffeine use to avoid potential health risks.

METHODOLOGY

Study design and participants

A total of 220 students from Universiti Teknologi MARA (UiTM) Perak, Tapah Campus, Malaysia, participated in this study between March and April 2024. This study used a cross-sectional study design, and convenience sampling was employed. The respondents of this study consist of male and female students of this university, which consists of 3 faculties, namely the College of Computing, Informatics, and Mathematics, the Faculty of Accounting, and the Faculty of Applied Science. An online self-administered questionnaire was developed for this study. A questionnaire was sent via WhatsApp and Telegram Messenger to the participants. Participants in this study provided their consent to take part in the survey. The survey contains information on demographic factors such as gender, age, faculty, and academic year (semester/part), as well as cumulative grade point average (CGPA), types of caffeine users, and weekly caffeine consumption. The CGPA serves as a metric to assess the student's academic performance. The CGPA was split into two categories: CGPA below 3.00 and CGPA above 3.00.

Statistical analysis

The data was compiled and statistically analyzed using the Statistical Package for the Social Sciences (SPSS), version 26.0 [19]. The data has been presented in frequencies and percentages to represent categorical data. The chi-square test was applied to determine the association between categorical variables, and a p-value < 0.05 was considered significant. The main goal of this study is to identify the factors that influence academic performance using CGPA and the characteristics of caffeinated drink users using a multinomial logistic regression model. The dependent variable (Y) in the form of CGPA is divided into two categories: below 3.00 and above 3.00. Likewise, for the independent variables, the form of a questionnaire about the characteristics of caffeinated drink users such as gender, age, faculty, part/semester, types of caffeinated beverages, and

caffeinated beverage consumption per week. In this study, CGPA has been considered as a reference category, set at 95% CI, with a value of $p < 0.05$ considered statistically significant.

RESULTS

Association between demographic profiles and academic performance

Table 1 shows the findings related to the association between students' demographic characteristics who consume the caffeinated drink and their academic performance. For gender, most female students (50.5%) and male students (29.5%) achieved CGPAs above 3.00. Additionally, most students (70.9%) with CGPAs above 3.00 were between 18 and 20 years old. Based on the three faculties of this university, which are the College of Computing, Informatics, and Mathematics, the Faculty of Accountancy, and the Faculty of Applied Science, the majority of students achieved CGPAs above 3.00 (35%, 19.5%, and 25.5%, respectively). Regarding the part/semester in all the courses at this university, they also scored CGPAs above 3.00 for all parts. Most students with CGPAs above 3.00 prefer consuming coffee (42.3%) as their favorite caffeinated beverage and drinking it less than five times per week (47.3%).

Table 1. Demographic profile and the academic performance of students

Characteristics		CGPA		P-value
		Below 3.00 n (%)	Above 3.00 n (%)	
Gender	Female	20 (9.1)	111 (50.5)	0.033 *
	Male	24 (10.9)	65 (29.5)	
Age	18 - 20	41 (18.6)	156 (70.9)	0.331
	21 - 23	3 (1.4)	18 (8.2)	
	Above 24	0 (0)	2 (0.9)	
Faculty	College of Computing, Informatics, and Mathematics	18 (8.2)	77 (35)	0.337
	Faculty of Accountancy	7 (3.2)	43 (19.5)	
	Faculty of Applied Science	19 (8.6)	56 (25.5)	

Part/Semester	1	18 (8.2)	33 (15)	0.013 *
	2	3 (1.4)	8 (3.6)	
	3	7 (3.2)	58 (26.4)	
	4	10 (4.5)	39 (17.7)	
	5	4 (1.8)	29 (13.2)	
	6	2 (0.9)	9 (4.1)	
Types of Caffeinated Beverages	Coffee	22 (10)	93 (42.3)	0.198
	Energy Drink	13 (5.9)	61 (27.7)	
	Caffeinated Soft Drink	5 (2.3)	18 (8.2)	
	Tea	4 (1.8)	4 (1.8)	
Caffeinated Beverage consumption per week	Less than 5 times	23 (10.4)	104 (47.3)	0.426
	5 -10 times	15 (6.8)	56 (25.5)	
	10 - 15 times	5 (2.3)	10 (4.5)	
	More than 15 times	1 (0.5)	6 (2.7)	

**Significant at p-value < 0.05.*

This result also indicates a significant association between gender (p-value: 0.033) and part/semester (p-value: 0.013) with the CGPA. However, surprisingly, there is no association between caffeinated beverage consumption and academic performance (p-value: 0.198).

