THE ASSOCIATION BETWEEN CAFFEINE INTAKE AND MENTAL HEALTH STATUS AMONG UNDERGRADUATE MEDICAL STUDENT IN HEALTH CAMPUS OF UNIVERSITI SAINS MALAYSIA, KELANTAN

IKA RAFIENA BINTI MUHAMAD NAJISI

SCHOOL OF HEALTH SCIENCE

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THE ASSOCIATION BETWEEN CAFFEINE INTAKE AND MENTAL HEALTH STATUS AMONG UNDERGRADUATE MEDICAL STUDENT IN HEALTH CAMPUS OF UNIVERSITI SAINS MALAYSIA, KELANTAN

By

IKA RAFIENA BINTI MUHAMAD NAJISI

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

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CERTIFICATE

This is to certify that the dissertation entitled “THE ASSOCIATION BETWEEN CAFFEINE INTAKE AND MENTAL HEALTH STATUS AMONG UNDERGRADUATE MEDICAL STUDENT IN HEALTH CAMPUS OF UNIVERSITI SAINS MALAYSIA, KELANTAN” is the bona fide record of research work done by Ms IKA RAFIENA BINTI MUHAMAD NAJISI during the period from “May” 2023 to July 2024 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfilment for the degree of Bachelor of Health Science (Honours) (Dietetics).

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.

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LIST OF ABBREVIATIONS

GAD-7 Generalised Anxiety Disorder

PHQ-9 Patient Health Questionnaire

JEPeM The Human Research Ethics Committee of Universiti Sains Malaysia

WHO World Health Organization

PERKAITAN ANTARA PENGAMBILAN KAFEIN DENGAN STATUS KESIHATAN MENTAL DALAM KALANGAN PELAJAR SARJANA MUDA PERUBATAN KAMPUS KESIHATAN UNIVERSITI SAINS MALAYSIA, KELANTAN

ABSTRAK

Kafein adalah bahan psikoaktif yang banyak digunakan, biasanya untuk meningkatkan kewaspadaan dan prestasi, terutamanya dalam kalangan pelajar. Corak penggunaan dan potensi kesan kafein terhadap kesihatan mental dalam kalangan pelajar perubatan yang sering mengalami tekanan akademik dan psikologi yang ketara masih belum difahami dengan baik. Kajian ini bertujuan untuk meneroka hubungan antara pengambilan kafein dan status kesihatan mental dalam kalangan pelajar perubatan prasiswazah di Kampus Kesihatan Universiti Sains Malaysia Kelantan. Kajian keratan rentas ini melibatkan sampel pelajar perubatan prasiswazah dari Kampus Kesihatan Universiti Sains Malaysia Kelantan. Data mengenai pengambilan kafein dan status kesihatan mental dikumpul melalui soal selidik yang diisi sendiri. Status kesihatan mental dinilai menggunakan Generalized Anxiety Disorder 7 (GAD-7) untuk kebimbangan dan Patient Health Questionnaire 9 (PHQ-9) untuk kemurungan. SPSS versi 27.0 digunakan untuk menganalisis data. Berdasarkan kajian, 64.1% pelajar mengamalkan pengambilan kafein, manakala 35.9% pelajar tidak mengambil kafein. Tidak terdapat hubungan yang signifikan antara status pengambilan kafein dan skor kesihatan mental GAD-7 ($p = 0.478$) dan PHQ-9 ($p = 0.820$). Kajian ini menyimpulkan bahawa tiada hubungan yang signifikan antara pengambilan kafein dan status kesihatan mental, seperti yang diukur oleh skor GAD-7 dan PHQ-9, dalam kalangan pelajar perubatan prasiswazah di Kampus Kesihatan Universiti Sains Malaysia Kelantan. Hasil ini menunjukkan bahawa pengambilan kafein

mungkin bukan faktor utama yang mempengaruhi hasil kesihatan mental dalam populasi ini. Faktor-faktor lain seperti tekanan akademik, faktor budaya, tabiat merokok, keadaan ekonomi, dan sejarah kesihatan mental tidak diperiksa secara langsung dalam kajian ini. Kajian lanjut diperlukan untuk meneroka faktor-faktor lain yang berpotensi mempengaruhi kesihatan mental pelajar perubatan dan untuk memahami implikasi lebih luas pengambilan kafein.

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ABSTRACT

Caffeine is a widely consumed psychoactive substance, commonly used to enhance alertness and performance, especially among students. The consumption patterns and potential impacts of caffeine on mental health among medical students, who are often under significant academic and psychological stress, are not well understood. This study aimed to explore the association between caffeine intake and mental health status among undergraduate medical students at the Health Campus of Universiti Sains Malaysia Kelantan. This was a cross-sectional study that involved a sample of undergraduate medical students from the Health Campus of Universiti Sains Malaysia Kelantan. Data on caffeine intake and mental health status were collected through a self-administered questionnaire. Mental health status was assessed using the Generalized Anxiety Disorder 7 (GAD-7) scale for anxiety and the Patient Health Questionnaire 9 (PHQ-9) for depression. SPSS version 27.0 was used to analyse the data. Based on the study finding, 64.1% of the student consumed caffeine, while 35.9% of the student did not consume caffeine. There was no significant association between caffeine status and mental health scoring of GAD-7 ($p = 0.478$) and PHQ-9 ($p = 0.820$). The study concluded that there was no significant association between caffeine intake and mental health status, as measured by GAD-7 and PHQ-9 scores, among undergraduate medical students at the Health Campus of Universiti Sains Malaysia Kelantan. These results indicate that caffeine consumption might not be a major contributing factor to the mental health outcomes in

this population. Other factors such as academic stress, cultural influences, smoking habits, economic conditions, and mental health history were not directly examined in this study. Further research is needed to explore other potential factors affecting the mental health of medical students and to understand the broader implications of caffeine consumption.

CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Caffeine (1, 3, 7-trimethylxanthine) is an alkaloid which is a large class of organic compounds, belonging to methylxanthine family that were commonly consumed by various population in the world (Kumar *et al.*, 2018). The term caffeine has its origins in two European languages, German and French. Specifically, it derives from the German word "Kaffee" and the French word "café," which both directly translated to "coffee." Caffeine has been a part of global history for thousands of years (Al-Bidhani, Alzobidy & Khudair, 2018). Caffeine is classified as a psychoactive drug and is scientifically recognized as a stimulant. Its primary mechanism of action involves stimulating key parts of the body, including the central nervous system and brain, which can promote wakefulness and combat fatigue (Shadaia, 2020). Caffeine is a stimulant which achieves its effects by binding to adenosine receptors, blocking the binding of adenosine to its receptor. This blockade of adenosine receptors indirectly influences the release of various neurotransmitters such as norepinephrine, dopamine, acetylcholine, serotonin, glutamate, and gamma-aminobutyric acid (GABA). Consequently, the increased production of these neurotransmitters affects mood, memory, alertness, and cognitive function (Fiani *et al.*, 2021).

Caffeine is naturally present in the seeds, leaves and fruits of more than 60 plant species. Caffeine is also found in kola nuts, guarana berries, cocoa beans, and yerba mate (Nehlig, 2018). Coffee, a widely popular beverage, is consumed all around the world, and its most recognizable component is caffeine. Coffee is considered as a primary source of caffeine because it contains more caffeine than most beverages while foods such as chocolate provides relatively small amounts (Drewnowski & Rehm, 2016). Caffeine is also present in numerous other drinks such as tea, soft drinks, energy drinks, and

foodstuffs like cocoa, chocolate, and guarana. It can even be found in sports supplements and medicines (Abalo, 2021). The level of caffeine content can vary significantly between different products. Products which naturally contain caffeine such as coffee, chocolate and tea may differ in caffeine content due to differences in type of plant, growing conditions, processing, and brewing techniques (Stachyshyn *et al.*, 2021). A study among 964 students of Jazan University reported that the most frequently consumed product among the recruited students was coffee (32%), followed by chocolate bars (16%) and soft drinks (12%) (Alfaifi *et al.*, 2022).

Approximately 90 percent of all adults in the world consume caffeine daily (Bryan & Harris, 2023). Malaysia ranks within the top 50 countries globally in terms of per capita caffeine consumption, with an approximate average of 1.3 kilograms consumed per person (Foster, 2021). Different populations use caffeine for various reasons. Its stimulating effects on the central nervous system, that mainly boosts energy levels of the human body, increasing alertness which is one of the key reasons why it is widely consumed worldwide (Gio *et al.*, 2022). Research suggested that caffeine consumption is highly common among college students and the college lifestyle seems to encourage greater consumption of caffeine when compared to the other population (Bertasi *et al.*, 2021). University students reported using caffeine-containing products to boost mood and performance or to satisfy their need for increased alertness (Riera-Sampol *et al.*, 2022). A study among 103 first year medical students in a private medical school in Perak, Malaysia reported that 86% of them consume caffeine to staying awake in class or to study during the night. Other reasons included preference for the taste and health purposes (Ching & Ling, 2021). In addition, a study conducted among Various University Students in the United Arab Emirates (UAE) reported that more than half of the students (59.4%) consumed caffeine for studying and avoiding sleep.

The recommended daily intake of caffeine that is considered safe to be consumed for healthy adults is up to 400 mg of caffeine per day which is about four or five cups of coffee (Food Drug Administration, 2020). The Saudi Ministry of Health also declared that individuals should limit their daily caffeine consumption to 400 mg to prevent any potential side effects (Alshakhs *et al.*, 2022). Caffeine has both benefit and adverse effects on the human body, and its activity concerns a variety of systems including the central nervous system, digestive system, immune system, respiratory system, and urinary tract. These effects are dependent on the type of product in which caffeine is contained, quantity, and on the individual differences among people such as sex, age, and diet (Rodak, Kokot & Kratz, 2021). In addition, the amount of caffeine needed to cause adverse effects varies from person to person and their sensitivity to caffeine. Slow metabolizers may experience negative effects at much lower doses, as low as 50 mg or less, compared to fast metabolizers (dePaula & Farah, 2019).

1.2 Problem Statement

While moderate caffeine consumption can have potential benefits, excessive intake can lead to harmful effects on both physical and mental health. Excessive caffeine consumption can cause caffeine poisoning or caffeinism, which includes symptoms such as anxiety, nervousness, excitement, irritability, perspiration, palpitations, restlessness, nausea, paresthesia, tremor, and possibly dizziness (Willson, 2018). In addition, research suggested that daily consumption of caffeine more than 500-600 milligrams may cause muscle tremors, nervousness, restlessness, and insomnia (Hassan, 2020). A study that was conducted among Korean adolescents revealed that caffeine intake was positively associated with the severity of depression and the severity of insomnia (Rajeswaran *et al.*, 2020).

