THE CORRELATION BETWEEN PERCEIVED STRESS LEVELS AND SUGAR-SWEETENED BEVERAGE (SSB) CONSUMPTION AMONG UNDERGRADUATES' STUDENTS IN USMKK

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CERTIFICATE

This was to certify that the dissertation entitled "The Correlation Between Perceived Stress Levels and Sugar-Sweetened Beverages (SSB) Consumption Among Undergraduates Students in USMKK" was the bona fide record of research work done by Ms Umi Aliyah Binti Mohd Zulkifli during the period from under my supervision. I have read this dissertation and that in my opinion it confirms to acceptable standard scholarly presentation and was fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfilment for the Bachelor of Health Sciences (Honours) (Dietetics).

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DECLARATION

I hereby declare that this dissertation was 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 degrees at the Universiti Science Malaysia or other institutions. I grant Universiti Science Malaysia the right to use the dissertation for teaching, research and promotion purposes.

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LIST OF ABBREVIATIONS

PSS   Perceived Stress Scale

SSB   Sugar-sweetened Beverages

BEVQ   Beverage Intake Questionnaire

JEPeM   The Human Research Ethics Committee of University Science Malaysia

NHMS   National Health and Morbidity Survey

SD   Standard Deviation

SPSS   Statistical Package of Social Science

USM   Universiti Sains Malaysia

WHO   World Health Organization

KORELASI TAHAP STRESS YANG DIRASAKAN DENGAN PENGAMBILAN MINUMAN BERGULA DALAM KALANGAN PELAJAR PRASISWAZAH USMKK

ABSTRAK

Pengambilan makanan berkalori tinggi, makanan yang diproses dan tabiat makan yang tidak sihat dikaitkan dengan tekanan, termasuk tekanan yang dirasakan. Kajian ini bertujuan untuk menentukan hubungan antara tahap tekanan yang dirasakan dan minuman manis di kalangan pelajar sarjana muda di Universiti Sains Malaysia (USM) Kampus Kesihatan. Dua ratus lima puluh tiga responden telah dipilih menggunakan kaedah sampel secara rawak. Dalam kajian ini, satu set soalan-soalan yang dikendalikan sendiri yang terdiri daripada data sosiodemografi, Skala Stres Dipercayai (PSS-10), sumber makanan dan minuman, corak pengambilan minuman manis (SSB), dan Soal-selidik Pengambilan Minuman (BEVQ-15) digunakan. Kajian ini mendedahkan bahawa 56.7% daripada responden dari bidang berkaitan kesihatan seperti Perubatan, Pergigian dan Sains Kesihatan mempunyai pengambilan SSB yang rendah yang merujuk kepada kurang daripada 250mL sehari. Sebahagian besar 80.1% pelajar mempunyai tahap tekanan yang dipandang sederhana (14-26). Korelasi positif yang signifikan telah dijumpai antara tahap tekanan yang dirasakan dan pengambilan minuman manis (SSB) dalam kalangan pelajar sarjana muda di Kampus Kesihatan Universiti Sains Malaysia (USM), yang diuji menggunakan ujian korelasi Spearman *(r = 0,153, p = 0,013)*. Kesimpulannya, ia adalah penting untuk memberi keutamaan kepada kesihatan mental, terutamanya pengurusan tekanan, kerana ia boleh menyumbang kepada tabiat makan yang tidak sihat seperti pengambilan minuman manis. Oleh itu, terdapat keperluan untuk menyiasat mekanisme khusus yang menghubungkan tekanan dan penggunaan SSB serta faktor menyumbang kepada pengambilan SSB untuk mewujudkan intervensi bagi mengurangkan pengambilan minuman bergula dalam kalangan pelajar universiti.

THE CORRELATION BETWEEN PERCEIVED STRESS LEVELS AND SUGAR-SWEETENED BEVERAGES (SSB) CONSUMPTION AMONG UNDERGRADUATES' STUDENTS IN USMKK

ABSTRACT

The consumption of high-calorie, processed foods and unhealthy eating habits was associated with stress, including perceived stress. This study aimed to determine the correlation between perceived stress levels and sugar-sweetened beverages among undergraduate students at University Sains Malaysia (USM) Health Campus. Two hundred fifty-three undergraduates were chosen using random sampling method. A set of self-administered questionnaires which consisted of socio-demographic data, Perceived Stress Scale (PSS-10), sources of food and drink, consumption patterns of sugar-sweetened beverages (SSB), and Beverage Intake Questionnaire (BEVQ-15) were used in this study. The study revealed that 56.7% of respondents from health-related field such as Medicine, Dentistry and Health Sciences had low SSB consumption which referred as less than 250mL per day. Majority 80.1% of the students had moderate perceived stress level (14-26 score). Significant, weak positive Correlation were found between perceived stress levels and consumption of sugar-sweetened beverages (SSB) among undergraduate students at University Sains Malaysia (USM) Health Campus, tested using Spearman's Correlation test (*r =0.153, p=0.013*). In conclusion, it was crucial to prioritize mental health, particularly stress management, as it can contribute to unhealthy eating habits such as consuming sugary drinks. Hence, there is a need to investigate the specific mechanisms linking stress and SSB consumption as well as the factors contribute to the SSB intake in order to create interventions to reduce SSB consumption among the university students.