Table 2 represents the logistic regression analysis to examine the association between caffeine consumption and academic performance. In this multivariable analysis, only gender (p-value: 0.040; AOR: 0.432; CI: 0.206–0.905) and part/semester (p-value: 0.044; AOR: 1.318; CI: 0.387–0.941) are significant factors that affect academic performance. Meanwhile, other factors do not impact academic achievement.

Table 2. Multinomial logistic regression analysis

Effects	Model Fitting Criteria	Likelihood Ratio Tests			
	-2 Log Likelihood of Reduced Model	Chi-square	df	Sig.	Adjusted Odd Ratio (AOR) (95% CI)
Intercept	149.182	0.000	0		
Gender	153.400	4.218	1	0.040*	0.432 (0.206 - 0.905)
Age	150.001	0.819	2	0.664	1.444 (0.403 - 5.178)
Faculty	149.697	0.515	2	0.773	0.909 (0.59 - 1.399)
Part	161.740	12.557	5	0.044*	1.318 (0.387 - 0.941)
Types of Caffeinated Beverages	152.349	3.167	3	0.367	0.754 (0.503 - 1.131)
Caffeinated Beverage consumption per week	150.616	1.434	3	0.698	0.971 (0.602 - 1.566)

**Significant at p-value < 0.05.*

The value of the accuracy of the classification of the academic performance of students was produced using a multinomial logistic regression analysis of 80%. Table 3 shows the percentage for the category of CGPA below 3.00 was 2.3% and CGPA above 3.00 was 99.4%.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IX September 2024

Table 3. Classification accuracy test

Observed	Predicted		Percent correct
	CGPA		
	Below 3.00	Above 3.00	
Below 3.00	1	43	2.30%
Above 3.00	1	175	99.40%
Overall percentage	0.90%	99.09%	80%

DISCUSSION

Caffeine consumption is widespread among university students. This survey found that coffee was the preferred source of caffeine, followed by energy drinks, caffeinated soft drinks, and tea. These findings are consistent with other studies that show high coffee consumption among university students and young adults globally [6, 8, 20]. A study in the United Arab Emirates (UAE) reported an average daily caffeine intake of 264 mg among university students [8], well within the recommended adult limit of 400 mg per day. Another study indicates that caffeine is prevalent among university students in the United Arab Emirates (UAE), with an average daily intake of caffeine found to be 264 mg per day [8].

The study revealed that most high-achieving students consumed caffeine between one and five times a week, indicating that they are mild users of caffeinated beverages. This aligns with the findings of [21], which showed that many students consume caffeine one to three times weekly, primarily for doing homework or assignments. The results also suggest that societal perceptions of coffee as a more prestigious beverage contribute to its rising popularity among students, particularly in Malaysia.

The findings of the current investigation show a significant relationship between academic performance and gender and part/semester. This study is consistent with [17] by discovering an association between academic years in medical school and academic success. In addition, the results of this study also found that the factors associated with academic performance are gender and academic year. The results of this study are contrary to the results of a study by [17], who claim that age and body mass index (BMI) are factors associated with academic performance. Additionally, a study from Malaysia [22] asserts that there is no relationship between the frequency of caffeine intake and stress levels or the quality of sleep. The results of the above study may differ from others due to different factors investigated.

The current investigation found no significant correlation between the type of caffeine beverage used and academic performance. These findings are consistent with [17], which also found no evidence of a relationship between caffeine intake and academic performance. Conversely, a study conducted in Lebanon reported a weak association between energy drink consumption and academic achievement [23]. The discrepancies between these studies may be related to differences in the types of caffeinated beverages chosen by students across various studies.

CONCLUSION

Caffeine consumption is prevalent among students at this university, with coffee being the most preferred beverage. Most students reported consuming caffeinated drinks fewer than five times per week, indicating they were mild users of caffeinated beverages. The study revealed a significant relationship between gender,

academic year (part or semester), and academic performance. However, there is no significant association between caffeinated beverage intake and academic performance. Notably, gender and part/semester are the factors that showed the relationship with CGPA. Despite these findings, students should remain mindful of the potential health risks associated with excessive caffeine consumption.

ACKNOWLEDGEMENT

The authors would like to express their gratitude to all survey participants and Universiti Teknologi MARA (UiTM), Perak Branch, for their invaluable feedback and support. All contributions are gratefully acknowledged and greatly appreciated.

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