

**THE ASSOCIATION BETWEEN CAFFEINATED BEVERAGES
CONSUMPTION WITH SOCIODEMOGRAPHIC FACTORS,
BODY MASS INDEX, AND SLEEP QUALITY AMONG
UNIVERSITY STUDENTS IN HEALTH CAMPUS OF UNIVERSITI
SAINS MALAYSIA**

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MALAYSIA

by

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Dissertation submitted in partial fulfilment
of the requirements for the degree
of Bachelor of Health Science (Honours) (Dietetics)

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DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledged. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.



.....
Nur Farzana Binti Mohamad Zubir

Date: 1 July 2025

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LIST OF ABBREVIATIONS

PSQI	Pittsburgh Sleep Quality Index
JEPeM	The Human Research Ethics Committee of Universiti Sains Malaysia
WHO	World Health Organization
USM	Universiti Sains Malaysia
BMI	Body Mass Index
US	United States
SES	Socioeconomic Status
mRNA	Messenger Ribonucleic Acid
DM4	Desasiswa Murni 4
PUMA	Pusat Mahasiswa
SPSS	Statistical Package for the Social Sciences
IIUM	International Islamic University Malaysia

**PERKAITAN ANTARA PENGAMBILAN MINUMAN BERKAFEIN
DENGAN FAKTOR SOSIODEMOGRAFI, INDEKS JISIM TUBUH,
DAN KUALITI TIDUR DALAM KALANGAN PELAJAR
UNIVERSITI DI KAMPUS KESIHATAN UNIVERSITI SAINS
MALAYSIA**

ABSTRAK

Kafein adalah perangsang yang boleh didapati dalam banyak sumber minuman seperti kopi, teh, coklat, matcha, minuman bergas, dan minuman bertenaga. Kafein telah diminum oleh ramai orang untuk mendapatkan faedah-faedahnya seperti meningkatkan fokus mereka dan tetap berjaga. Pelajar universiti didapati mengambil kafein untuk mendapatkan faedah tersebut, terutamanya semasa situasi yang menekankan. Oleh itu, kajian keratan rentas ini dijalankan untuk mengukur kekerapan pengambilan minuman berkafein dalam kalangan pelajar sarjana muda di kampus kesihatan USM serta untuk menentukan faktor sosiodemografi, BMI, dan perkaitan kualiti tidur dengan kekerapan pengambilan kafein. Kajian pensampelan mudah telah dijalankan dengan 162 (n = 43 lelaki, n = 119 perempuan) pelajar sarjana muda dari tahun 1 hingga tahun 3 dengan lingkungan umur antara 19 hingga 25 tahun dari Pusat Pengajian Sains Kesihatan, Pusat Pengajian Sains Perubatan dan Pusat Pengajian Sains Pergigian. Soal selidik tinjauan terdiri daripada faktor sosiodemografi, *Caffeine Consumption Pattern*, dan *Pittsburgh Sleep Quality Index* (PSQI) untuk mengumpul data daripada responden dan dinilai menggunakan SPSS (Versi 29.0) untuk menyediakan analisis deskriptif dan Fisher's Exact Test. Kajian ini mendapati tiada perkaitan yang signifikan antara pengambilan minuman berkafein dengan faktor sosiodemografi seperti jantina ($p = 0.351$), umur ($p =$

0.353), kursus pengajian ($p = 0.545$), tahun pengajian ($p = 0.646$), BMI ($p = 0.198$), dan kualiti tidur ($p = 0.692$) dalam kalangan pelajar sarjana muda. Namun begitu, kajian ini mendapati bahawa terdapat perkaitan antara status biasiswa dan kekerapan pengambilan kafein ($p = 0.002$). Kajian ini menunjukkan pelajar yang menerima biasiswa mengambil lebih tinggi kekerapan kafein berbanding pelajar yang membiaya pelajarannya tanpa biasiswa. Walau bagaimanapun, penyiasatan lanjut diperlukan untuk menentukan hubungan antara faktor yang menyebabkan penggunaan kafein yang tinggi.

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ABSTRACT

Caffeine is a stimulant that can be found in many sources of beverages such as coffee, tea, chocolate, matcha, soft drinks, and energy drinks. It has been consumed by people to gain benefits such as improving their alertness and staying awake. University students have been found to consume caffeine to get those benefits, especially during stressful situations. Therefore, this cross-sectional study is conducted to measure the frequency of caffeinated beverage consumption among undergraduate students in the USM health campus as well as to determine the sociodemographic factors, BMI, and sleep quality association with frequency of caffeine intake. A convenience sampling study was conducted with 162 (n = 43 males, n = 119 females) undergraduate students from year 1 until year 3 with the age range between 19 to 25 years old from the School of Health Sciences, School of Medical Sciences, and School of Dental Sciences. The survey questionnaire consisted of sociodemographic factors, Caffeine Consumption Patterns, and Pittsburgh Sleep Quality Index (PSQI) to collect data from the respondents and were assessed using SPSS (Version 29.0) to provide descriptive analysis and Fisher's Exact Test. This study found no significant association between caffeinated beverages consumption with sociodemographic factors such as gender ($p = 0.351$), age ($p = 0.353$), school ($p = 0.545$), year of study ($p = 0.646$), BMI ($p = 0.198$), and sleep quality ($p = 0.692$) among undergraduate students. Nonetheless, a significant association has been

found between scholarship status and frequency of caffeine intake ($p = 0.002$). This study indicates that scholarship students consumed higher frequency of caffeine compared to self-sponsored university students. However, further investigations are needed to determine the relationship between factors that may lead to higher caffeine consumption.