CHAPTER 1

INTRODUCTION

1.1 Background of study

The pursuit of higher education at the university level can often be accompanied by significant levels of stress, as it was a common experience for students to encounter stress at some point during their academic journey. Stress was defined as a real or perceived threat to an individual's physiological or psychological integrity that results in physiological and/or behavioural responses (McEwen, 2007). Students enrolled in health care courses might be at an elevated risk of experiencing stress compared to their counterparts in other academic disciplines. This susceptibility might stem from exposure to a heightened burden of academic, social, and financial stressors (Sharp & Theiler, 2018). Elevated stress levels among university students might also be linked to the engagement in risky behaviours, such as smoking and substance abuse and unhealthy dietary behaviour (Tavolacci *et al.*, 2013).

Moreover, stress or more specifically metabolic stress has been associated with food based on two situations which were when food was restricted or consumed in excess (Ulrich *et al.*, 2015). Similarly, caloric restriction and/or fasting, as metabolic stressors, promoted a resilient metabolic adaptation, while an excess of food or drink consumption promoted maladaptation and the development of vulnerabilities which refers to the increased risk of metabolic diseases such as obesity, type 2 diabetes, cardiovascular diseases, and cancer that were associated with overeating and excessive calorie intake (Adam & Epel, 2007). Stress triggers the body and produces a response called 'fight or flight' that releases cortisol hormone which induces hunger. Hence, this makes our body crave energy to combat the stressor. When this situation happens, individuals, specifically students, would choose unhealthy energy dense food as options (DiMichele, 2017; Ludy *et al.*, 2018; Whatnall *et al.*, 2021).

There was an increasing body of evidence indicating that regular consumption of sugar-sweetened beverages (SSB) was associated with metabolic and inflammatory dysfunctions (De Koning *et al.,* 2012). Epigenetic changes, which refer to environmental factors influencing gene regulation, were frequently associated with diet. These changes exemplify the ability of cells to adapt in different tissues and organs, thereby affecting their function over an individual's dietary lifetime. These adaptations had an impact on the central nervous system as well as various organs, leading to the regulation of food and beverage intake, as well as mechanisms controlling appetite and satiety. Furthermore, these adaptations were accompanied by changes in metabolism, such as the accumulation of lipids, and have an impact on immune, endocrine, and autonomic functions (Beaulieu *et al.,* 2018).

Sugar-sweetened beverages (SSB) have the ability to directly impact the brain's reward system, leading to changes in stress responses. These changes can subsequently influence eating behaviour, as well as metabolic and biological stress responses (Dallman *et al.,* 2005; Morrwas *et al.,* 2015; Pool *et al.,* 2015). In addition, research has demonstrated that consuming SSB can have a positive impact on reducing stress levels (Ulrich *et al.,*2015). However, there was a lack of research examining the correlation between perceived stress levels and sugar-sweetened beverage (SSB) consumption among university students in Malaysia wherein one research conducted in Mexico by Campos-Ramírez *et al*., (2023) demonstrates for the first time the Correlation between perceived stress and SSB consumption and suggests that it was connected to gender in the young population. Therefore, this study seeks to fill a research gap by examining the relationship between perceived stress levels and consumption of sugar-sweetened beverages (SSB) among undergraduate students enrolled at the Health Campus of Universiti Science Malaysia.

1.2 Problem Statement

University students encounter various stressors, which encompass academic demands, societal norms, and financial worries. Various stressors can result in heightened levels of perceived stress, which have been linked to a variety of adverse health outcomes. These included an increased vulnerability to illness, impaired cognitive abilities, and the adoption of unhealthy coping strategies. Sugar-sweetened beverages (SSB), including sodas, energy drinks, and sweetened fruit juices, were widely consumed by university students due to their popularity and easy accessibility. These beverages served as a significant source of both calories and sugar. Sugar-sweetened beverages (SSB) might offer a short-term increase in energy levels and a perceived alleviation of stress. However, it was important to noted that these beverages contain excessive amounts of sugar and lack essential nutrients. Consequently, their consumption can lead to various health issues such as obesity, type 2 diabetes, and cardiovascular diseases (Chevinsky *et al.,* 2021).

There has been a significant increase in the worldwide consumption of sugar-sweetened beverages (SSB), particularly among young adults aged 20 to 39, as reported by Singh *et al.,* (2015). According to a study conducted by the National Institute of Health Malaysia (NHMS) in 2019, it was found that there was a significant prevalence of high consumption of sugar-sweetened beverages (SSB) among Malaysian undergraduate students aged 19 to 26 years. The study revealed that a staggering 96.5% of the participants reported consuming SSB at least once a week, while 89.3% reported consuming SSB on a daily basis. The results of this study highlight a worrisome pattern of high consumption of sugar-sweetened beverages (SSB) among undergraduate students. This indicated a lack of understanding about the significance of moderating SSB intake. Additionally, the high academic workload and lifestyle of undergraduate students might be a contributing factor to the increased consumption of sugar-

sweetened beverages (SSB).

A growing body of research indicated a potential correlation between perceived stress and the consumption of sugar-sweetened beverages (SSB). Research has indicated that individuals who perceive higher levels of perceived stress were more inclined to consume sugar-sweetened beverages (SSB) (Hong & Peltzer, 2017; Tajik *et al.,* 2017). Furthermore, it was suggested that this relationship might be influenced by the stress-alleviating properties of SSB. Further research was required to gain a comprehensive understanding of the intricate connection between perceived stress and consumption of sugar-sweetened beverages (SSB) among university students. Thus, this study was needed to be done to determine the correlation between perceived stress levels and sugar sweetened beverages consumption (SSB) among undergraduate university students of USMKK.

