RELATIONSHIP BETWEEN SLEEP DURATION, SLEEP QUALITY WITH SUGAR-SWEETENED BEVERAGE INTAKE AMONG UNIVERSITI TUNKU ABDUL RAHMAN (UTAR) STUDENTS

By

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ABSTRACT

RELATIONSHIP BETWEEN SLEEP DURATION, SLEEP QUALITY WITH SUGAR-SWEETENED BEVERAGE INTAKE AMONG UNIVERSITI TUNKU ABDUL RAHMAN (UTAR) STUDENTS

Tan Mei Xin

Background: Lately, prevalence of obesity is emerging among university students. Sugar-sweetened beverage (SSB) is the major source of added sugar in their diet, which contributed major calorie towards their daily energy need. Thus, it is crucial to understand the factors associated with their SSB intake. Currently, limited research has been conducted to investigate the influence of sleep on SSB intake of university students. This study aims to determine the correlation between sleep duration, sleep quality and SSB intake among UTAR students. **Method:** A cross-sectional study was conducted among 147 UTAR students. Sleep characteristics (sleep duration and quality) and SSB intake were assessed using Pittsburgh Sleep Quality Index (PSQI) and Beverage Intake Questionnaire (BEVQ-15) respectively. Mean comparison of daily amount of total SSB consumed between sleep duration and sleep quality group was assessed using independent t-test and one-way ANOVA. Pearson correlation was performed to determine the relationship between sleep duration, sleep quality and SSB intake of university students. **Results:** On average, participants aged 21.4 years old, most of them were female (n=76.2%) and

had a low SSB intake (< 1 time per day). Male students consumed significant higher amount of SSB compared to female students (p=0.028). In contrast, no significant difference in amount of SSB intake was observed between sleep duration groups (p=0.222). Similarly, good, and poor sleep quality students had no significant difference in the amount of SSB consumed (p=0.654). **Conclusion:** SSB intake of UTAR students was not concerning. Sleep duration and sleep quality of university students were not correlated to their SSB consumption, so they are not suggested as the primary measure to manage SSB intake of university students. Further study that represents Malaysian university students is needed to warrant the finding for effective health program development.

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DECLARATION

I hereby declare that this final year project report is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

Tan Mei Xin

APPROVAL SHEET

This final year project report entitled " **RELATIONSHIP BETWEEN SLEEP DURATION, SLEEP QUALITY AND SUGAR-SWEETENED BEVERAGE INTAKE AMONG UNIVERSITI TUNKU ABDUL RAHMAN (UTAR) STUDENTS**" was prepared by TAN MEI XIN and submitted as partial fulfilment of the requirements for the degree of Bachelor of Science (Hons) Dietetics at Universiti Tunku Abdul Rahman.

Approved by:

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Mr Cheah Khang Jin Date: 4/9/2022

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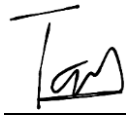
PERMISSION SHEET

It is hereby certified that **TAN MEI XIN** (ID No: **18ADB06930**) has completed this final year project report entitled "**RELATIONSHIP BETWEEN SLEEP DURATION, SLEEP QUALITY WITH SUGAR-SWEETENED BEVERAGE INTAKE AMONG UNIVERSITI TUNKU ABDUL RAHMAN (UTAR) STUDENTS**" under the supervision of Mr Cheah Khang Jin from the Department of Allied Health Science, Faculty of Science.

I hereby give permission to the University to upload the softcopy of my final year project in pdf format into the UTAR Institutional Repository, which may be made accessible to the UTAR community and public.