CHAPTER 1: INTRODUCTION

1.1 Background of Study

Most university students consumed caffeine in their daily life. Study by Mahoney *et al.*, (2019) showed that caffeine was consumed by 92% of their students from various forms that includes both regular consumers and non-consumers in multiple universities situated in United States. However, for those who consumed caffeine, it will give some effects on their sleep (Mahoney *et al.*, 2019). It had been suggested that some caffeinated drinks such as energy drinks could reduce sleep quality as well as having sleepiness subsequently among students (Patrick *et al.*, 2016). Nevertheless, caffeine, has become an ergogenic aid especially among university students to improve their cognition (Rosdi & Hamirudin, 2023).

Furthermore, caffeine has a lot of variation in the food industry such as coffee, tea, and chocolate (Ikram *et al.*, 2024). Hence, it is essential to define caffeine intake not just from coffee, but from other various sources available in Malaysia. Previous study by Gardiner *et. al* (2023) only informed on the effects of caffeine dose and timing of intake on total sleep time, and thus further investigation regarding sleep quality is required to determine significant effects of caffeine intake from caffeinated beverages among USM students.

Furthermore, caffeine consumption has been shown to be affected by demographic factors and socioeconomic status in adults and elderly but there is a lack of literature that reviews this factor on socioeconomic status (SES) and body mass index (BMI) among university students. Identification of socioeconomic status and BMI helped us to identify individuals especially university students that have been

affected by their intake of caffeine to stay awake and task differences between different social class. Therefore, this study was conducted to assess the association of caffeine intake from various sources of beverages with sociodemographic factors, BMI, and sleep quality among university students using convenience sampling via survey questionnaire among Universiti Sains Malaysia students located in the Health Campus. In addition, habitual caffeine consumption and reasons of intake were also assessed to improve the results on how sleep quality is associated with caffeine consumption among university students.

1.2 Problem Statement

It has been found that about 57.95% of university students that consumes tolerable to excessive amount of caffeine has poor sleep quality (Ikram *et al.*, 2024). Moreover, poor behaviour of caffeine consumption in combination with poor sleep quality may impair their cognition, productivity as well as academic performance (Dahlawi *et al.*, 2024). It has been found that excessive caffeine intake may influence quality of life negatively by increasing the state of anxiety, reducing sleep efficiency, frequent urination, incoherent speech and thoughts, irregularity of heartbeat, and restlessness (Rodak *et al.*, 2021). Numerous studies have been conducted regarding the relationship between caffeine intake with sleep quality among university students (Eduviere *et al.*, 2021; Riera-Sampol *et al.*, 2022; Widjaya & Halim, 2023). However, there is still a lack of literature related to university students in Malaysia their consumption pattern, and the factors leading to their caffeine intake. Therefore, it is important to study the association of caffeinated beverages consumption with sociodemographic factors, body mass index and sleep quality among university students. The final outcome of this study informed on the sociodemographic factors such as gender, school, year of study, and scholarship status as

well as body mass index that are associated with caffeinated beverages consumption among university students in USM Kubang Kerian and how it affected their sleep quality. By increasing understanding of possible associations of caffeine consumption and sleep quality, we are able to tackle the issues regarding poor sleep quality among university students due to their caffeine intake behaviours.

1.3 Rationale of Study

Sleep quality among university students is an essential component in their life. A good sleep may help them to go through their daily routine without problem. Therefore, it is important to highlight their dietary habits such as caffeine intake that influenced their daily sleep quality after consumption. University students, who are at their transitional age where lifelong dietary habits are formed, represent a critical demographic for this study. This study focused on caffeinated beverages intake that is widely available in Malaysia to fill in this particular gap in previous research findings on how caffeinated beverages could give an impact on sleep quality among university students.

Moreover, as most studies only focus on caffeine intake among university students, the potential factors of caffeine consumption such as sociodemographic factors and BMI are disregarded. In this study, our aim was to find out the differences between their habitual caffeine intake and how it is affected by their demographic factors such as gender, socioeconomic status such as school of education, year of study and scholarship status, as well as BMI. Caffeine in Malaysia is known for its coffee rather than any other sources of caffeinated beverages. Social demands and anthropometry variability among different individual backgrounds may have variations in the amount of caffeine intake. From this study, the preference of caffeinated beverages from different sociodemographic and BMI among university students were shown.

The findings from this study make some important contributions to inform public health policies and university health programs. By identifying the relationship between sociodemographic factors, BMI, caffeine intake, and sleep quality, policy makers, educational institutions and health-related organisation can design targeted interventions and produce suitable caffeinated products to promote awareness and healthier consumption of caffeine among university students based on their socioeconomic status. Therefore, university students will get the best benefits from caffeinated products as they are well educated and can afford to buy good sources of caffeinated products in a healthy range. Such program like campaign and educational programs regarding caffeine intake can be conducted to inform the targeted groups, and thus increase their awareness regarding the safe amount of caffeine and its effect on sleep quality.