1.3 Rationale and Justification of Study

This study was designed to identify the correlation between perceived stress level and sugar-sweetened beverages (SSB) consumption among undergraduate students at Universiti Science Malaysia in Kubang Kerian, Kelantan. Sugar-sweetened beverages (SSB) were selected for the study due to their higher prevalence of consumption among adolescents and young adults, which was consistent with the chosen population (Singh *et al.,* 2015). The results of this study would enhance comprehension of the correlation between these variables within the population of university students. Furthermore, the results of this study have the potential to provide insights into the potential health consequences linked to perceived stress levels. Besides, the findings might also enlighten us on other possible health outcomes related to the perceived stress level as this study also intended to raise the awareness among the university students regarding the importance of having a good management of stress and its impacts on

our overall health. In addition, the findings of this study would offer researchers a thorough comprehension of the present prevalence of sugar-sweetened beverage (SSB) consumption and the perceived stress levels among university students at the Universiti Science Malaysia in Kubang Kerian, Kelantan. Furthermore, this study aims to ascertain the sociodemographic characteristics of the students involved.

The data collected from this study will be used to create intervention programmes that were effective in preventing the occurrence of certain issues. Additionally, the study's results highlighted the importance of recognizing the link between individuals' perceived stress levels and their consumption of sugar-sweetened beverages (SSB), as well as the bidirectional impact of these factors on each other. The acquisition of this knowledge has the potential to empowered individuals participating in the study, enabling them to make well-informed decisions regarding their perceived levels of stress and their current consumption habits of sugar-sweetened beverages (SSB). This, in turn, might have the effect of preventing potential health complications in the future. The findings of this study would provide valuable information on the perceived stress levels and consumption of sugar-sweetened beverages (SSB) among university students. This research would contribute to the identification and dissemination of current knowledge in that area, making it a valuable reference for scholars and researchers.

1.4 Research Questions

1. What is the sugar-sweetened beverages (SSB) consumption level among undergraduate students in USMKK?

2. What is the perceived stress level among undergraduate students in USMKK?

3. Is there any correlation between perceived stress level and sugar-sweetened beverages (SSB) consumption undergraduate students in USMKK?

1.5 Research Objectives

1.5.1 General Objectives

To determine the correlation between perceived stress level and sugar-sweetened beverages (SSB) consumption among undergraduate students in USMKK.

1.5.2 Specific Objectives

1. To determine the sugar-sweetened beverages (SSB) consumption level among undergraduate students in USMKK.

2. To identify the perceived stress level among undergraduate students at USMKK.

3. To determine the correlation between perceived stress level and sugar-sweetened beverages (SSB) consumption among undergraduate students in USMKK.

1.6 Research Hypothesis

1.6.1 Hypothesis

Null Hypothesis:

There is no significant correlation between perceived stress level and sugar-sweetened beverages (SSB) consumption among undergraduate students in USMKK.

Alternative hypothesis:

There is a significant correlation between perceived stress level and sugar-sweetened beverages (SSB) consumption among undergraduate students in USMKK.

CHAPTER 2

LITERATURE REVIEW

2.1 Prevalence of Stress

Stress can occur due to the exposure of stressor wherein stressors were the cause of stress. Personal and environmental event that cause stress were referred to stressors (Schneiderman *et al.,* 2005). These included separation from family support, high personal expectations, time, urgency, academic overload, examinations, competitions, attempting to achieve educational goals, despite financial limitations, and lack of leisure time activities (Sharp & Theiler, 2018).

There were two types of stress which were 'favourable stress' that facilitates learning and 'unfavourable stress' supresses learning. Students might exhibit varying perceptions of identical stressors, shaped by their unique cultural backgrounds, personal attributes, life experiences, and coping mechanisms. A moderate level of stress, previously termed 'favourable stress', can promote learning (Rudland *et al.,* 2019). Conversely, excessive stress can contribute to physical and mental health issues (Mofatteh *et al.,* 2021). Moreover, according to Malik et al., (2015) it can erode students' self-esteem and potentially hinder academic performance and personal or professional growth.

Yazdani *et al.,* (2010) claimed that stress was the result of an individual's reaction to stimuli and the interplay between the individual and their surroundings. Stress was a complex phenomenon that encompasses multiple dimensions, mostly centred on the dynamic relationship between an individual and their surrounding environment. There was a cross-sectional study conducted by Tay *et al.,* (2022) among 18–65 years old adults which demonstrated 36% of stress symptoms in the four countries include Malaysia, Indonesia,

Thailand, and Singapore. Participants were recruited via paid advertisements on social media platforms (Instagram and Facebook), as well as on Google Search and Google Display, to participate in the study by completing an online survey on the website of Naluri, a Southeast Asian digital health company that offered structured multidisciplinary health coaching to promote and enhance physical and mental well-being (Tay *et al.,* 2022). Moreover, in the context of university students, one in three undergraduate students in University of Putra Malaysia (UPM) would experience heavy stress which provided evidence of the high prevalence rate of perceived stress (37.7%) among undergraduate students in general (Teo & Jia, 2018)