Yours truly,



(TAN MEI XIN)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BMI	Body Mass Index
FAM	Faculty of Accountancy and Management
FAS	Faculty of Arts and Social Science
FBF	Faculty of Business and Finance
FCI	Faculty of Creative Industries
FEGT	Faculty of Engineering and Green Technology
FICT	Faculty of Information and Communication Technology
FMHS	Faculty of Medicine and Health Science
FSC	Faculty of Science
ICS	Institute of Chinese Studies
LKC FES	Lee Kong Chian Faculty of Engineering and Science
MANS	Malaysian Adult Nutrition Survey
MDG	Malaysian Dietary Guidelines
NHANES	National Health and Nutrition Examination Survey
NHMS	National Health and Morbidity Survey
PSQI	Pittsburgh Sleep Quality Index
RNI	Recommended Nutrient Intakes
SSB	Sugar-sweetened Beverage
SSBs	Sugar-sweetened Beverages
UNM	University of Nottingham Malaysia
UTAR	Universiti Tunku Abdul Rahman
WHO	World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Research Background

Sugar-sweetened beverage (SSB) is defined as beverage with added sugar or added caloric sweeteners, such as high fructose corn syrup, brown sugar, raw sugar, sucrose, fruit juice concentrate, malt syrup and so on (Brand-Miller and Barclay, 2017; Malik and Hu, 2019). Added sugar refers to sugar that are added during food processing, excluding the naturally presented sugar (Mela and Woolner, 2018). Therefore, SSBs include regular carbonated or non-carbonated soft drinks, sport drinks, energy drinks, sweetened coffee, sweetened tea, flavoured milk, cordial drinks, yogurt drinks, fruit and vegetable drinks and other added sugar beverages, whereas 100% fruit or vegetable juices are not considered as a SSB (Brand-Miller and Barclay, 2017).

World Health Organisation (WHO) (2015) emphasises on limiting sugar consumption to combat obesity epidemic, with less than 10% daily calorie intake from free sugar, which was equivalent to 50g or about 12 teaspoons sugar. SSB is recognised as the major source of added sugar, which contributes to calorie intake with no nutritive values. It has a poor satiety effect and incomplete calorie compensation, thereby contributing to obesity (Gombi-Vaca et al., 2016; Gui et al., 2017; Shin et al., 2018). Apart from that, SSB intake also increase the likelihood of

other adverse health risks, such as type 2 diabetes, metabolic syndrome, liver disorder as well as mortality risk of cardiovascular diseases and cancer (Papier et al., 2017; Shin et al., 2018; Chen et al., 2019; Malik et al., 2019). Therefore, it is crucial to limit SSB consumption.

In recent years, the SSB market was dominated by a younger population, with young adults aged 18 to 39 years old being the major SSB consumers (Rosinger et al., 2017; Lundeen et al. 2018; Miller et al., 2020). University students are fall under the young adult category, who have more independence in making decision on their diet intake. Prior study has risen the concern that obesity epidemic was emerging among university students, with approximately 24.2% of male university students and 9.3% of female university students in ASEAN countries were obese (Petlzer and Pengpid, 2017). It is worth mentioning soft drink intake was deemed to be one of the risk factors to obesity among university students (Wan Mohamed Radzi et al., 2019). Despite there was a scarcity of research on SSB consumption of university students, most of the existing studies shows an alarming SSB intake in university students, with nearly 60% to 89.3% had daily SSB consumption (Al-Otaibi, 2017; Bawadi et al., 2019; Ahmad et al., 2019). Thus, factors linked to SSB intake of university students should be addressed to prevent development of lifetime health problems.

University students often confront with problem related to sleep due to academic workload. Seven to nine hours sleep each night is the ideal sleep duration for

university students (Hirshkowitz et al., 2015). Sleep deprivation was defined as getting inadequate amount of sleep, which was less than 7 hours per night for university students (Naito et al., 2021; Suni, 2022). On the other hand, sleep quality is another aspect of sleep. It measures how well the sleep, whether it is a restorative sleep (Ohayon et al., 2017). The indicators used to determine sleep quality including sleep latency, sleep efficiency, number of awakening as well as wakefulness after sleep onset (Ohayon et al., 2017). It is notable that sleep quality should be the prioritized concern over sleep duration. Past studies revealed even if university students meet the recommended amount of sleep, their sleep quality is generally poor (Becker et al., 2018; Du, Zan et al., 2021). Researchers claimed that sugar craving was deteriorated by insufficient sleep, where a positive relationship between sleep and added sugar intake was observed (al Khatib et al., 2018; Zuraikat et al., 2020). As a result, it appears that sleep may be the underlying factor in SSB intake among university students.