As university students will undergo transition into workforce and wider community, the nutritional habits and behaviour of caffeine intake that have been adopted may lead to wider implication. Hence, it is vital to increase the awareness early on to prevent this habit from this group of people before they are in a high-risk population that may develop circumstances from poor sleep quality during early adulthood lifestyle. This will ultimately reduce the overall burden of older population with diseases coming from poor sleep quality due to caffeine consumption on our healthcare system.

1.4 Study hypothesis

1.4.1 Null Hypothesis

H₀: There is no significant association of caffeinated beverages consumption with sociodemographic factors, body mass index and sleep quality among university students in Health Campus of Universiti Sains Malaysia.

1.4.2 Alternative Hypothesis

H₁: There is a significant association of caffeinated beverages consumption with sociodemographic factors, body mass index and sleep quality among university students in Health Campus of Universiti Sains Malaysia.

1.5 Research Questions

Is there any association between caffeinated beverages consumption with sociodemographic factors, body mass index and sleep quality among university students in Health Campus of Universiti Sains Malaysia?

1.6 Objectives

1.6.1 General Objective

To determine the association between caffeinated beverages consumption with sociodemographic factors, body mass index and sleep quality among university students in Health Campus of Universiti Sains Malaysia.

1.6.2 Specific Objectives

1. To determine the frequency of caffeinated beverages consumption pattern among university students in Health Campus of Universiti Sains Malaysia.
2. To determine the body mass index (BMI) among university students in Health Campus of Universiti Sains Malaysia.

3. To determine the level of sleep quality among university students in Health Campus of Universiti Sains Malaysia.
4. To assess the association between sociodemographic factors and frequency of caffeinated beverages consumption among university students in Health Campus of Universiti Sains Malaysia.
5. To assess the association between BMI and frequency of caffeinated beverages consumption among university students in Health Campus of Universiti Sains Malaysia.
6. To assess the association between frequency of caffeinated beverages consumption with sleep quality among university students in Health Campus of Universiti Sains Malaysia.

1.7 Conceptual Framework

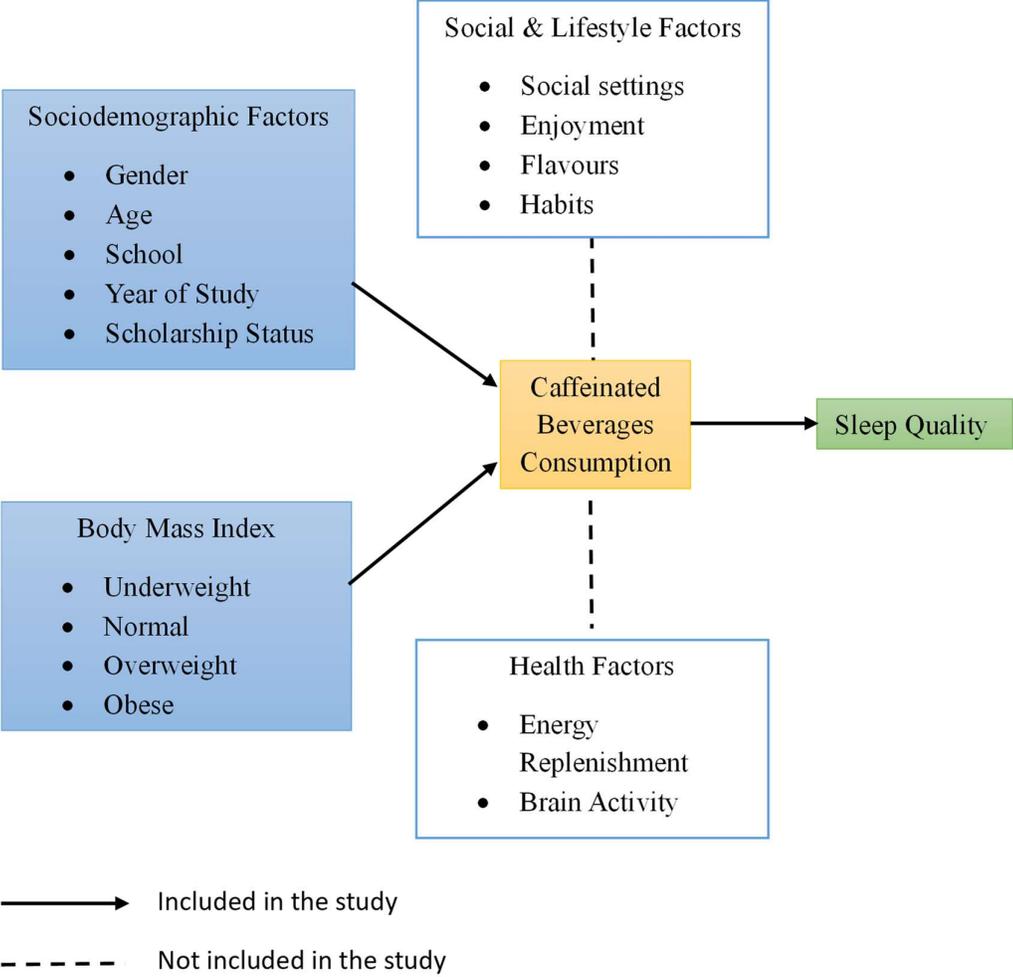


Figure 1: Conceptual framework on the factors of caffeinated beverages consumption and its effect on sleep quality