Another cross-sectional study conducted among undergraduate nursing students in a public university in Malaysia also found that majority of the students had moderate perceived stress. First year nursing students, living at hometown during COVID-19 were the students that recorded high stress in the study conducted by Mohamad Shariff, (2021). The elevated levels of stress experienced by first-year students might be attributed to the impact of the COVID-19 pandemic, which began in early 2020. This global health crisis has resulted in significant changes to the way education was conducted, particularly due to the implementation of Movement Control Orders (MCO). Meanwhile, according to another study conducted by Aslan and Pekince (2020), individuals between the ages of 18 and 20 years old might experience elevated levels of stress due to factors such as disruptions in education and clinical practices during their formative years, a lack of professional knowledge and skills, anxiety related to academic performance, and the implementation of curfews. Hence, this indicated that even without the MCO students in first year would also experience high level of stress.

Furthermore, another cross-sectional study on perceived stress was carried out among 290 undergraduate health sciences students from five public universities in Malaysia. The

findings of this study revealed that 73.4% of the students reported experiencing moderate stress, while 17.6% reported high stress (Abdul Aziz *et al.,* 2023). However, there was currently a scarcity of recent research on the prevalence of perceived stress levels among undergraduate university students studying in the health major, specifically in Kelantan. The lack of knowledge in this area highlighted the importance of conducting a study to investigate this matter further, as stress can emerge as a significant health concern especially among university students.

2.2 Determinants of Perceived Stress

<u>2.2.1 Sociodemographic Characteristics</u>

2.2.1.1 Gender

Gender was found to be associated with perceived stress levels among university students. This reflects on the several studies conducted in Malaysia where the link between gender and perceived stress illustrates that female students reported having higher levels of perceived stress than male students (Teo & Jia, 2018; Ahmad et al., 2019; Aida Aliah et al., 2020). To be more precise, Teo & Jia, (2018) also reported that the female students were almost twice likely to be stressed compared to male students. This gender difference also consistent with previous studies which suggested that female students were more vulnerable to stress than their male fellow students (Shamsuddin *et al.,* 2013; Graves *et al.,* 2021). The underlying cause for the heightened risk observed in female students remains ambiguous. While research has indicated that there was no significant difference in the level of academic stress experienced by female and male students, it was worth noting that females might view difficult and unfavourable situations as more stress-inducing compared to their male counterparts (Dyrbye *et al.,* 2006). Besides, according to McKenzie *et al.,* (2018), there was evidence to suggest that within social contexts, the display of emotions by males might be perceived as indicative of vulnerability and diminished levels of masculinity.

2.2.1.2 Year of Study

The finding also suggested year of study as the determinants of perceived stress levels. A study conducted among undergraduate nursing students during COVID_19 stated that there was a significant relationship has been demonstrated between the first-year student compared to others (Mohamad Shariff, 2021). The first-year student recorded highest record in comparison with other level of study. The reason behind the highest stress levels among first-year student might be due to the outbreak of COVID-19 that shifted the norms of learning into online learning. In the study conducted by Teo & Jia, (2018) among undergraduates' student in University Putra Malaysia (UPM) also showed the same result and they also mentioned that the students in the first year were 2.383 times more likely to be stressed than the fourth-year students. The results of this study align with a prior research investigation that indicated first-year students experience higher levels of stress compared to students in subsequent years of study (Geng and Midford, 2015). This might be due to the social or environment change from being in high school then being enrolled into university which increase their stress levels and seniors might already well adapted and well-adjusted to university environment.

2.2.1.3 Nature of courses

The study also revealed a correlation between perceived stress levels and the nature of courses. In Saudi Arabia, a cross-sectional study was conducted to examine the perceived stress levels among students enrolled in healthcare universities in comparison to non-healthcare students. The findings of the study revealed that a significant proportion in healthcare courses, approximately three-quarters, of the student population reported perceiving themselves as experiencing stress (Alwhaibi *et al.,* 2023). Moreover, the study conducted by Worku *et al.,* (2020) in Ethiopia revealed a significant prevalence of perceived stress among students pursuing Health Sciences, in contrast to their peers in different academic fields. The present

prevalence of perceived stress among the study participants was found to be 63.5% with a moderate stress level. Among the study participants, anaesthesia students reported the highest proportion of perceived stress at 70.5%, followed by pharmacy students at 68.9%. The proportion of perceived stress among medical laboratory, midwifery, public health officer, and nursing students was 67.9%, 63.5%, 58.2%, and 57.3% respectively, with nursing students reporting the lowest proportion of perceived stress. Several reasons contribute to this issue. One reason that might cause anaesthesia students reported to have the highest perceived stress levels was academic-related stress, which includes the pressure to maintain good grades, practical attachments, clinical rotations, and interpersonal relationships with patients, families, and medical personnel. Another reason was environmental-related stress, such as adapting to a new and unfamiliar environment. Lastly, psychosocial-related stressors, like high parental expectations, academic pressure, and financial difficulties, also play a role. A separate investigation carried out in the southwestern region of Saudi Arabia similarly revealed elevated levels of perceived stress among healthcare university students, amounting to 13.6%, compared to 12.0% among non-healthcare university students (Alsaleem *et al.,* 2021). The wide variation in stress levels might be attributed to differences in stress study designs used in various populations, as well as variations in the intensity of personal, family, academic, financial, and university environment stressors.

