

# The Correlation of Caffeine Levels Consumption with Sleep Quality Levels of Active Students

Yellica Veronica<sup>1</sup>, Heidy<sup>2</sup>, Nelson Sudiyono<sup>2</sup>

<sup>1</sup>School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, North Jakarta, Indonesia

<sup>2</sup>Department of Physiology, School of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, North Jakarta, Indonesia

\*Corresponding author: Heidy, heidy.trisna@atmajaya.ac.id

## Abstract

**Introduction:** Caffeine is one of the many stimulants found in popular foods and beverages consumed by the global population. Caffeine has many benefits if it is consumed in accordance with recommended daily doses, such as reducing fatigue and facilitating activity. Caffeine consumption in excess is detrimental to the body, particularly the quality of sleep. Numerous students consume caffeine with the intention of enhancing daytime performance, but they disregard its negative effects, particularly on sleep quality.

**Methods:** This is a cross-sectional study using data collected with the Pittsburgh Sleep Quality Index (PSQI) and a questionnaire for caffeine content based on BPOM for active students at the Faculty of Medicine and Health Sciences, Atma Jaya Catholic University, classes of 2019–2021. The Spearman test was performed to determine the relationship between the independent variable (caffeine intake) and the dependent variable (sleep quality levels).

**Results:** There were forty respondents who satisfied the inclusion criteria. 20% of respondents had good sleep quality, whereas 80% of respondents had poor sleep quality. 60% of respondents consumed low amounts of caffeine or none at all (<32 mg), while 40% consumed high amounts of caffeine (>151 mg). The analysis utilizing the Spearman test revealed that some outcomes had no effect ( $p = 0.876$ ) while others did ( $r = 0.026$ ).

**Conclusion:** There is no correlation between caffeine consumption and sleep quality among active students at Atma Jaya Catholic University's School of Medicine and Health Sciences.

**Keywords:** Sleep Quality - Caffeine Consumption - Medical Students.

## INTRODUCTION

Caffeine is a stimulant that can be found in beverages, foods, medications, dietary supplements, and candies. 73% of the participants in a one-week study conducted by Mary Margaret Sweeney et al. consumed coffee, making it the most commonly

consumed high-caffeine beverage.<sup>1</sup> According to Statista, between 1990 and 2020, the total coffee consumption in Indonesia reached 4,8 million 60-kilogram (kg) bags.<sup>2</sup> According to research conducted at the University of Surabaya by Monica Purdiani, 80.83 percent of participants consumed caffeine weekly.<sup>3</sup>

Caffeine is one of the stimulants present in popular foods and beverages consumed by the global population today. According to research conducted by Maureen Morley, caffeine enhances short-term memory by increasing alertness and decreasing drowsiness.<sup>4,5</sup> Caffeine has both positive and negative effects when consumed in excess of 2 cups per day, resulting in poor sleep quality.

According to Liveina, a researcher from Udayana University, 91.9% of the 491 medical students from the Faculty of Medicine at Udayana University who participated in the research consumed caffeine. 76.1 percent of the population consumed caffeine and experienced side effects. Other possible side effects discussed in the study included difficulty sleeping (50.5%), palpitations (33.7%), increased urination frequency (31.9%), headache (20.2%), tremors (10.9%), nausea and vomiting (14.8%), anxiety symptoms (15.7%), heartburn (15.3%), and increased bowel movements (10.0%).<sup>6</sup>

According to research conducted by Sarah AlSharif et al. from the College of Medicine, King Abdulaziz University, with 476 respondents aged 18–25 years from both public and private colleges in Saudi Arabia, 80.7% experienced poor sleep quality, 40.5% consumed caffeine, and 51.5% consumed excessive amounts of caffeine. The research found that 83.3% of participants consumed

caffeine and had poor sleep quality. The study analyzed the relationship between caffeine consumption and sleep quality by combining data from two universities.<sup>7</sup>

According to S.S. Br. Ginting et al.'s research on the level of knowledge regarding the effects of caffeine consumption and caffeine intake among students, the prevalence of caffeine consumption among academic-level students in Indonesia is quite high at 82.58%. This becomes a reason for researchers to conduct research at the Faculty of Medicine and Health Sciences of Atma Jaya University, given the previously demonstrated side effects. Active students from the 2019–2021 cohort of the Faculty of Medicine and Health Sciences at Atma Jaya University participated in this study. It is anticipated that the research will provide information for all individuals who consume caffeine, both in moderate and excessive amounts, as well as for other researchers interested in developing this topic for broader application.<sup>8</sup>

## **METHODS**

### **Study Design**

This study was a correlational analysis using a cross-sectional research design. The research sample consists of active 2019–2021 cohort students from the Faculty of Medicine and Health Sciences at Atma Jaya University. The survey was distributed online between April 5 and April 12, 2023.