Caffeine consumption can cause symptoms related to behavior and mood that are associated with psychiatric disorders (López-Cruz, Salamone & Correa, 2018). Caffeine works by inhibiting adenosine receptors, which are found in high concentrations in regions of the central nervous system such as the hippocampus, amygdala, and prefrontal cortex. These areas are associated with emotion, cognition, and motivation, and may therefore play a role in the association between caffeine consumption and depression (Bertasi *et al.*, 2021). In addition, Pifer & St. Arnault (2022) have indicated that consuming caffeine is linked to increased anxiety, reductions in serotonin levels, and potential impacts on mental health, particularly in relation to its interference with sleep patterns. Research showed that university students might be at a particularly high risk of adverse effects due to their high intake of caffeine (Jahrami *et al.*, 2020). A high prevalence of mental health problems, including depression, anxiety, and stress, has been found among college students in general (Makki *et al.*, 2023).

Nowadays, the very competitive nature of the medical field and the hard work may require an increase in the uptake of caffeine by medical students to be capable to work for additional hours, enhance alertness, and improve overall concentration (Jamil, Sadiq & Salih, 2023). Medical students are known to lead a stressful life that requires an extended period of wakefulness and a high level of concentration to cope with their academic workload. Therefore, medical students are one of the most susceptible and more prone to caffeine than others among college students (Al-Turki *et al.*, 2013). The lack of information on student's patterns of caffeine consumption has led us to further determine the association between caffeine intake and mental health status among undergraduate medical student in health campus of Universiti Sains Malaysia, Kelantan with the aim of identifying potential correlation.

1.3 Research Question

The following questions are sought to be answered at the end of the study: -

i. Is there an association between caffeine intake and sociodemographic factors among undergraduate medical student in health campus of Universiti Sains Malaysia?

ii. Is there an association between caffeine intake and attitude towards caffeine among undergraduate medical student in health campus of Universiti Sains Malaysia?

iii. Is there any difference between the perception of consumers and non-consumers toward caffeine intake among undergraduate medical student in health campus of Universiti Sains Malaysia?

iv. Is there an association between caffeine intake and mental health status among undergraduate medical student in health campus of Universiti Sains Malaysia?

1.4 Research Objectives

1.4.1 General Objectives

This study aims to assess the caffeine intake and its association with sociodemographic factors, attitude, and mental health status as well as difference between consumers and non-consumers among undergraduate medical students in health campus of Universiti Sains Malaysia

1.4.2 Specific Objectives

i. To determine the association between caffeine intake and sociodemographic factors among undergraduate medical student in health campus of Universiti Sains Malaysia

ii. To determine the association between caffeine intake and attitude towards caffeine among undergraduate medical student in health campus of Universiti Sains Malaysia

iii. To determine the difference between perception of consumers and non-consumers toward caffeine intake among undergraduate medical student in health campus of Universiti Sains Malaysia

iv. To determine the association between caffeine intake and mental health status among undergraduate medical student in health campus of Universiti Sains Malaysia

1.5 Research Hypothesis

1.5.1 Hypothesis 1

Null Hypothesis (H0)

There is no association between caffeine intake and sociodemographic factors among undergraduate medical student in health campus of Universiti Sains Malaysia

Alternative Hypothesis (HA)

There is an association between caffeine intake and sociodemographic factors among undergraduate medical student in health campus of Universiti Sains Malaysia

1.5.2 Hypothesis 2

Null Hypothesis (H0)

There is no association between caffeine intake and attitude towards caffeine among undergraduate medical student in health campus of Universiti Sains Malaysia

Alternative Hypothesis (HA)

There is an association between caffeine intake and attitude towards caffeine among undergraduate medical student in health campus of Universiti Sains Malaysia

1.5.3 Hypothesis 3

Null Hypothesis (H0)

There is no mean difference between perception of consumers and non-consumers toward caffeine intake among undergraduate medical student in health campus of Universiti Sains Malaysia

Alternative Hypothesis (HA)

There is a mean difference between perception of consumers and non-consumers toward caffeine intake among undergraduate medical student in health campus of Universiti Sains Malaysia