2.3 Prevalence of Sugar Sweetened Beverages (SSB) consumption

The use of sugar-sweetened beverages among Malaysians has experienced a significant and quick increase within the last 15 years (Lo *et al.,* 2019). Sugar-sweetened beverage was defined as various types of beverages contain free sugars, such as carbonated or non-carbonated soft drinks, fruit and vegetable juices, liquid and powder concentrates, flavoured water, energy and sports drinks, ready-to-drink tea, and coffee, as well as flavoured milk drinks (WHO, 2017).

Adolescents and young adults demonstrated a greater inclination towards the use of sugar-sweetened beverages (SSB) as comparison to individuals in other age brackets (Teng *et al.,* 2019). Singh *et al.,* (2015) reported that the mean daily intake of sugar-sweetened beverages (SSB) across adults across 187 countries was 137.2 mL which was approximately two-thirds of 200 mL glass. Notably, their findings indicate that men consumed an average of 1.7 servings per day, while younger persons consumed an average of 2 servings per day which exhibit much greater consumption levels. According to a study conducted by Teng *et al.,* (2019), the prevailing rates of added sugar consumption in Malaysia were reported to be 9.0% among children and 28.4% among adults. It was worth mentioning that Malaysia was recognized for having the greatest frequency of sugar consumption in the Asia Pacific area, as stated by Zahari et al., (2018). The Malaysian Adult Nutrition Survey (MANS) conducted in 2002/2003 revealed that Malaysian adults consumed an average of approximately 7 teaspoons of sugar sweetened beverages. The total quantity consists of 3 teaspoons of sweetened condensed milk combined with 4 teaspoons of table sugar, which were added to beverages.

Based on the findings of a survey by UNICEF, it was observed that a significant proportion of students in Malaysia, specifically 36%, consumed sugary beverages on a daily basis (Lo *et al.,* 2019). Furthermore, in the same study also stated the average daily sugar

consumption among adolescents in Putrajaya has risen from seven teaspoons in 2012 to 10 teaspoons in 2017, above the recommended limit for adults. According to Lo *et al.,* (2019), the typical sugar consumption of Malaysians amounts to approximately 3kg per year which was equivalent to 8.22g per day and it was primarily through the consumption of sugary beverages. According to data from the food balance sheet, the per capita supply of sugar in Malaysia, which includes sugar crops like cane and beetroot sugar, as well as other sweeteners like raw sugar, honey and other sweeteners, increased from 297 kcal/day in 2005 to 385 kcal/day in 2009 (Amarra *et al.,* 2016).

A study conducted by Haslinda *et al.,* (2008) examined the beverage consumption habits of 6742 participants in Malaysia, specifically targeting individuals aged 18 to 59 years old. The study utilized stratified random sampling to ensure representation from both urban and rural areas. The findings revealed that the most frequently consumed beverage among Malaysians was plain water. A significant portion of the population indicated that they drink plain water at least six times daily. Following plain water, the next most frequently used beverages were tea, with an average consumption of 1.8 times per day, coffee beverages, with an average consumption of 1.6 times per day, and chocolate drink and cordial, with an average consumption of 1.4 times per day with sugar usually added to the beverages (Haslinda *et al.,* 2008). In addition, Haslinda *et al.,* (2008) found that while many Malaysians consume a significant amount of plain water, they also have a high intake of other beverages. The study revealed that approximately 59% of the population typically adds around four tablespoons of sugar per day to their drinks.

2.4 Factors influencing Sugar-Sweetened Beverages (SSB) consumption.

2.4.1 Availability and Accessibility

The availability and accessibility of sugar-sweetened beverages was one of the factors that can influence SSB consumption. The presence of a growing number of self-operated vending machines within the university campus has made it more convenient for students and staff to purchase sugar-sweetened beverages (Rauzon *et al.,* 2020). These beverages include soft drinks, fruit-sweetened juices, canned coffee, energy drinks, and sport drinks (Shi, 2010). According to a study conducted in 51 public school in California, Oregon Washington, Maryland, and Washington DC reported that the school SSB vending machine in the staff lounge led to school staff to be likely to purchase more than 1 SSB per day in comparison to staff without SSB vending machine at the staff lounge (Rauzon *et al.,* 2020). Moreover, another study conducted among students in California using adolescent sample of 2005 California Health Interview survey (CHWAS) which was a biennial population health survey based on telephone interview which showed similar results wherein students who have access to sugar-sweetened beverages through their school vending machines were much more likely to consume these beverages (Shi, 2010; Ponce *et al.,* 2004). In the 2005 CHWAS adolescent sample, participants were asked about the availability of sugar-sweetened beverages (SSB) in vending machines at their school. This variable serves as the main independent variable in the study. This information was considered the outcome variable for the purposes of this study (Shi, 2010). In short, the presence of vending machines in schools and universities that offer sugar-sweetened beverage facilitates increased consumption among students and staff, which might lead to adverse health effects such as obesity and diabetes (Rauzon *et al.,* 2020).