## **Subject and Sampling Method**

Sampling method was random sampling. This study will only include medical students from FKIK Atma Jaya University who are willing to sign an informed consent form. While the exclusion criteria include students with sleep-affecting diseases such as diabetes, cardiovascular disease, obesity, depression, lung disease, asthma, GERD, and certain mental disorders, students who regularly take drugs that affect sleep, students on vacation, students with poor sleep hygiene, students with lifestyle patterns such as working night shifts, exposure to electronics at night, and jet-lag, and students with environmental factors such as room temperature which are too hot/cold are eligible to participate. Using preclinical active student respondents with a uniform lifestyle and respondents with good sleep hygiene allows for the control of exclusion criteria.

## **Data Collection**

The students filled out the PSQI (Pittsburgh Sleep Quality Index) questionnaire and the BPOM-based Caffeine Beverage Questionnaire, which were administered through Google Forms to measure the level of sleep quality and caffeine consumption.

## **Statistical Analysis**

The study used a correlative analytical formula with a large sample estimate of 39

respondents for random sampling and obtained 40 respondents who met the inclusion criteria but not the exclusion criteria.

This study will incorporate univariate and bivariate analyses. The frequency distribution and percentage of each research variable will be described using univariate analysis and presented in frequency distribution tables. This study examines the cohort, caffeine consumption, and sleep quality as independent variables. On the other hand, a bivariate analysis will be conducted to determine whether or not a relationship exists between the independent and dependent variables. If the data are normally distributed, Pearson correlation analysis will be used for bivariate analysis, and Spearman correlation analysis will be used if the data are not normally distributed.

## **RESULTS**

From April 5, 2023, to April 12, 2023, this study was conducted online utilizing a questionnaire via Google Forms. Active students from the Faculty of Medicine and Health Sciences at Atma Jaya University in the 2019–2021 cohort participated in this study.

The research questionnaire was distributed to active 2019–2021 cohort students. 3 respondents were excluded due to their unwillingness to complete the questionnaire,

6 respondents were excluded due to having sleep-affecting diseases, and 216 respondents were excluded due to poor sleep hygiene. This study included a total of 40 respondents who met the inclusion criteria but were not excluded by the exclusion criteria. Based on the analysis of respondent characteristics, the results indicate that the majority of respondents were female (67.5%), while the lowest proportion was found among male respondents (32.5%) (Table 1).

**Table 1.** Distribution of Respondent Characteristics

Characteristics	Frequency	
	n	%
<b>Year</b>		
2019	14	35
2020	13	32.5
2021	13	32.5
Total	40	100
<b>Gender</b>		
Female	27	67.5
Male	13	32.5
Total	40	100
<b>BMI</b>		
Underweight	6	15
Normal weight	23	57.5
Overweight with risk	6	15
Obesity	4	10
Severe obesity (Obesity II)	1	2.5
Total	40	100

In terms of sleep quality, eight (20%) of the forty (100%) respondents had good sleep quality, while thirty-two (80%) had poor sleep quality (Table 2).

**Table 2.** Distribution of Sleep Quality Levels

Sleep Quality Levels	Frequency	
	n	%
Good	8	20
Poor	32	80
<b>Total</b>	40	100

Regarding caffeine consumption levels, 24 of the 40 respondents (60%) consumed low levels of caffeine (<32 mg), 0 consumed moderate levels (33–150 mg), and 16 consumed high levels (>151 mg) (Table 3).

**Table 3.** Distribution of Caffeine Consumption Levels

Caffeine Consumption Levels	Frequency	
	n	%
<32 mg (low/not consumed)	24	60
33-150 mg (moderate)	0	0
>151 mg (high)	16	40
<b>Total</b>	40	100

Five individuals (12.5%) consumed caffeine 6 hours prior to bedtime, whereas 35 individuals (87.5%) did not (Table 4).

**Table 4.** Distribution of Caffeine Consumption Levels 6 Hours Before Sleep

Caffeine Consumption 6 Hours Before Sleep	Frequency	
	n	%
Yes	5	12.5
No	35	87.5
Total	40	100

Based on the findings of the study, a correlation coefficient of 0.026 with a significant value of 0.877 was determined. Consequently, it can be concluded that there is no correlation between caffeine consumption and sleep quality. According to the results of the analysis, there is no correlation between caffeine consumption and sleep quality (Table 5).