1.5.4 Hypothesis 4

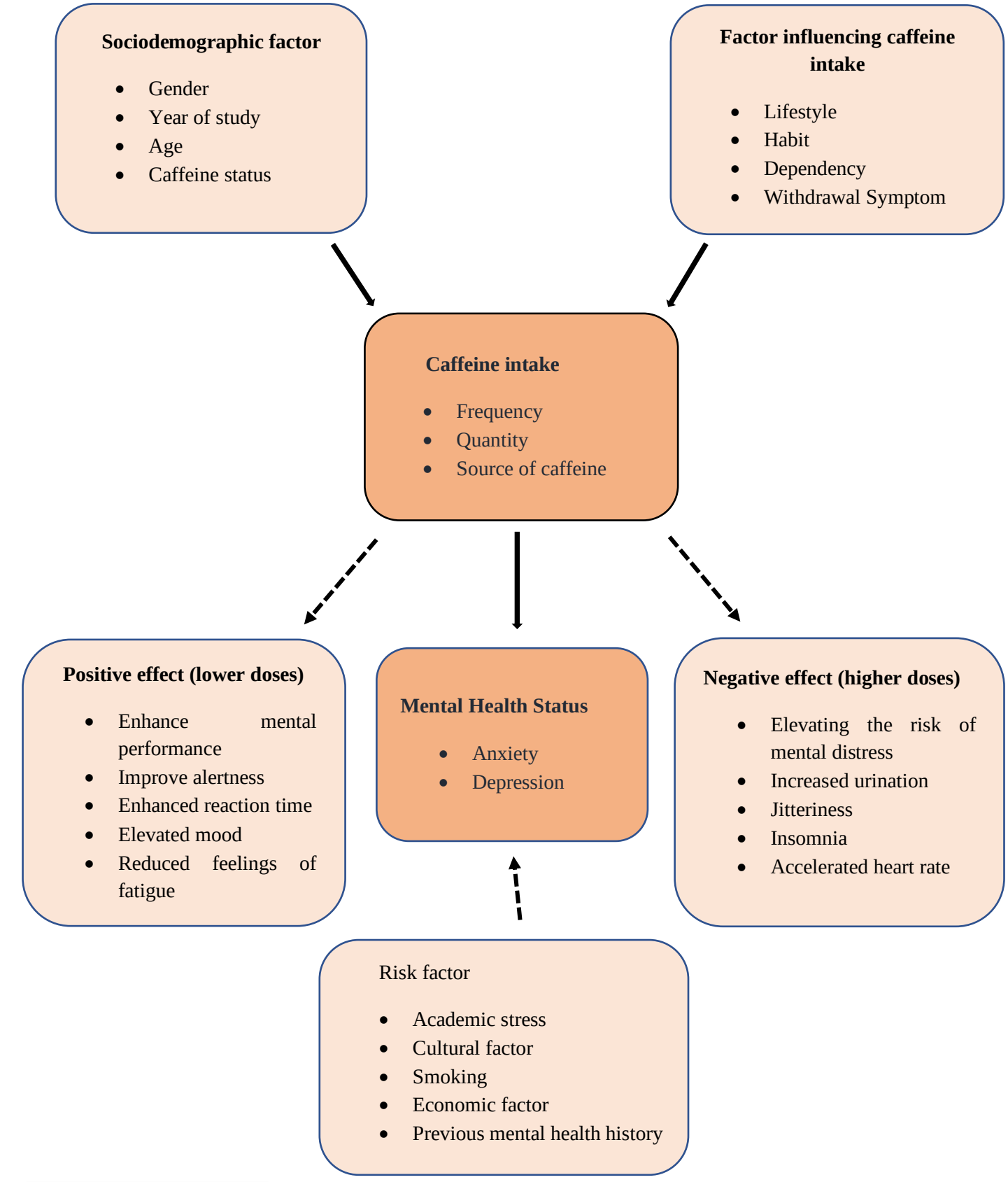
Null Hypothesis (H0)

There is no association between caffeine intake and mental health status among undergraduate medical student in health campus of Universiti Sains Malaysia

Alternative Hypothesis (HA)

There is an association between caffeine intake and mental health status among undergraduate medical student in health campus of Universiti Sains Malaysia

1.6 Conceptual Framework



Caffeine intake is examined in terms of frequency, quantity, and diverse sources. This include the patterns of consumption, whether through coffee, tea, energy drinks, or other sources, and how often and how much caffeine is being consumed by the students. Various factors influencing caffeine intake include lifestyle choices, habitual behavior, physiological dependency, withdrawal symptoms upon reduction, and financial constraints. Sociodemographic factors could influence caffeine intake such as age, gender, and year of study. Attitudes toward caffeine, including perception of its effects, and reasons for consumption, also contribute to this relationship which may affect the quantity and frequency of intake. Those who view caffeine as beneficial or necessary might consume more compared to those who belief in its possible negative health effects (Samoggia & Riedel, 2019a).

The mental health status, consisting of anxiety and depression, serves as crucial indicators within this framework. These parameters reflect the potential psychological consequences or impacts arising from caffeine intake. It suggests that the amount and regularity of caffeine consumption can impact mental health outcomes among these students. High consumption of caffeine (in mg/kg bw) was associated with worse physical and mental health compared to those with lower consumption (Halldorsson *et al.*, 2021). At moderate or lower doses, caffeine often yields cognitive enhancements such as improved alertness, reaction time, elevated mood, and diminished feelings of fatigue. At higher doses, the risk experiencing adverse effects from caffeine consumption rises. These negative effects may include jitteriness, increased urination, insomnia, and accelerated heart rate. However, the effects of caffeine on individuals differ based on genetic and environmental factors, as well as age, sex, and habituation to caffeine (Turner *et al.*, 2023a).

There are certain factors that are not directly related to this study such as academic stress, cultural factor, smoking habits, economic status, and previous mental health history. Academic stress stands as a prominent factor not directly linked to caffeine intake but holds significant potential to impact mental health outcomes among undergraduate medical students. The pressures associated with academic performance, deadlines, and high study load could influence stress, anxiety, and depression levels independently of caffeine consumption (Ruzhenkova *et al.*, 2018). Cultural factor also plays a role that might affect mental health differently across diverse cultural backgrounds (Tirintica *et al.*, 2018). Moreover, smoking habits, economic circumstances, and prior mental health history are additional elements that could act as risk factor, impacting mental health regardless of caffeine intake (Sheldon *et al.*, 2021).

1.7 Significant of Study

The finding of the research will provide information about the association between caffeine intake and the mental health status of medical students in health campus of Universiti Sains Malaysia, Kelantan. Currently, the demanding nature of medical education and workload placed upon medical students can lead to raised stress levels, anxiety, and even depression (Mofatteh, 2021). These mental health issues can have negative effects on the overall well-being and academic performance of students. Understanding the factors that may influence mental health in this specific population is crucial, and caffeine intake is one such potential factor. Given that medical students often turn to caffeine to enhance alertness and cope with the pressures of their studies, it is essential to investigate the potential impact of caffeine on their mental health. Furthermore, the study is justified by the lack of comprehensive research in this specific context. While caffeine's effects on mental health have been studied in various populations, there is a gap in the literature when it comes to its influence on medical

students. Understanding whether caffeine intake impairs mental health issues in this group is crucial for developing targeted interventions and support systems to ensure their overall well-being and academic success. This study has the potential to provide valuable insights that can lead to the development of evidence-based strategies to support the mental health of medical students, ultimately benefiting both the students themselves and the healthcare system.