2.4.2 Unhealthy Dietary Pattern and Lifestyle among students

Research studies have shown that individuals who demonstrate a preference for snacks, high-fat food, and fast food tend to also choose high-calorie sweetened beverages that provide little to no nutritional value (Scaglioni *et al.,* 2018). As evidence, a study conducted by Duffey and Popkin (2006) found that individuals who do not follow a healthy dietary pattern were more likely to consume beverages that contain calories. Furthermore, individuals who engage in a sedentary lifestyle have a tendency to consume sugar-sweetened beverages on a more frequent basis (Gan *et al.,* 2019). Unhealthy lifestyle behaviours refer to the lack of engaging in moderate or vigorous physical activity, as well as the habit of watching television for two or more hours per day (Hobbs *et al.,* 2014). Hence, individuals with a sedentary lifestyle were more susceptible to consuming elevated quantities of sugar-sweetened beverages (SSB) due to their tendency to consume these beverages while engaging in activities such as looking at television or sitting in front of a computer (Rehm *et al.,* 2008).

Furthermore, it was worth noting that inadequate sleep quality has been found to be positively associated with increased consumption of sugar-sweetened beverages (SSB) among adolescents of school age (Prather *et al.,* 2016). The observed correlation might be ascribed to the inclination of individuals with shorter sleep durations to engage in the consumption of caffeinated sugar-sweetened beverages (SSB) as a means to enhance their alertness and counteract feelings of drowsiness. In other words, the excessive intake of caffeine has been found to reduce the duration of sleep (Bogart *et al.,* 2013). In addition, coffee consumption among college students serves various purposes, such as enhancing concentration, facilitating wakefulness during nocturnal study sessions, and enabling attendance at early morning classes (McIlvain, Noland, & Bickel, 2011). The aforementioned observation aligns with a study conducted on medical students in South Africa, wherein it was discovered that 62.6% of participants reported caffeine consumption for the purpose of enhancing their academic
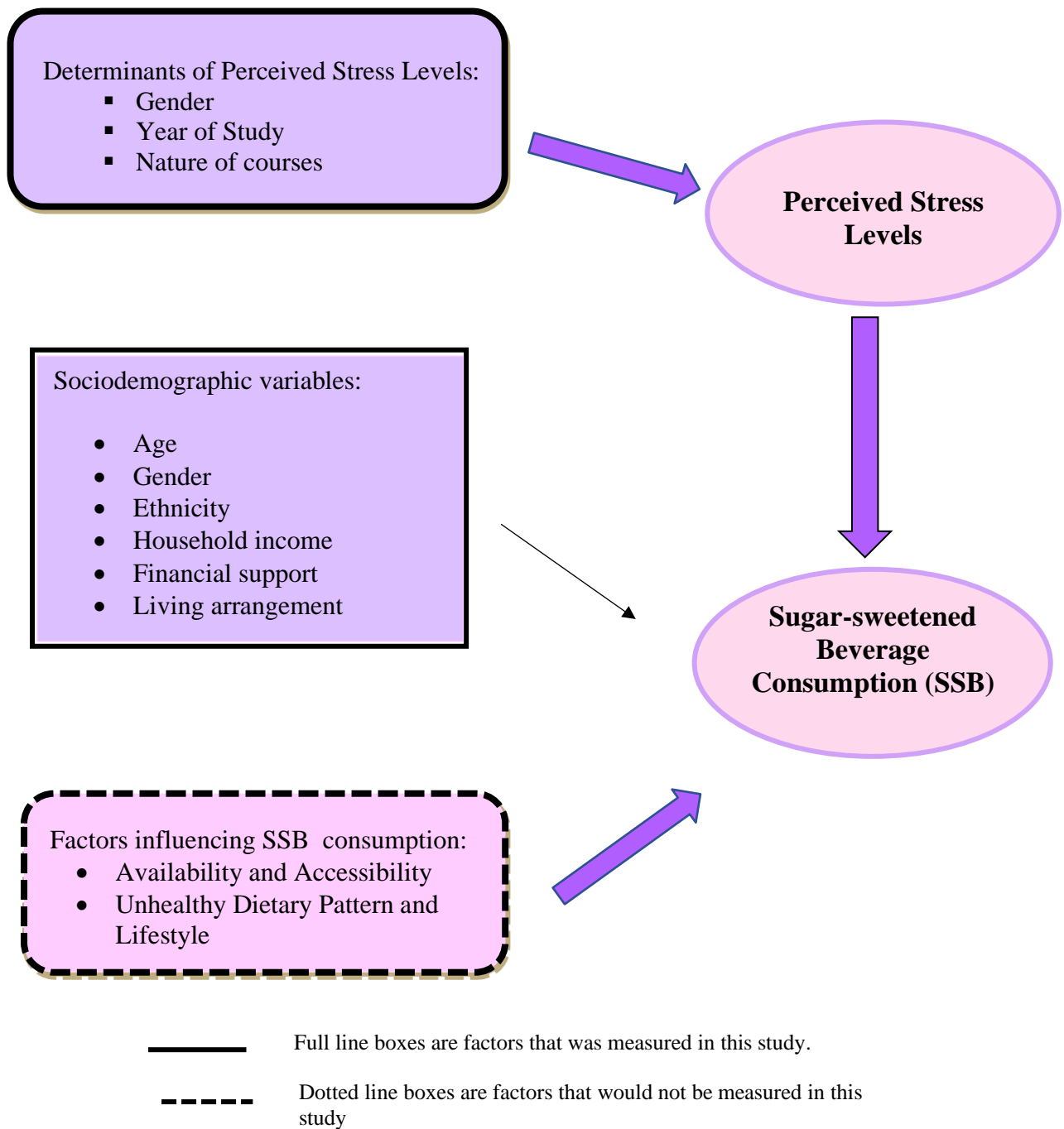
performance (Lee *et al.,* 2009).