This conceptual framework explains the relationship between factors that are associated with caffeinated beverages consumption and how it could affect sleep quality. Firstly, it has been found that caffeinated beverages is consumed to increase brain activity that later will increase energy replenishment and wakefulness (Pauchon *et al.*, 2024). This is because caffeine will cross the blood-brain barrier to act on adenosine receptors especially

the action of A2A receptor that is shown to increase the brain activity (Pauchon *et al.*, 2024). However, habitual caffeine intake also have been found to impact the brain activity that may lead to stress and anxiety (Magalhães *et al.*, 2021; Nehlig, 2016) This is due to how caffeine can enhance the release of adrenaline by stimulating the central nervous system (Liu *et al.*, 2024). Meanwhile, Bertasi *et al.* (2021) has reported that caffeine is consumed due to enjoyment. It is found that caffeine can enhance enjoyment by various factors, such as for its taste (Rahman *et al.*, 2023), social interactions (Mahoney *et al.*, 2019), and its effect on daily activities.

Even though caffeine is associated to bitter taste, it is found that caffeine enjoyer keeps on drinking caffeinated beverages even with bitter taste due to their perceived effect of benefits it could give to them as well as they have genetic variations in the taste tissue, in which they have lower receptor mRNA that is relevant to the bitter taste (Lipchock *et al.*, 2017). Hence, habitual caffeine-drinkers can only taste the bitterness if they consume more caffeine than usual (Lipchock *et al.*, 2017). Moreover, it is found that social interaction that is associated with caffeine consumption may improve mood and sociability (Unnava *et al.*, 2018). It is found that those that consumes caffeinated beverages, will most likely engage more with the conversation compared to those that does not consume it (Unnava *et al.*, 2018).

In addition, caffeine is consumed due to the individual's perceived of caffeine health benefits. A study has shown that caffeine can improve antioxidant regulation and formation, that will lead to reduce inflammation, in which both are vital in the prevention of cancer and health maintenance (Saraiva *et al.*, 2023). Furthermore, as caffeine has been shown to give positive effects on overall health, the habit of caffeinated beverages consumption is developed, causing consumption of caffeine becoming a part of their lifestyle habits (Rodak *et al.*, 2021).

Other than that, sociodemographic variables play a role in affecting their caffeinated beverages consumption. Firstly, it is found that males consume more caffeine than female (Lemaire *et al.*, 2022). A study by Domaszewski (2018) discusses that there is gender differences in caffeine metabolism, in which males is found to metabolise caffeine at higher rate compared to females. Next, there is an association between body mass index (BMI) and caffeine intake (Larsson *et al.*, 2023). Lower BMI is associated with higher caffeine intake (Larsson *et al.*, 2023). This is due to caffeine ability to increase metabolism that may lead to weight loss (Larsson *et al.*, 2023). In the case of school that includes department of study, there is still a lack of literature that focuses on different departments among university students and their caffeine intake. Moreover, higher year of study and level of education is associated with more caffeine intake (Mahoney *et al.*, 2019). As for scholarship status, students with scholarship is found to consume more caffeine to enhance their academic performance due to academic pressure to maintain their grades (Faezah Jamal & Abu Hasan, 2024).

Furthermore, based on a study by Ikram *et al.* (2024), in which students that consumes excessive amounts of caffeinated beverages have higher percentage of poor sleep quality compared to those that consume tolerable amount of caffeine. This is due to the blocking of adenosine receptors by caffeine; known as a neurotransmitter that enhance sleepiness (Pauchon *et al.*, 2024). It prevents the pressure to sleep by keeping the consumer alert. However, higher intake of caffeine interferes with the consumer's ability to fall asleep and stay asleep throughout the sleep cycle (Gardiner *et al.*, 2023). This led to delayed sleep onset, reduce sleep duration, as well as altered sleep architecture by reducing the amount of deep sleep and increasing the amount of light sleep cycle (Gardiner *et al.*, 2023).

CHAPTER 2: LITERATURE REVIEW

2.1 Types of Caffeinated Products and its Consumption Pattern Among University Students

Caffeine is a stimulant psychoactive drug that is consumed by people all around the globe (Reddy *et al.*, 2024). Nowadays, caffeine is packaged in liquid and solid form to be enjoyed as food and beverages (Reyes & Cornelis, 2018). Different sources of caffeinated products are manufactured because of the demand from the general public (Samoggia & Rezzaghi, 2021). Some examples of caffeinated products are coffee, tea, soft drinks, energy drinks, and chocolate (Mahoney *et al.*, 2019).