CHAPTER 2: LITERATURE REVIEW

2.1 Caffeine intake

2.1.1 Frequency of Caffeine Consumption

It has been estimated that over 80% of the world population consumes caffeine (AlSharif *et al.*, 2018). According to the study conducted among 174 respondents in Malaysia, 77.6% of participants consumed coffee and the largest proportion of coffee consumers, accounting for 70.4%, falls within the age range of 18 to 30 years. In contrast, only 3.7% of the surveyed coffee consumers are aged above 55 years. Predominantly, coffee consumers consist of individuals who are either students, comprising 49.6%, or employed in the private sector, making up 34.8% of the total. Caffeine intake varies across different types of beverages and in different population groups (Cheong & Tan, 2021a). Around 85% of individuals in the United States aged 2 years and older, along with approximately 73% of American children, are documented as consuming at least one caffeinated beverage daily (Turner et al., 2023). Caffeine consumption among young adult and young adolescent has increased dramatically over the past decade through both, increased coffee consumption and the so-called "power beverages' (El-Nimr, Bassiouny & Tayel, 2019).

The prevalence of regular caffeinated beverage consumption among adolescents has been reported to reach as high as 83.2%, whereas occasional consumption has been reported at approximately 96% (Khan, 2019). A study conducted across five U.S. universities revealed that 92% of college students regularly consume caffeine (Mahoney *et al.*, 2019). Research suggest that medical students are more prone for consumption of caffeine due to perceive higher levels of stress than students in other health-related disciplines. According to the study conducted among medical and non-medical students at various institutes of Lahore Pakistan, 66% of medical and 57% of non-medical students reported an increase in their caffeine consumption since entering university.

Consequently, it appeared that medical students consume a higher amount of caffeine compared to their non-medical peers (Ahmad, Tayyab & Hinna, 2017). Since caffeine is a psychoactive substance that stimulates the central nervous system, they use to consume caffeine to overcome the stress due to studying (Samaha *et al.*, 2020).

2.1.2 Quantity of Caffeine Consumption

Coffee is one of the most widely consumed caffeinated beverages in the world (Tangade & Priyadarshi, 2023). Globally, coffee consumption was around 176 million of 60 kg bags between 2020 to 2021 (Conway, 2021). From 2013 onwards, a statistical analysis of coffee consumption in Malaysia has been increasing from 635 thousand 60kg coffee bags in 2020 to 800 thousand 60kg coffee bags in both 2021 and 2022 (Statista Research Department, 2023a). In Europe, Scandinavia stands out as the region with the highest coffee consumption, averaging around 10kg per capita annually. Specifically, Finland leads the pack at 12kg per capita per year, followed closely by Norway at 9.9kg, Iceland at 9kg, Denmark at 8.7kg, and Sweden at 8.2kg (International Coffee Organization (ICO), 2019). Based on study involving 16,173 adults from National Health and Nutrition Examination Survey in the United States, the average usual caffeine intake per person was 169±4 mg/day and the intake were highest among individuals aged 50 to 54 years, lowest among those aged 20 to 24 years, and intermediate among individuals aged 70 to 74 years and 75 to 79 years (Lieberman, Agarwal & Fulgoni, 2019).

In fact, according to Statista, individuals aged 55 and above constitute the demographic that consumes the most coffee, with nearly three-quarters of Americans in this age group enjoying at least one cup per day (Ridder, 2022). According to the research from different universities in Bahrain, approximately 76% of the participants consumed at least one cup of regular coffee per day with the average daily caffeine intake was estimated to be 268 mg/day from various sources. The findings show a slight increase

compared to the published figures for caffeine intake among U.S. and Dutch university students, who typically consume an average of 159 mg/day and 144 mg/day, respectively. It is recommended that healthy adults can safely consume around 400mg of caffeine a day and it does not associate with adverse health effects (Kim, 2018).

2.1.3 Sociodemographic Factor and Caffeine Intake

Caffeine intake patterns often vary across different demographics. The different age groups exhibited notable impacts on both the percentage of consumers and the quantities of consumption. According to National Health and Nutrition Examination Survey (NHANES 2011–2016), 38.9% of individuals consumed coffee among those 20–30 years while in the group aged 71 years and older, the prevalence of coffee consumption was 74.3% (Rehm *et al.*, 2020). Data from the Korean National Health and Nutrition Examination Survey (KNHNES), carried out between 2010 and 2012 indicated that individuals aged 30 to 49 years exhibited the greatest caffeine intake, averaging 101.83 mg/day or 1.55 mg/kg body weight per day (Verster & Koenig, 2018). Women exhibited a notably higher tendency to consume caffeine from various sources, including coffee, tea, soda, and other beverages, compared to men (Dillon *et al.*, 2019). A study involving 1248 students across five U.S. universities revealed that students, particularly women, tend to consume a slightly higher amount of caffeine than the general population of individuals aged 19-30 years, although their intake remains lower than that of individuals aged 31-50 years (Mahoney *et al.*, 2019).

Students depend on coffee to enhance their academic performance by employing a range of learning skills, such as memory retention (Jamaludin *et al.*, 2021). Regarding cognitive function and alertness, findings from a study involving female students in Saudi Arabia revealed a correlation between higher academic performance and increased coffee

consumption. The study showed that first year student has a higher consumption of coffee as compared to final-year students (Alfawaz *et al.*, 2020). First-year students often consume higher amounts of coffee due to prolonged studying during stressful conditions like exams, aiming to improve their academic performance (Simpson, 2016).