2.5 Correlation between Perceived Stress Level and SSB consumption

Perceived stress level was said to have link to the sugar-sweetened beverage consumption of an individual. A research study conducted among 632 university students in central Mexico that aims to determine the correlation between perceived stress levels and sugar-sweetened beverage consumption revealed that female participants reported experiencing higher levels of perceived stress. The perceived stress was measured by using the Cohen Perceived Stress Scale meanwhile SSB consumption, on the other hand was measured using validated questionnaire called SSB Consumption questionnaire. The SSB consumption questionnaire administered inquired about the participants' consumption of various beverage groups, including both caloric and non-caloric versions (Campos-Ramírez *et al.,* 2023). Additionally, this was the first study found a significant correlation between stress levels and the consumption of sugar-sweetened beverages (SSB) especially in women (*r = 0.115, p< 0.05*). The study revealed that women have a tendency to consume more sugar-sweetened beverages (SSB), particularly industrials juices and overall SSB. However, this increase in consumption was only statistically significant for industrialised juices and total SSB. On average, women with high perceived stress scores consumed 1.2 litres more of these beverages compared to women with low perceived stress scores. This finding implied that there was a correlation between stress levels and the consumption of sugar-sweetened beverages (SSB) among university students. Also, it suggested that this relationship might vary depending on the gender of the individuals involved because of the results revealed no significant correlations found between perceived stress level and SSB consumption in men (Campos-Ramírez *et al.,* 2023).

2.6 Conceptual framework

The conceptual framework presented in Figure 1.0 illustrates the relationship between sociodemographic variables and perceived stress levels, as well as the consumption of sugar-sweetened beverages and the factors that influence the intake of these beverages. The framework demonstrates that determinants like gender (Aliah *et al.,* 2020), year of study (Mohamad Shariff, 2021) and the nature of courses (Alwhaibi *et al.,* 2023) have an impact on students' perceived stress levels. The stress levels were associated with the consumption of SSB, which were beverages containing added sugar like soda, juice, and energy drinks. Sociodemographic variables, including age, gender, ethnicity, household income, financial support, and living arrangement, also influence this process.

The framework proposes that students who perceived higher levels of stress were more likely to consume sugar-sweetened beverages (SSB). Consuming sugar-sweetened beverages (SSB) can have detrimental effects on health, including an increased risk of obesity, diabetes, and dental cavities (Malik *et al.,* 2010). The framework suggests that the sociodemographic characteristics of students might influence both their stress levels and their patterns of SSB consumption

Determinants of Perceived Stress Levels:
- Gender
- Year of Study
- Nature of courses

Perceived Stress Levels

Sociodemographic variables:

- Age
- Gender
- Ethnicity
- Household income
- Financial support
- Living arrangement

Sugar-sweetened Beverage Consumption (SSB)

Factors influencing SSB consumption:
- Availability and Accessibility
- Unhealthy Dietary Pattern and Lifestyle

———— Full line boxes are factors that was measured in this study.

- - - - - Dotted line boxes are factors that would not be measured in this study

Figure 1.0 Conceptual framework showing the Correlation between Perceived Stress Level and Sugar-Sweetened Beverage Consumption. Sociodemographic variables in the dotted box would not be tested but might affect the study and the confounding factors were represented in closed box which later on was tested.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Study Design

This study utilized a cross-sectional study design, employing questionnaires to gather data. The data obtained represents the current information of the population and was utilized for subsequent analyses. This cross-sectional study utilized a set of questionnaires to collect data on perceived stress levels and sugar-sweetened beverage (SSB) consumption among university students at USM Health Campus, Kelantan. The cross-sectional study design was chosen because it allows for simultaneous sample information collection at a single point in time, maximizing the completeness of essential data points by examining entire population groups at a specific moment. This method's appropriateness arose from its ability to gather information from samples in a short period and its low budgetary requirements as well as lack of need for follow-up, as there were no treatments administered to the study population.

3.2 Study Area

The Universiti Science Malaysia (USM) in Kubang Kerian, Kelantan was selected as the study site due to its logistical advantages for the researcher in terms of efficient data collection within a compressed timeframe. Moreover, the student population's diverse backgrounds and career aspirations align with the study's aim of incorporating a representative sample from various societal segments. This diversity was further enriched by the institution's global student body, offering a broader perspective on the study's research questions. Additionally, the hectic schedules of USMKK students, particularly those pursuing medical and dental degrees, coincide with the study's parameters, enabling the development of an intervention that can serve as a valuable tool for future research. The study further benefits from a sufficiently broad dataset encompassing individuals aged 19 until 35 years old facilitating a comprehensive analysis and ensuring the study's generalizability to a wider

demographic.

3.3 Study Population

        The study participants comprised full time undergraduates' students between the ages of 19 until 35 years old who were currently enrolled at the Kubang Kerian Health Campus of the Universiti Science Malaysia, Kelantan.