Coffee is known as the main source of caffeine consumption. A large epidemiological study of 1248 university students by Mahoney *et al.* (2019) supports this statement. This study is being conducted in five-geographically-dispersed United States (U.S.) universities have found that coffee is consumed the most by their students followed by energy drinks and soda. Several local studies in Malaysia such as Md Isa *et al.* (2021) and Rosdi & Hamirudin (2023) also stated that coffee was the main source of caffeine among university students in their respective study location followed by tea, chocolate, matcha, soft drinks and energy drinks as the least consumed.

Based on a recent study by Rosdi & Hamirudin (2023), it was revealed that consumption of caffeine between male and female undergraduate students were similar, in which male consuming slightly higher with an average of one to three times consumption per week. This finding was consistent with a study conducted by Knapik *et al.* (2022), in which male students reported only slightly higher caffeine consumption (87%) compared to female students (86%). Despite that, there is no significant association found on the study conducted by Rosdi & Hamirudin (2023) due to possible

confounders and limitation that may interrupt the findings in this study such as stress, in which the researcher measures that variable.

In terms of variations of caffeine consumption, Rosdi & Hamirudin (2023) reported that coffee was the main caffeine sources consumption in both male and female undergraduate students in International Islamic University Malaysia (IIUM) Kuantan, Pahang, Malaysia. Moreover, it was also revealed that male students consume caffeine from more sources such as energy drinks compared to female students (Dillon et al., 2019; Rosdi & Hamirudin, 2023). However, female student preferences for other sources aside from coffee are green tea and those with lower caffeine beverages (Rosdi & Hamirudin, 2023).

In addition, there was an association found between body mass index (BMI) and caffeine intake (Larsson *et al.*, 2023). Lower BMI is associated with higher caffeine intake (Larsson *et al.*, 2023). This has been proven by a study by Al-areefy & Alattas (2023), in which the normal BMI students in Jazan University had the highest prevalence of high caffeine consumption compared to obese students. This was because caffeine has been found to induce sympathetic nervous system in fight-or-flight response, elevate the energy output, and increase fat metabolism that can cause weight loss (Henn *et al.*, 2023; Tabrizi *et al.*, 2019). However, Zhang *et al.* (2018) reported that higher BMI among medical students in China were bound to consume more caffeinated beverages due to caffeine intake in the late evening.

2.2 Socioeconomic Status and Its Impact on Caffeinated Beverages Consumption Among University Students

There are three categories to define socioeconomic status which is low, middle, and high socioeconomic status (Were *et al.*, 2022). Higher socioeconomic status (SES) is related to higher education, income and career while lower socioeconomic status is the opposite

of high SES (Munir *et al.*, 2023). A study among female university students at Princess Nourah Bint Abdulrahman University in Saudi Arabia had revealed that students coming from high socioeconomic status consumes more expensive types of caffeinated beverages such as specialty coffee compared to lower SES, in which they consumed more regular brewed coffee, capsule coffee, and black tea (AlAteeq *et al.*, 2021). This statement was supported by Mahoney *et al.* (2019), in which students from higher-SES tends to consume more coffee and tea from coffee shops, while students from lower-SES consumed higher energy drinks and soft drinks that were cheaper compared to coffee and tea.

Moreover, as for age, Mahoney *et al.* (2019) had suggested that older students consumed more caffeine compared to younger university students. This may be due to an increase need to focus in class as they are nearing the end of their graduation. Classes becoming more complex to cater the students to work efficiently in the community. Additionally, Bertasi *et al.* (2019) found that higher level of education increases caffeine consumption. In comparison, a study by Eduviere *et al.* (2021) found that there was no difference in caffeine consumption between older students and younger students with probability that all university students get to access caffeine products easily and without restriction. This is true that all age groups of university students get to access the same availability of caffeine especially if they are from the same university.

Other than that, in terms of scholarship status, it had been found that scholarship students consume more caffeinated beverages due to academic pressure to achieve desirable grades during examination season (Mahoney *et al.*, 2019). However, a study conducted among pharmacy students with lower socioeconomic status reported to have higher caffeine intake due to the same reason which was academic pressure (Liu *et al.*, 2024). This was also supported by AlAteeq *et al.* (2021), in which those from lower-SES that did not have enough money or in debt reported higher intake of caffeine as a stress

reliever due to academic stress. Nevertheless, this study conducted based on one course and female students each. Hence, the generalisation cannot be made based on both of these studies but rather include multiple departments or school to make significant generalisation.

2.3 Motives of Caffeine Consumption Habit Among University Students

Major findings for motives of caffeine consumption habit among university students based on Afroz *et al.* (2020) in a private medical university were due to its flavour or habits, and to replenish energy. A previous study had supported both factors as the main motivations for caffeine consumption among college students, in which those students consumed caffeine to increase wakefulness and its taste (Mahoney *et al.*, 2019). Additionally, caffeine is a stimulant that has been proven for its effectiveness to improve the brain activity (Pauchon *et al.*, 2024). Furthermore, it is no doubt that the bitterness of caffeine has always been associated with coffee, and thus a frequent drinker associates the bitterness with the benefits a coffee could provide (Lipchock *et al.*, 2017).