Until now, most of the studies has been done among preschoolers or adolescents, rarely concerned with university students (Pérez-Farinós et al., 2017; Sampasa-Kanyinga et al., 2018; Min et al., 2018; Gan et al., 2019). On this basis, the present study aims to examine the relationship between sleep duration, sleep quality and SSB intake among university students.

1.2 Problem Statement

Consuming SSBs may satisfy sweet cravings while also improving mood. However, excessive SSB intake will deteriorate our health and increase the risk of obesity and chronic diseases. In recent years, obesity was existing in Malaysian university students, with 37.5% of them are overweight or obese. Meanwhile, soft drink intake was deemed to be the determinant of obesity among this population (Wan Mohamed Radzi et al., 2019). SSB contributed significantly to daily energy intake of university students, with more than 10% of daily calorie intake was contributed by SSB, which put them at risk of gaining weight or getting chronic diseases (Islam et al., 2020). In addition, previous study found that SSB was the major source of added sugar in the diet of university students. University of Nottingham Malaysia (UNM) students consumed 59.14g of sugar from SSB in a day, which was higher than the WHO recommendation of below 50g sugar intake per day (Cheng and Lau, 2022). Taken together, SSB intake of university students should be concerned.

Several initiatives have been implemented by the Malaysia government to reduce the SSB intake, including establishing Malaysian Dietary Guidelines (MDG) 2020, taxation on sugary drink and joint effort with food and drink industries (Ministry of Health Malaysia, n.d.). Same goes to other developing countries, taxation on SSB has been implemented. Despite constant effort to reduce the SSBs intake, it is still prevalent among university students, ranging from 60% to 89.3% of students reported a daily SSB consumption. Hence, it is in an urge to determine the factors

associated with their SSB intake (Bawadi et al., 2019; Ahmad et al., 2019; Cheng and Lau, 2022).

There are other factors that may influence SSB intake have not been studied among university students. Prior studies have investigated sleep duration and sleep quality in relation to SSB intake (Pérez-Farinós et al., 2017; Sampasa-Kanyinga et al., 2018; Min et al., 2018; Gan et al., 2019). An inconsistent relationship between sleep duration and SSB intake was observed. On the other hand, sleep quality was consistently found to be correlated with SSB intake, despite limited study has been conducted. However, it remains unclear whether sleep duration and quality are the underlying factors of SSB intake among university students as most of the prior studies have rarely been conducted among university students.

1.3 Significance of Study

The present study can provide information on the prevalence of SSB consumption among university students, which could contribute to the current limited literature and serve as basis for future research. Besides, the finding of this study could provide insight into the underlying factors to the prevalence rate of SSB intake among university students. A thorough understanding on the determinants related to high SSB intake is useful in devising an effective intervention program or strategy to regulate SSB intake of university students. Nonetheless, the present study could assist government or healthcare professional in better understanding

the SSB consumption of university students for effective policy and health program development to guarantee the overall health of university students.

1.4 Research Objectives

1.4.1 General Objective

To determine the relationship between sleep duration, sleep quality with sugar-sweetened beverage (SSB) intake among UTAR students.

1.4.2 Specific Objectives

1. To determine the prevalence of SSB intake, sleep duration and sleep quality among UTAR students.
2. To determine the mean difference of daily amount of total SSB intake between gender, BMI, and sleep duration among UTAR students.
3. To determine the difference in daily amount of total SSB intake between sleep quality among UTAR students.
4. To determine the correlation between age, BMI, sleep duration, sleep quality with daily amount of total SSB intake among UTAR students.

1.5 Research Questions

1. What is the prevalence of SSB intake, sleep duration and sleep quality among UTAR students?

2. Is there a difference in daily amount of total SSB intake between gender, BMI, and sleep duration?

3. Is there a difference in daily amount of total SSB intake between sleep quality?

4. Are age, BMI, sleep duration, sleep quality correlated with daily amount of total SSB intake of UTAR students?

1.6 Research Hypothesis

1. UTAR students have a high SSB intake, short sleep duration and poor sleep quality.
2. There is a significant difference in mean daily amount of total SSB intake between gender, BMI, and sleep duration.
3. There is a significant difference in mean daily amount of total SSB intake between sleep quality.
4. There is a significant correlation between age, BMI, sleep duration and sleep quality with daily amount of total SSB intake among UTAR students.