3.4 Selection Criteria

3.4.1 Inclusion Criteria

1. Full time undergraduate USMKK students.

2. Individuals aged 20 until 35 years old.

3. Able to understand and read English language.

3.4.2 Exclusion Criteria

1. Individuals undergoing any dietary interventions.

2. Individual taking any medications that could interfere with normal pattern of beverages consumption and stress level.

3. Pregnant and lactating mother.

4. Individual having pre-diabetes, diabetes mellitus type I or II diagnosed by medical doctors.

3.5 Sample Size Estimation

3.5.1 Sample Size Estimation based on Specific Objective 1: Perceived Stress Level

Sample size was calculated using single proportion formula. The formula was as below:

$$n = \left[\frac{z}{\Delta}\right]^2 p\,(1-p)$$

  n = sample size

  Z = value representing the desired confidence level

  Δ = precision (0.05)

  p = anticipated population proportion

The confidence level was set at 95%, which corresponds to a Z-score value of 1.96. The predetermined level of precision has been set at 5%. Based on a cross-sectional study by Syafiq Abdul Rahman *et al.,* (2021) the prevalence of perceived stress among Malaysian undergraduate first-year students was 91.5% wherein majority of the students categorized into high stress level as determined by scores ranging from 27 to 40 (Syafiq Abdul Rahman *et al.,* 2021). Therefore, the proportion of the population was 0.915.

$$n = \left[\frac{1.96}{0.05}\right]^2 0.915(1-0.915)$$

=120 + 20% (dropout rates added to the samples)

= **144 samples** (undergraduate students enrolled in USMKK were needed in this research)

3.5.2 Sample Size Estimation based on Specific Objective 2: Sugar-sweetened beverages Consumption (SSB)

$$n = \left[\frac{Z}{\Delta}\right]^2 p\,(1-p)$$

n = sample size

Z = value representing the desired confidence level

Δ = precision (0.05)

p = anticipated population proportion

The level of confidence was set to be 95%, and the Z-score value for 95% confidence level was 1.96. The desired level of precision was set at 5%. In the previous cross-sectional study reported on the consumption of sugar-sweetened beverages among university students in Sarawak. The results demonstrated about one-quarter of the participants reported consuming sugar-sweetened beverages (SSB) on a daily basis, accounting for 83.6% of the total respondents. The three most often consumed varieties of sugar-sweetened beverages (SSB) were coffee, flavoured milk, and 3-in-1 sachet drinks (Cheah *et al.,* 2023). Therefore, the population proportion was 0.836.

$$n = \left[\frac{1.96}{0.05}\right]^2 0.836(1-0.836)$$

$= 211 + 20\%$

$= $ **253 samples** (undergraduate students enrolled in USMKK were needed in this research)

3.5.3 Sample Size Estimation based on Specific Objective 3: Correlation between Perceived Stress Levels and Sugar- sweetened beverages Consumption (SSB)

$$n = \frac{p_1(1 - p_1) + p_2(1 - p_2)}{(p, -p_2)^2}\left(z_a + z_\beta\right)^2$$

n = sample size

p = anticipated population proportion

α = level of statistical significance

1-β = power of the study

Za = 1.96 (α = 0.05)

ZB = 0.84 (80% power)

The level of confidence for this study was set to be at 95%. The Z-score value for 95% confidence level was 1.96 and the power of study was set to be at 80%. It was found from a study done among undergraduate students (Teo & Jia, 2018), the prevalence of perceived stress levels was 37.7%. P- value representing the prevalence of perceived stress levels was 0.377. Meanwhile, in another study by Zahari *et al.,* (2018) the prevalence of SSB consumption was 7.18%. P-value represents the prevalence of SSB consumption was 0.0718.

P1 = prevalence of perceived stress levels among undergraduate students = 91.5% = 0.915

P2 = prevalence of SSB consumption = 7.18% = 0.0718

Za = 1.96

ZB = 0.84

$$n = \frac{0.377(1 - 0377) + 0.0718(1 - 0.0718)}{(0.377 - 0.0718)^2}(1.96 + 0.84)^2$$

= 26 + 20% drop-out rates added to the samples

= 31 samples per group

= 31 x 2

= **62 samples** (undergraduate students in USMKK were needed in this research)

Based on all the sample size calculations done from every specific objective of this study, the sample size ranged from 62 to 253. The highest sample size that has been added with 20% of drop-out rate was selected. Thus, a total of 253 participants that fulfil the inclusion criteria would participate in this study.

3.6 Sampling Method and Subject Recruitment

Participant selection for this study employed a probability simple random sampling technique. This method was chosen to ensure a representative sample from the target population of university students at the USMKK Health Campus. Simple random sampling involves assigning an equal probability of selection to each member of the population, eliminating any potential bias in the selection process. This method was widely used due to its fairness and unbiased nature. Probability simple random sampling was particularly suited for this study as it ensures that the sample accurately reflects the characteristics of the broader population. Its implementation was relatively straightforward, making it a practical choice for this research endeavour. Initially, a comprehensive list of students, including their respective email addresses, procured from the esteemed academic office of the School of Medical, Dental and Health Sciences via electronic mail, seeking formal authorization to undertake the research. The participants for this study were selected through a random number method, whereby each individual assigned a numerical value. The selection process was conducted using random number tables to ensure a truly random representation of the population. A representative from each year of study in the School of Medical and Dental, as well as each course in Health Sciences, was contacted with a list of selected students who participated in the study, and participants who voluntarily provide informed consent and meet the established inclusion and exclusion criteria was recruited as participants for the study. Prior to participating, study participants were thoroughly informed about the research objectives, procedures, and potential risks through the provided information sheet and consent forms. They would also be required to complete the study questionnaire.