Moreover, Bertasi *et al.* (2021) had reported that college students at Florida State University used caffeine as enjoyment and a good environment to start studying. In relation to previous findings by Afroz *et al.* (2020) and Mahoney *et al.* (2019) where students consume caffeine for wakefulness and energy, this probably will provide an ideal environment for them to maximise their energy for studying. In addition, enjoyment may come from an improvement in their academic performance. This statement has been agreed by Kharaba *et al.* (2022), in which they had found that students consume caffeinated beverages to improve alertness and concentration while studying, enhancing their memory as well as stabilising their mood. Hence, a good environment and cognitive

function improve the mood to study that may produce a significant performance in their academic.

According to a study among college students in Korea, social factors and knowledge regarding the characteristics of caffeine, influence and deviate the sources of caffeine consumption (Choi, 2020). It was found that coffee drinkers were motivated by its effect on enhancing alertness, meanwhile tea drinkers mostly consumed it during social gathering as it can be served in a tea pot. Furthermore, energy drinks consumer always associates it with health benefits such as aids for headache, digestion, and blood pressure (Choi, 2020). This is due to various advertisements that has promote energy drinks for its health benefits without actually emphasising the risk from overdosing it. Nonetheless, there is a lack of literature that has reviewed social factors and knowledge regarding caffeine from other sources asides from this and Ágoston *et al.* (2017) based on my own research. Therefore, it is vital to acknowledge the motivations of caffeine intake especially its relationship with sleep quality among university students.

2.4 The Influence of Caffeine Consumption on Sleep Quality Among University Students

According to a study by Rosdi & Hamirudin (2023), most students that consumed caffeine had poor sleep quality based on the criteria set by Pittsburgh Sleep Quality Index (PSQI). It was among those that consumes 1-3 times on a weekly basis and once daily (Rosdi & Hamirudin, 2023). However, most of those that consumes caffeine 4-5 times daily making up 1.4% of students, had been found to have good sleep quality (Rosdi & Hamirudin, 2023). Nevertheless, a study from Ikram *et al.* (2024), in which students that consumed excessive amounts of caffeinated beverages have higher percentage of poor sleep quality compared to those that consume tolerable amount of caffeine.

In terms of comparing those that did not consume caffeinated beverages at all, it was reported that most university students in Malaysia had good sleep quality if no caffeine was consumed followed by tolerable amount of caffeine intake (Ikram *et al.*, 2024). However, according to a study by Sulaiman N *et al.* (2024) among several universities in Malaysia, it had been found that more students who did not consume caffeine also has poor sleep quality. This is probably to underlying issues that has not been controlled such as confounding variables, resulting to this result.

According to a systematic review and meta-analysis that includes 24 studies by Gardiner *et al.* (2023), it had been shown that a reduction of 45 minutes from total sleep time and 7% from sleep efficiency was recorded if caffeine was being consumed. From the same systematic review and meta-analysis, it was reported that caffeine consumption may increase sleep onset latency by 9 minutes and increased wakefulness after onset of sleep by 12 minutes (Gardiner *et al.*, 2023). Furthermore, timing and amount of caffeine intake also influenced the quality of sleep a person might have (Gardiner *et al.*, 2023). Hence, it is vital to study the frequency of caffeine intake on a daily and weekly basis to provide more understanding on how caffeine influences sleep quality among university students.

CHAPTER 3: METHODOLOGY

3.1 Research Design

The study design for this research is cross-sectional study.

3.2 Study Area

This study was conducted in Health Campus of Universiti Sains Malaysia in Kelantan.

3.3 Study Population

The subjects involved in this study were USM Health Campus undergraduate students (Year 1 to Year 3) from various courses in School of Health Sciences, School of Medical Sciences, and School of Dental Sciences. This study population were approached via announcement on WhatsApp and physically at Desasiswa Murni 4 (DM4), Pusat Mahasiswa (PUMA), Desasiswa Nurani.

3.4 Subject Criteria

3.4.1 Inclusion Criteria

- Undergraduate students in Health Campus of Universiti Sains Malaysia from Year 1 until Year 3
- Age range between 19 to 25 years old

3.4.2 Exclusion Criteria

- Individuals that are on medications that may affect their sleep quality
- Individuals that do not consume any caffeinated beverages

3.5 Sample Size

The sample size was calculated based on the objectives of this research.

Objectives:

1. To determine the frequency of caffeinated beverages consumption pattern among university students in Health Campus of University Sains Malaysia.

One proportion formula was used to estimate the sample size for this objective.

The formula is shown as below:

$$n = \frac{Z^2 P (1 - P)}{d^2}$$

in which,

n = sample size,

Z = Z-score corresponding to the desired confidence level,

P = anticipated prevalence (proportion), and

d = desired precision (margin of error)

The Z-score was set as 1.96, corresponding to the confidence level of 95%. Next, the desired precision, d was set as 0.05, corresponding to the margin of error tolerated in this study which was 5%. Moreover, as for anticipated prevalence, P was set as 0.9 corresponding to a previous study by Chan & Teoh (2021), in which there was 90% proportion of caffeine consumption among university students.

$$n = \frac{1.96^2 \times 0.9 (1 - 0.9)}{0.05^2} = 138.3 \sim 139 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study is n=155.

$$n_{\text{adjusted}} = \frac{n}{1 - r} = \frac{139}{1 - 0.1} = 154.4 \sim 155 \text{ subjects}$$

2. To determine the body mass index (BMI) among university students in Health Campus of Universiti Sains Malaysia.

One proportion formula was used to estimate the sample size for this objective.