CHAPTER 2

LITERATURE REVIEW

2.1 Background of Sugar-sweetened Beverage (SSB)

2.1.1 SSB Definition and Recommended Intake

Sugar-sweetened beverages (SSBs) refer to any beverages that contain added sugar or added caloric sweeteners, such as sucrose, high fructose corn syrup, brown sugar, raw sugar, fruit juice concentrate, malt syrup and so on (Brand-Miller and Barclay, 2017; Malik and Hu, 2019). SSBs usually contain ≥ 25 calories per 8 fluid ounces. High fructose corn syrup and sucrose are the common sugar or sweeteners used to flavour SSBs (Malik and Hu, 2022). On the other hand, beverages containing naturally occurring sugar or artificial sweeteners, such as 100% fruit juice and diet soda, are not classified as SSBs (Sousa et al., 2020).

WHO (2015) emphasised limiting sugar intake to less than 10% of the daily energy intake from free sugar, which was equivalent to 50g or 12 teaspoons of sugar to prevent obesity and tooth decay. On average, a single can soda contains up to 40g sugar, which is around 10 teaspoons (WHO, 2015). Similarly, Recommended Nutrient Intakes (RNI) for Malaysia also suggested less than 10% of daily energy intake from free sugar. In MDG 2020, limiting sugar intake from beverages is one of the key messages for a better health. Besides, in Malaysian Healthy Plate,

consumption of plain water, unsweetened milk or soy products are encouraged to replace the SSB intake.

2.1.2 SSB Intake Trend

A study investigated SSB intake of adults in 187 countries found that global SSB consumption in adults aged 20 years old and above was 0.58 servings/day, in which Caribbean had the highest SSB consumption, whereas East Asia had the lowest SSB intake (Singh et al., 2015). In United States, National Health and Nutrition Examination Survey (NHANES) data showed that nearly half of the United States adults (49.3%) consumed at least one SSB per day, with an average of 149kcal from SSB (Rosinger et al., 2017).

Currently, there was limited data regarding the trend of SSB intake among Malaysian population. However, according to the Malaysian Adult Nutrition Survey (MANS) 2014 and National Health and Morbidity Survey (NHMS) 2019, SSB intake was prevalent among Malaysian population, where sugar-added self-prepared beverages, such as tea, coffee, malted drinks are the most preferred SSBs. MANS 2014 revealed that 70.3% of Malaysian adults consume tea daily, followed by malted drink (59.1%) and coffee (53.2%) (Institute for Public Health, 2014). Similarly, NHMS 2019 demonstrated that 53.2% of the Malaysian population consume sugar-added self-prepared drink daily (Institute for Public Health, 2020).

2.1.3 SSB Intake and Obesity Prevalence

An emerging obesity epidemic was observed among university students. As evidence, Peltzer et al. (2014) who gathered data from 22 universities in different countries demonstrated that 22% of university students were overweight and obese. Similar finding was observed among university students from eight ASEAN countries, where a total of 24.2% male and 9.3% of female students were obese. Among these eight countries, the prevalence of general and abdominal obesity was prominent among Malaysian university students (Petlzer and Pengpid, 2017b). In Malaysia, previous study reported nearly 37.5% of university students were overweight or obese, while soft drink consumption was recognized as one of contributing factors (Wan Mohamed Radzi, 2019). Likewise, a negative finding from previous study was that overweight and obese university students were prone to sugary drinks intake, where 54.8% of obese and 51.8% of overweight university students consumed carbonated and energy drink daily (Syed et al., 2020).

A body of evidence supported the claim that consuming SSB increased risk of obesity (Gui et al., 2017; Shin et al., 2018). A significant positive relationship between SSB consumption with risk of obesity, abdominal obesity, and metabolic syndrome was observed by past studies (Gui et al., 2017; Shin et al., 2018). The findings showed that higher SSB consumption (≥ 1 serving per day) increased obesity risk by 59% in female and 41% in male (Shin et al., 2018). Thus, this finding suggests that SSB intake maybe linked to obesity, where necessary action is required to limit sugary drinks intake.