2.1.4 Attitude and Perception toward caffeine and caffeine intake

Health beliefs play a significant role in both encouraging and discouraging coffee consumption. The impact of coffee can influence whether a person desires to consume it or abstain. While many are drawn to its perceived benefits like alleviating migraines or boosting energy, others, particularly those dealing with insomnia or anxiety, tend to perceive coffee as harmful and choose to avoid it (Samoggia & Riedel, 2019b). In addition, a study conducted in Portugal-Lisbon urban area indicated that the positive effects of coffee, such as increased alertness and energy, serve as driving forces encouraging consumption. Conversely, concerns about negative health effects stand as significant reasons for abstaining from coffee intake (Samoggia, Del Prete & Argenti, 2020). According to a survey from the Institute for Scientific Information on Coffee (ISIC), many consumers have expressed confusion when it comes to understanding the health advantages and disadvantages associated with drinking coffee (Medical Daily, 2016). It was reported that just 16% of consumers mentioned hearing about coffee's health benefits, a drop from 20% in 2015. Additionally, a significant 66% expressed concerns about reducing their caffeine intake (Auffermann, 2017).

2.2 Mental Health Status

2.2.1 Mental health (Depression and anxiety)

Mental health conditions are increasing worldwide, and the prevalence rates were 28.0% for depression, 26.9% for anxiety, 24.1% for post-traumatic stress symptoms, 36.5% for

stress, 50.0% for psychological distress, and 27.6% for sleep problems (Nochaiwong *et al.*, 2021). Depression, anxiety, and stress are the most common mental health condition in the world (World Health Organization, 2023). It was suggested that younger individuals exhibited a significantly greater prevalence of generalized anxiety and depressive symptoms when compared to older individuals (Huang & Zhao, 2020). Moreover, research conducted across multiple age groups in Poland highlighted that younger individual within the age of 18–29 and 30–44 reported more elevated levels of depressive and generalized anxiety symptoms compared to older adults aged between 45–59 and 60–85 years (Gambin *et al.*, 2021).

Depression and anxiety are the most prevalent and widespread among students (Satish *et al.*, 2023). According to the National Health and Morbidity Survey conducted by Ministry of Health (MOH) in Malaysia, the prevalence of mental health problems among people aged 16 years and above was 29.2% as approximately 4.2 million (Ahmad *et al.*, 2015). The National Health and Morbidity Survey 2017 in Malaysia involved over 30,000 secondary school adolescents aged 13 to 17, representing Malay, Chinese, and Indian revealed prevalence rates of 18.3% for depression, 39.7% for anxiety, and 9.6% for stress among these adolescents (Institute for Public Health, 2017). Studies indicated that one-third of undergraduates exhibiting significant symptoms of a mental health problem such as anxiety that affecting 38% to 55% of students (Oswalt *et al.*, 2020). Studies also indicated that mental health much more prevalent in medical student compared to other majors and have been reported to be continuously increasing (Zeng *et al.*, 2019). There are many factors that can influence mental health. These include genetics, diet, exercise, substance use, psychological well-being or stress, relationships, and sleep (Merlo & Vela, 2022).

2.2.2 Stress Level

Stress refers to the psychological response elicited when individual faced with challenging and threatening situations prompting the activation of various defense mechanisms (Cheng & Mohd Kamil, 2020). This response involves the activation of psychological, behavioral, and physiological systems aimed at coping with the perceived stressor. However, chronic, or extreme stress results in prolonged activation of these response systems leading to dysregulation and adverse psychological and behavioral outcomes (Smith & Pollak, 2020). In a mental health and wellness survey carried out by Rakuten Insight in Malaysia in May 2022, 59% of participants aged 16 to 24 reported experiencing heightened levels of stress or anxiety in the preceding 12 months. Conversely, among respondents aged 25 to 34, 34% noted that their stress and anxiety levels remained consistent with the previous year (Statista Research Department, 2023).

Similarly, stress is considered as a common mental health problem among students (Barbayannis *et al.*, 2022). According to Globe Newswire, 45% of high school students indicated experiencing stress all the time (Collins, 2018). According to a 2015 American College Health Association-National College Health Assessment survey, three in four university students self-reported feeling stressed (American Psychological Association, 2020). A study among 314 medical and 291 nonmedical students that conducted in Minia University showed that the prevalence of perceived stress was slightly higher (88.9%) among medical students than among nonmedical students (83.5%) (Seedhom *et al.*, 2019). Medical students often experience high level of stress levels from various sources. These may include the pressures of daily life, the heavy academic workload, limited relaxation time, the extensive and intricate nature of the subject matter, and frequency of examinations in a highly competitive environment (Gazzaz *et al.*, 2018). However, stress would not be included in the study.

2.2.3 Anxiety, Depression and Caffeine Intake

Diet has been associated with mental health (Nouri-Majd *et al.*, 2022). College students, burdened with excessive workloads, often turn to caffeine to counter their energy deficits or time to complete their academic work (Freetly, 2018). Adult, turn to caffeine to increases in alertness throughout the working day (Goh *et al.*, 2023). Caffeine enhances mental performance by reducing feelings of fatigue and triggering the release of dopamine, contributing to an improved sense of well-being. However, it also stimulates the hypothalamic-pituitary-adrenal (HPA) axis in a dose-dependent manner, potentially elevating the risk of mental distress (Begdache *et al.*, 2023). Since caffeine is not limited to coffee and beverage but also exists in sodas and various other sources, majority of consumers are not aware of amount of caffeine in their caffeinated beverages and its potential effects on them (Choi, 2020). When caffeine is consumed in large doses, it can cause anxiety, restlessness, depression, fidgeting, insomnia, irritability, agitation and elevated or irregular heart rate (Evans, Richards & Battisti, 2023). However, lack of studies focusing on the associations between coffee consumption and common mental health, and reported inconsistent findings, indicating either a negative, a positive, or no association between them (Min *et al.*, 2023).