The Z-score was set as 1.96, corresponding to the confidence level of 95%. Next, the desired precision, d was set as 0.05, corresponding to the margin of error tolerated in this study which was 5%. Moreover, as for anticipated prevalence, P was set as 0.776 corresponding to a previous study by Sulaiman N *et al.* (2024), in which there was 77.6% percentage of low BMI (underweight and normal) university students in Malaysia.

$$n = \frac{1.96^2 \times 0.776 (1 - 0.776)}{0.05^2} = 267.1 \sim 268 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study is n=298.

$$n_{\text{adjusted}} = \frac{268}{1 - 0.1} = 297.78 \sim 298 \text{ subjects}$$

3. To assess the level of sleep quality among university students in Health Campus of University Sains Malaysia.

One proportion formula was used to estimate the sample size for this objective.

The Z-score was set as 1.96, corresponding to the confidence level of 95%. Next, the desired precision, d was set as 0.05, corresponding to the margin of error tolerated in this study which was 5%. Moreover, as for anticipated prevalence, P

was set as 0.773 corresponding to a previous study by Sulaiman N *et al.* (2024), in which there was 77.3% percentage of poor sleep quality among university students in Malaysia.

$$n = \frac{1.96^2 \times 0.773 (1 - 0.773)}{0.05^2} = 269.64 \sim 270 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study is n=300.

$$n_{\text{adjusted}} = \frac{270}{1 - 0.1} = 300 \text{ subjects}$$

4. To assess the association between sociodemographic factors and caffeinated beverages consumption among university students in Health Campus of Universiti Sains Malaysia.

a) Gender

Two proportion formula was used to estimate the sample size for this objective. The formula was as shown below:

$$n = \frac{p_1(1 - p_1) + p_2(1 - p_2)}{(p_1 - p_2)^2} (z_\alpha + z_\beta)^2$$

in which,

n = sample size,

p₁ = prevalence of caffeine consumption by the first population,

p₂ = prevalence of caffeine consumption by the second population,

z_α = level of significance, and

z_β = corresponding to the power of study

z_α was set as 1.96, corresponding to level of significance 95%. z_β was set as 0.84, corresponding to the power of study 80%. According to a study by Ikram *et al.*

(2024), P_1 was set as 0.975, corresponding to the percentage (97.5%) coming from caffeine consumption by male university students. P_2 was set as 0.933 corresponding to the percentage (93.3%) coming from caffeine consumption by female university students.

$$n = \frac{0.975(1 - 0.975) + 0.933(1 - 0.933)}{(0.975 - 0.933)^2} (0.84 + 1.96)^2$$

$$= 386.16 \sim 387 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study was $n=1300$ subjects.

$$n_{\text{adjusted}} = \frac{387}{1 - 0.1} = 430 \text{ subjects}$$

$$n_{\text{total}} = n_{\text{male}} + n_{\text{female}} = 430 + 430 = 860 \text{ subjects}$$

b) Age

Two proportion formula was used to estimate the sample size for this objective. z_α was set as 1.96, corresponding to level of significance 95%. z_β was set as 0.84, corresponding to the power of study 80%. According to a study by Kharaba *et al.* (2022), P_1 was set as 0.801, corresponding to the percentage (80.1%) coming from caffeine consumption by older university students. P_2 was set as 0.199 corresponding to the percentage (19.9%) coming from caffeine consumption by younger university students.

$$n = \frac{0.801(1 - 0.801) + 0.199(1 - 0.199)}{(0.801 - 0.199)^2} (0.84 + 1.96)^2$$

$$= 6.90 \sim 7 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study was n=16 subjects.

$$n_{\text{adjusted}} = \frac{7}{1 - 0.1} = 8 \text{ subjects}$$

$$n_{\text{total}} = n_{\text{older}} + n_{\text{younger}} = 8 + 8 = 16 \text{ subjects}$$

c) School

Two proportion formula was used to estimate the sample size for this objective.

- School of health sciences vs school of medical sciences

z_{α} was set as 1.96, corresponding to level of significance 95%. z_{β} was set as 0.84, corresponding to the power of study 80%. According to a study by Rosdi & Hamirudin (2023), P_1 was set as 0.445, corresponding to Kulliyah of allied health sciences and nursing percentage (44.5%) among students that consume caffeinated beverages. P_2 was set as 0.097 corresponding to Kulliyah of medicine percentage (9.7%) among students that consume caffeinated beverages out of 290 students.

$$n = \frac{0.445(1 - 0.445) + 0.097(1 - 0.097)}{(0.445 - 0.097)^2} (0.84 + 1.96)^2$$

$$= 21.66 \sim 22 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study was n=50 subjects.

$$n_{\text{adjusted}} = \frac{22}{1 - 0.1} = 24.44 \sim 25 \text{ subjects}$$

$$n_{\text{total}} = n_{\text{health sciences}} + n_{\text{medical sciences}} = 25 + 25 = 50 \text{ subjects}$$