2.2 SSB Consumption of University Students

Younger generations are prone to SSB consumption. Most previous studies focused on SSB intake among pre-schoolers or adolescent, less emphasised on university population. Despite a scarcity of research on SSB intake among university students, the existing literatures found a noticeable SSB consumption among university students, where nearly 60% to 89.3% of them had a daily SSB intake (Al-Otaibi, 2017; Bawadi et al., 2019; Ahmad et al., 2019).

Recent study revealed that SSB intake of Malaysian university students was at a concern level, where 89.3% of them had at least one SSB intake per day (Ahmad et al., 2019). Among them, 51.6% of them had ≥3 times of SSB intake per day. Similarly, SSB intake was also prevalent among university students in other developing countries. As evidence, 60% of Jordanian university students and 67.5% of Saudi Arabian university students consumed SSBs in daily basis (Bawadi et al., 2019; Al-Otaibi, 2017). It is worth mentioning an average of 10.2% of daily calorie intake of university students was contributed by SSB, which was higher than the recommended added sugar calorie contribution from WHO (Islam et al., 2020). Taken together, the findings suggesting SSB intake of university students is worthy of attention.

Apart from that, the SSB preference of university students varies across the countries. It is difficult to determine the most preferred SSB among university students due to different types of SSB included in the study. Overall, the existing

literatures showed that university students were prone to sweetened coffee, tea, and soft drink intake (Ahmad et al., 2019; Bawadi et al., 2019; Islam et al., 2020).

Previous study had limitation in determining the total SSB intake of university students (Ahmad et al., 2019; Bawadi et al., 2019; Al-Otaibi, 2017). Past studies on total SSB intake mostly concerned soda, energy drinks, coffee, tea, and fruit drinks intake, rarely included other SSBs such as cultured milk, soybean milk and syrup drink. Thus, it may lead to underestimation of total SSB intake. On this basis, it is crucial to take them into account to provide a more inclusive picture on total SSB intake of university students.

Until now, SSB intake of Malaysian university students has not been extensively explored. The main weakness of the prior study from Ahmad et al. (2019) was that it only involved medical and health science students from one public Malaysia university. Hence, the finding may not be representative and should be cautiously generalized to whole Malaysia university population. In addition, their finding was limited to frequency of SSB intake, with minimal attention devoted to daily amount and calorie intake from SSB. Therefore, further study conducted in other universities, or a large population-based study is crucial to better understand the SSB intake of university students in Malaysia.

2.2.1 SSB Consumption Between Gender

Most of the previous studies demonstrated that male university students had a higher SSB consumption as compared to female university students (Bawadi et al., 2019; Ahmad et al., 2019; Islam et al., 2020). Bawadi et al. (2019) and Islam et al. (2021) found that male university students consumed a significantly higher calorie from SSB than female university students. Despite this, past studies revealed that gender was not associated with SSB consumption (Ahmad et al., 2019; Cheng and Lau et al., 2022).

In addition to this, with adjusted odd ratio of 2.19 and p-value of 0.031, Ahmad et al. (2019) revealed that male had a higher risk of SSB intake, where male university students were two times more likely to drink sugary drinks compared to female. Likewise, Gase et al. (2014) targeted United State adults also found a similar finding, where men consumed extra seven times SSB per month as compared to female. These findings suggested being a male was the predictor of high SSB intake. It could be attributed to different body image perception between gender, where males are less concerned on their body image and body weight as compared to female (Kuan et al., 2011; Bibiloni et al., 2017). Overall, male was prone to sugary drink intake compared to female, however, there was no association between gender and SSB intake.