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Research Design

This is a cross-sectional study that involves data collection through the distribution of questionnaires by using online platform to the target respondent among undergraduate medical student from first to fourth-year batches in health campus of Universiti Sains Malaysia, Kelantan. Cross-sectional study design is chosen for this study because it involves collecting data at a single point in time. This method is suitable as it allows to collect information of the samples in a short period of time and easy to perform. Informed concern was obtained electronically before data were collected from respondent.

3.2 Study Area

The study was conducted at health campus of Universiti Sains Malaysia Kelantan, where medical students are enrolled. This campus would serve as the primary location for data collection. The data collection method, as mentioned, involves distributing questionnaires through an online platform to gather information on caffeine intake habits and mental health indicators among the targeted respondents.

3.3 Study population

Reference population

All undergraduate year 1-4 medical students at the Health Campus of the Universiti Sains Malaysia

Target population

Year 1-4 undergraduate medical students at the Health Campus of the Universiti Sains Malaysia who are actively enrolled during the time of the study

Study frame

The list of all currently enrolled undergraduate year 1-4 medical students at the Health Campus of the Universiti Sains Malaysia.

3.4 Subject criteria

3.4.1 Inclusion Criteria

a) Student aged 20 years old – 30 years old

b) Undergraduate medical student

c) Able to understand English

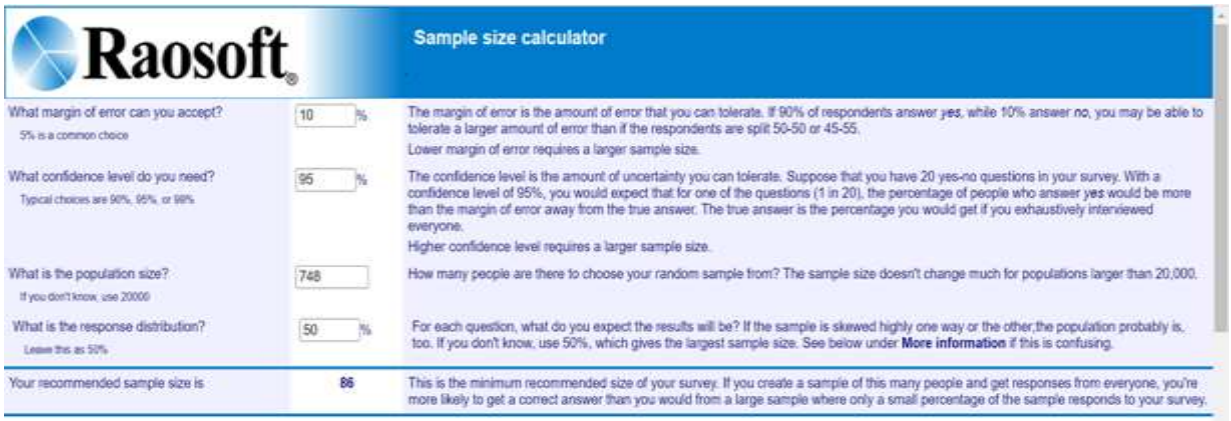
d) Voluntary agreed to participate in the study

3.4.2 Exclusion Criteria

a) Year 5 medical student

3.5 Sample Size Estimation

The sample size was calculated by using a software, called 'Raosoft Software'.



To calculate sample size, 95% confidence interval, 10% margin of error were assumed. A total of 86 out of 748 medical students were recruited for this study. However, the percentage sample size was increased up to 20% to prevent a low response rate. Hence, a total sample of 103 participants were included in this study.

3.6 Sampling Method and Subject Recruitment

The sampling method used in this research was convenience sampling, where the participants are chosen because they can be accessed easily and conveniently. Other than that, participant who met the inclusion criteria will be chosen for this study. However, the participants must voluntarily agree to participate in this study. The participant needs to read research info and an informed consent will be obtained from all participants. The first 103 participant who complete the questionnaire voluntarily are selected as this research subject. The convenience sampling method is a cost-effective way to gather data compared to more elaborate sampling techniques, which might involve extensive screening or selection processes.

3.7 Research Tools

The questionnaire (refer to appendix 2) used in the study are adopted from previous study with approval from the author (Annuar *et al.*, 2023). This questionnaire consists of 5 sections.

i)Section A: Socio-demographic

There are four questions regarding subject's personal information that are related to the sociodemographic characteristic. It includes of age, gender, year of study, and caffeine status (consumed or non-consumed).

ii)Section B: Pattern of Caffeine Intake

This section comprised questions related to the pattern of caffeine intake. The question includes purpose, type of caffeinated beverages, frequency and the factors influencing the caffeine intake.

iii)Section C: Anxiety and Depression

This section contains Generalised Anxiety Disorder (GAD-7) and the Patient Health Questionnaire (PHQ-9). The GAD-7 use to measures the severity of generalized anxiety disorder symptoms, such as excessive worry, restlessness, and irritability, by asking respondents to rate the frequency of these symptoms over the past two weeks. Similarly, the PHQ-9 assesses the severity of depression including low mood, loss of interest, and changes in appetite or sleep. This section is a Likert- type with four options to measure frequency: 0 (Not at all),1 (Several days), 2 (More than half the days) and 3 (Nearly every day). The total question in this section is 16 questions.