- School of health sciences vs school of dental sciences

z_{α} is set as 1.96, corresponding to level of significance 95%. z_{β} was set as 0.84, corresponding to the power of study 80%. According to a study by Rosdi & Hamirudin (2023), P_1 was set as 0.445, corresponding to Kulliyah of allied health sciences and nursing percentage (44.5%) among students that consume caffeinated beverages. P_2 was set as 0.038 corresponding to Kulliyah of dentistry percentage (3.8%) among students that consume caffeinated beverages out of 290 students.

$$n = \frac{0.445(1 - 0.445) + 0.038(1 - 0.038)}{(0.445 - 0.038)^2} (0.84 + 1.96)^2$$

$$= 13.42 \sim 14 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study was $n=32$ subjects.

$$n_{\text{adjusted}} = \frac{14}{1 - 0.1} = 15.56 \sim 16 \text{ subjects}$$

$$n_{\text{total}} = n_{\text{health sciences}} + n_{\text{dental sciences}} = 16 + 16 = 32 \text{ subjects}$$

- School of health sciences vs school of medical sciences

z_{α} was set as 1.96, corresponding to level of significance 95%. z_{β} was set as 0.84, corresponding to the power of study 80%. According to a study by Rosdi & Hamirudin (2023), P_1 was set as 0.038, corresponding to Kulliyah of dentistry percentage (3.8%) among students that consume caffeinated beverages. P_2 was set as 0.097 corresponding to Kulliyah of medicine percentage (9.7%) among students that consume caffeinated beverages out of 290 students.

$$n = \frac{0.038(1 - 0.038) + 0.097(1 - 0.097)}{(0.038 - 0.097)^2} (0.84 + 1.96)^2$$

$$= 279.61 \sim 280 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study was n=624 subjects.

$$n_{\text{adjusted}} = \frac{280}{1 - 0.1} = 311.11 \sim 312 \text{ subjects}$$

$$n_{\text{total}} = n_{\text{dental sciences}} + n_{\text{medical sciences}} = 312 + 312 = 624 \text{ subjects}$$

d) Year of Study

Two proportions formula was used to estimate the sample size for this objective.

- Year 1 vs Year 2

z_{α} was set as 1.96, corresponding to level of significance 95%. z_{β} was set as 0.84, corresponding to the power of study 80%. According to a study by Sulaiman N *et al.* (2024), P_1 was set as 0.177, corresponding to Year 1 percentage (17.7%) among students that consume caffeinated beverages. P_2 was set as 0.397 corresponding to Year 2 percentage (39.7%) among students that consume caffeinated beverages.

$$\begin{aligned} n &= \frac{0.177(1 - 0.177) + 0.397(1 - 0.397)}{(0.177 - 0.397)^2} (0.84 + 1.96)^2 \\ &= 62.37 \sim 63 \text{ subjects} \end{aligned}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study was n=140 subjects.

$$n_{\text{adjusted}} = \frac{63}{1 - 0.1} = 70 \text{ subjects}$$

$$n_{\text{total}} = n_{\text{year 1}} + n_{\text{year 2}} = 70 + 70 = 140 \text{ subjects}$$

- Year 1 vs Year 3

z_{α} was set as 1.96, corresponding to level of significance 95%. z_{β} was set as 0.84, corresponding to the power of study 80%. According to a study by Sulaiman N *et al.* (2024), P_1 was set as 0.177, corresponding to Year 1 percentage (17.7%) among

students that consume caffeinated beverages. P_2 was set as 0.333 corresponding to Year 3 percentage (33.3%) among students that consume caffeinated beverages.

$$n = \frac{0.177(1 - 0.177) + 0.333(1 - 0.333)}{(0.177 - 0.333)^2} (0.84 + 1.96)^2$$

$$= 118.48 \sim 119 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study was $n=266$ subjects.

$$n_{adjusted} = \frac{119}{1 - 0.1} = 132.22 \sim 133 \text{ subjects}$$

$$n_{total} = n_{year 1} + n_{year 3} = 133 + 133 = 266 \text{ subjects}$$

- Year 2 vs Year 3

z_α was set as 1.96, corresponding to level of significance 95%. z_β was set as 0.84, corresponding to the power of study 80%. According to a study by Sulaiman N *et al.* (2024), P_1 was set as 0.397, corresponding to Year 2 percentage (39.7%) among students that consume caffeinated beverages. P_2 was set as 0.333 corresponding to Year 3 percentage (33.3%) among students that consume caffeinated beverages.

$$n = \frac{0.397(1 - 0.397) + 0.333(1 - 0.333)}{(0.397 - 0.333)^2} (0.84 + 1.96)^2$$

$$= 883.34 \sim 884 \text{ subjects}$$

Taking into consideration for potential non response rate from the participants at 10%, total respondents of this study was $n=1966$ subjects.

$$n_{adjusted} = \frac{884}{1 - 0.1} = 982.22 \sim 983 \text{ subjects}$$

$$n_{total} = n_{year 2} + n_{year 3} = 983 + 983 = 1966 \text{ subjects}$$