**Table 5.** Correlation between Caffeine Consumption Level and Sleep Quality

	Caffeine Consumption Level	Sleep Quality Level
<b>Caffeine Consumption Level</b>		
Correlation Efficient	1000	.026
Sig. (2-tailed)	.	.0876
N	40	40
<b>Sleep Quality Level</b>		
Correlation Efficient	.026	1000
Sig. (2-tailed)	.0876	.
N	40	40

## DISCUSSION

In this study, sleep quality was determined using the PSQI questionnaire, which assessed the sleep quality of participants over a one-month period. The number of respondents with poor sleep quality was found to be 32 individuals (80%), which was greater than the number with good sleep quality, which was 8 individuals (20%). According to research conducted by Wahyu in 2022, the prevalence of poor sleep quality was greater than that of good sleep quality by 85.4%. The research was conducted among medical students at the Islamic University of Bandung during the 2021–2022 academic year, with a focus on student sleep patterns. It utilized the chi-square method and investigated different aspects than the current study.<sup>10</sup>

According to research conducted by Insaf et al. (2012) on Turkish students, poor sleep quality can be brought on by a number of factors. These factors include psychology (67.2%), stress (64.8%), exposure to tobacco smoke in the bedroom (63.7%), pain (62.9%), family problems (62.5%), patience (55.1%), indoor air quality (55.1%), heavy physical activity (53.9%), fatigue (53.5%), sadness (53.1%), noise caused by others in the room (52.0%), room odor (sweat, perfume, etc.) (53.1%), depression (51.6%), anxiety, and tension (51.1%).<sup>11</sup> The number of respondents who consumed high levels of caffeine (>151 mg) was found to be 16

individuals (40%) compared to 24 individuals (60%) who either did not consume caffeine or consumed low levels (<32 mg). Contrary to the findings of the 2021 Nathalia study, respondents who consume high levels of caffeine are 81.4% more likely to be obese than those who consume low levels of caffeine or no caffeine. The study was conducted among adolescents in the Sidoarjo region of Juanda.<sup>12</sup> In the study, Nathalia consumed more caffeine and found a correlation between caffeine consumption and sleep quality. This study differs in that the research sample, Nathalie, was a teenager from the Juanda Siroarjo region who consumed caffeinated beverages. The research was conducted in several coffee shops in the Juanda region, where it was determined that respondents who consumed more caffeine consumed higher levels, and the habitual caffeine consumption level of respondents was discussed.

Each individual's caffeine consumption is influenced by factors such as taste preferences, environmental factors, and habits. In addition, differences in methods, sampling techniques, variables, and sample sizes among studies, including this one, can result in divergent findings.

At the outset of the study, the researchers hypothesized that students in the Faculty of Medicine and Health Sciences at Atma Jaya University consumed a large amount of

caffeine due to the demands of their educational field, which frequently required them to stay up late researching, completing assignments, participating in student activities, etc. However, the results of this study revealed that 16 students (40%) consumed caffeine in excess of the normal level (>32 mg/day), and only 5 (12.5%) consumed caffeine 6 hours before bedtime. Based on the research conducted and documented in the book by the Committee on Military Nutrition Research, it has been determined that 32 mg of caffeine is the minimum amount that can affect physical and mental performance. Therefore, this guideline was adopted by the researchers for the current study. Caffeine consumption six hours before bedtime is considered one of the indicators of poor sleep hygiene. According to previous research conducted by Christopher Drake et al., caffeine consumption six hours before bedtime can affect the quality of sleep. In this study, the researchers focused on caffeine, which is why caffeine consumption six hours before bedtime remained an inclusion criterion.<sup>9,13</sup>

The discrepancy in research results may be attributable to the fact that the majority of students in the 2019–2021 cohort at the Faculty of Medicine and Health Sciences of Atma Jaya University consume caffeine only when necessary, as opposed to on a regular basis. In general, these students do not

consume large quantities of caffeine on a daily basis, meaning that the target average caffeine consumption of 32 mg/day is not met.