The total score of these scales were interpreted as follows: Generalised Anxiety Disorder (GAD-7): normal (0 - 4), mild (5 – 9), moderate (10 - 14), severe (15 – 19) anxiety. Patient Health Questionnaire (PHQ-9): minimal (0 – 4), mild (5 – 9), moderate (10 – 14), moderately severe (15 – 19), severe (20 – 27) depression.

iv)Section D: Attitude toward caffeine

This section consists of 9 questions related to attitude toward caffeine (Poor attitude = 9 to 19, Moderate attitude = 20 to 32, Good attitude = 33 to 45). These questions are design to know the subject's general feelings about statement given. All items were measure using a five-point Likert scale (1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5 =Strongly Agree).

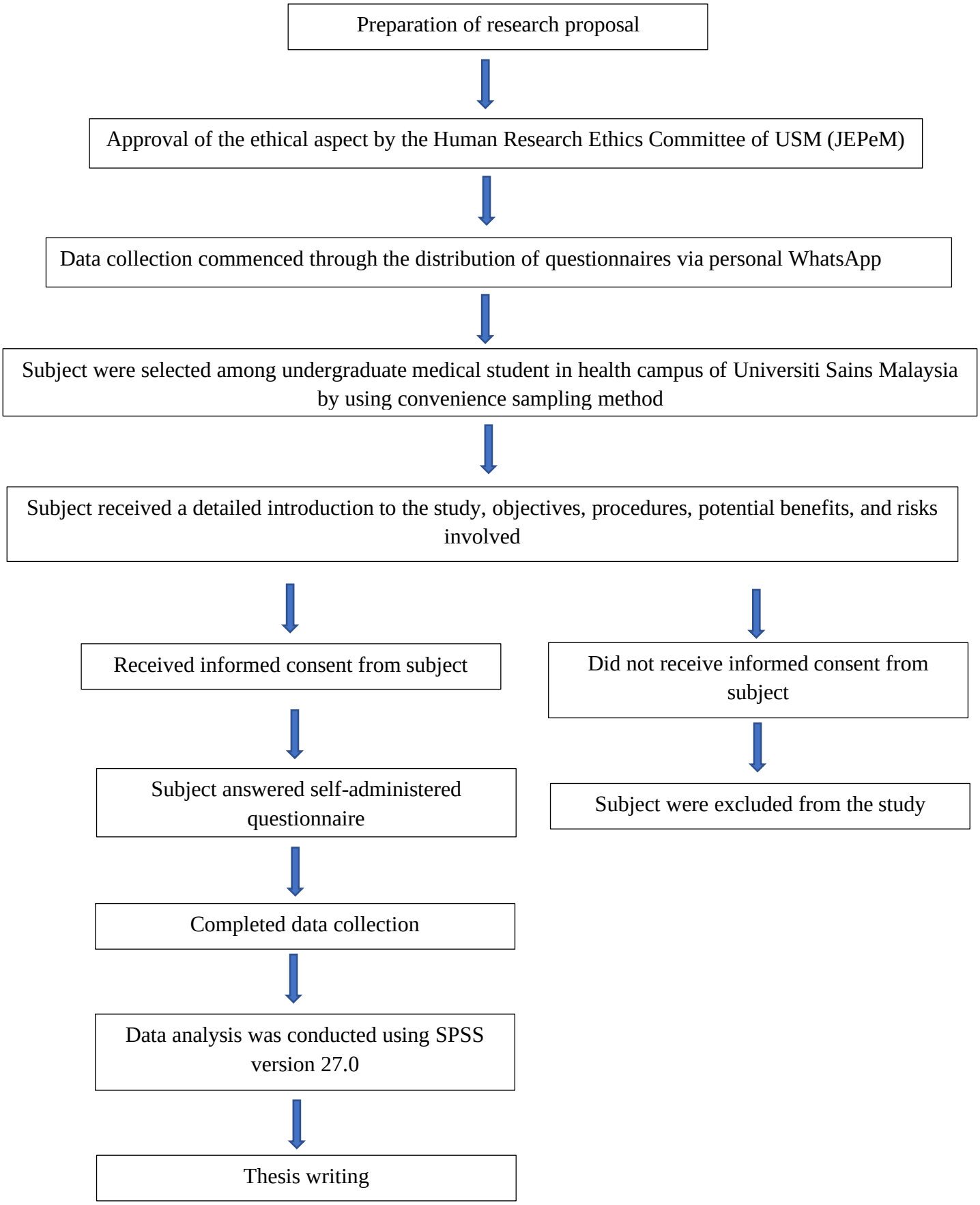
v)Section E: Perception toward caffeine

This section has 6 questions. All items were measure using a five-point Likert scale (1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5 =Strongly Agree).

The online questionnaires were shared using the Google Form platform, then distributed to respondents through WhatsApp.

3.8 Data collection Method

Data collection was conducted among undergraduate medical student in health campus after receiving ethical approval from the Human Research Ethics Committee of Universiti Sains Malaysia. Initially, each of the potential participant who met the inclusion criteria was chosen. The questionnaire was distributed via personal WhatsApp, allowing participants to complete it through an online Google Form. Each participant received a detailed introduction to the study, objectives, procedures, potential benefits, and risks involved. They were informed of their right to refuse from participating.

For participant who agreed to participate in the study, commenced consent were obtained before the study can begin. A clear instruction was provided in the questionnaire to ease the participant. They could also leave the study at any point with no penalty or loss of benefits. However, the rejected participants were disqualified and were not required to participate in the study. The data collected were protected and confidentiality was ensured.

3.9 Study Flowchart