This study's statistical analysis revealed a correlation coefficient of 0.026 and a significance level of 0.877. On the basis of these findings, it can be concluded that there is no correlation between caffeine consumption and sleep quality among the active students of the 2019–2021 cohort of the Faculty of Medicine and Health Sciences at Atma Jaya University. Due to the small sample size caused by the exclusion of respondents based on illness, medication, lifestyle, environment, and sleep hygiene, this study failed to find a correlation. In addition, respondents' responses to the questionnaire, which was administered at a single point in time, may have been biased. This is supported by a 2014 study titled "The Relationship Between Caffeinated Beverage Consumption, Sleep Patterns, and Their Effects on the Behavior of University of Surabaya Students" conducted by Monica. Using the Chi-Square method, the researchers found no significant correlation between caffeine consumption and sleep quality, with results below 5.991. At Surabaya University, students from six distinct faculties participated in Monica's study. Monica analyzed the relationship between gender and caffeine consumption, caffeine consumption and workload, caffeine consumption and the influence on sleep

quality, caffeine consumption and psychological aspects, caffeine consumption and student behavior, and caffeine consumption and learning motivation using a variety of variables.<sup>3</sup>

## **CONCLUSION**

In Atma Jaya University's Faculty of Medicine and Health Sciences, there is no correlation between caffeine consumption and sleep quality, according to the findings of the research and statistical analyses. In addition, the findings revealed that only 20% of respondents slept well, while 80% slept poorly. 60% of active students at the Faculty of Medicine and Health Sciences of Atma Jaya University were found to either not consume caffeine or consume it at low levels (<32 mg), whereas 40% were found to consume caffeine at high levels (>151 mg).

## **ACKNOWLEDGMENT**

The authors would like to thank the Faculty of Medicine and Health Sciences at the University of Atma Jaya, particularly their colleagues and friends who are willing to support and devote time to this study.

## **CONFLICT OF INTEREST**

There was no conflict of interest.

## REFERENCES

1. Sweeney MM, Weaver DC, Vincent KB, Arria AM, Griffiths RR. Prevalence and Correlates of Caffeine Use Disorder Symptoms Among a United States Sample. *J Caffeine Adenosine Res.* 2020;10(1):4–11.
2. Nurhayati-Wolff H. Total coffee consumption in Indonesia 1990- 2020. *Consumer Goods & FMCG* [Internet]. 2022;1.
3. Purdiani M. Hubungan Penggunaan Minuman Berkafein Terhadap Pola Tidur Dan Pengaruhnya Pada Tingkah Laku Mahasiswa/I Universitas Surabaya Monica Purdiani. *Calyptra J Ilm Mhs Univ Surabaya* [Internet]. 2014;3(1):1–15.
4. Morley M. Coffee jump-starts short-term memory. *Radiological Society of Nourth America* [Internet]. 2005;1.
5. Afreen. Effects of Caffeine Addiction. *RRJCHEM | Spec Issue-S1.* 2016;15–22.
6. Liveina, Artini. Pola Konsumsi Dan Efek Samping Minuman Mengandung Kafein Pada Mahasiswa. *E-Jurnal Med Udayana* [Internet]. 2014;3(4):1–12.
7. AlSharif SM, Al-Qathmi MS, Baabdullah WM, Alhrkan TA, Fayoumi YA, Alhejaili FF, et al. The Effect of Caffeinated Beverages on Sleep Quality in College Students. *Saudi J Intern Med* [Internet]. 2018;8(1):43–8.
8. Br Ginting SS, Astiarani Y, Santi BT, Vetinly V. Tingkat Pengetahuan Efek Konsumsi Kafein Dan Asupan Kafein Pada Mahasiswa. *Journal of Nutrition College.* 2022 Oct 31;11(4):264–71.
9. Medicine I of. Caffeine for the Sustainment of Mental Task Performance: Formulations for Military Operations. [Internet]. 2001.
10. Wahyu Kijang Ramadhan, Santun Bhekti Rahimah, Ellyi Marliyani. Pengaruh Konsumsi Kopi dengan Kualitas Tidur Mahasiswa Fakultas Kedokteran Unisba. *Bandung Conf Ser Med Sci.* 2022;2(2).
11. I. A, N. C, C. D. The contributing factors to poor sleep experiences in according to the university students: A cross-sectional study. *J Res Med Sci* [Internet]. 2012;17(6):557–61.
12. Windasari N. Hubungan Kebiasaan Konsumsi Minuman Berkafein dengan Pola Tidur pada Remaja di Wilayah Kelurahan Sedati Gede Juanda Sidoarjo [Internet]. 2021.
13. Drake C, Roehrs T, Shambroom J, Roth T. Caffeine effects on sleep taken 0, 3, or 6 hours before going to bed. *J Clin Sleep Med.* 2013 Nov;9(11):1195–200.