2.2.2 SSB Consumption Between BMI Categories

SSB consumption was linked to obesity. However, most of the previous studies demonstrated that BMI was not associated with SSB consumption of university students (Islam et al., 2020; Ahmad et al., 2019; Cheng and Lau, 2022). Ahmad et al. (2019) and Cheng and Lau (2022) found that BMI status has no significant association with SSB consumption of Malaysian university students. Similarly, Islam et al. (2020) revealed BMI has a weak positive and not significant relationship with SSB consumption of university students (r_p= 0.44, p>0.05). Currently, there was lacking study examine the difference of SSB intake between underweight, normal, or overweight categories. The available literature showed that obese university students had a high calorie intake from SSB, which was marginally not significant (p=0.05) as compared to non-obese students (Islam et al., 2020). Similarly, Salleh et al. (2021) also found that the SSB consumption has no significant difference between BMI categories, despite this study was conducted among adolescents. Overall, most of the studies seem to imply that BMI has no impact on SSB consumption among university students.

2.3 Sleep Duration and Quality of University Students

Sleep deprivation is defined as getting inadequate amount of sleep. Seven to nine hours sleep per night is recommended for adults aged 18 to 64 years old (Hirshkowitz et al., 2015). Therefore, getting less than seven hours of sleep per night is considered as sleep-deprivation for university students. On the other hand,

sleep quality measure how well a person's sleep, which is assessed based on sleep latency, sleep efficiency, number of awakening as well as wakefulness after sleep onset (Ohayon et al., 2017).

Sleep deprivation and poor sleep quality are the primary concern among university students. Past study revealed that the prevalence of sleep deprivation (less than 7 hours per day) ranged from 36.6% to 42.3% among university students from 26 countries (Peltzer and Pengpid, 2017a). Similar finding was reported, where 30.4% of European university students and 35.7% of U.S. university students were found to be sleep-deprived. These findings seem to indicate most university students could meet the recommended sleep hours (Gruba et al., 2021; Becker et al., 2018).

In contrast, some literatures demonstrated a higher rate of sleep deprivation among this population. As evidence, 58.1% of Malaysian university students and two-third of Jordanian university students (n=1308) had insufficient sleep (Albqoor and Shaheen, 2020; Naito et al., 2021). The discrepancy of the result might be attributed to difference in data collection method and period. For instance, Albqoor and Shaheen (2020) assessed sleep duration of the university students during period when there was no examination to ensure the outcome was not affected, whereas this factor was not concerned by other above-mentioned previous studies.

Besides, previous studies have limitation in assessing sleep duration. Most studies used Pittsburgh Sleep Quality Index (PSQI) or questioned on average sleep duration

in 24 hours to assess sleep, without considering the weekend and weekday sleep duration. Thus, this aspect should be considered in future study to provide a more reliable finding about the sleep duration of university students. Indeed, sleep deprivation was observed among university students, however, it was not the prominent concern as majority of them could meet the recommended sleep duration as revealed by previous studies (Peltzer and Pengpid, 2017a; Becker et al., 2018; Gruba et al., 2021; Du, Zan et al., 2021).

On the contrary, previous literatures suggested that sleep quality problem should be prioritized. As evidence for this claim, Becker et al. (2018) found 61.9% of U.S university students reported poor sleep quality, while most of them (62%) met the recommended sleep with an average 7 hours' sleep per day. Similar finding was reported by Du, Zan et al. (2021), who conducted a study among university students in 7 nations. The global PSQI scores of these 7 countries were all more than 5, indicating poor sleep quality. However, on average, university students from all 7 countries had a minimum 7 hours of sleep per night (Du, Zan et al., 2021). Taken together, the available evidence suggesting that sleep quality problem among university students should be emphasised over sleep duration. To further support this claim, Marelli et al. (2020) demonstrated a rise in poor sleep quality rate during COVID-19. It is worth mentioning that poor sleep quality was in a concerning level even in pre-COVID-19, with 58% of university students reported a poor sleep, suggesting poor sleep quality is the major concern among university students over sleep deprivation.

In Malaysia, there was limited literature concerning sleep characteristics among university students. The existing studies reported that sleep deprivation rate of university students in Malaysia ranged from 34.1% to 58.1% (Du, Zan et al., 2021; Naito et al., 2021). Naito et al. (2021) found a higher prevalence of sleep deprivation among students in a public Malaysia university, with 58.1% were sleep deprived. On the other hand, Du Zan et al. (2021) found that most of the students had adequate sleep, with only 34.1% of them were sleep-deprived. The variation in result might be due to difference in sample size, data collection method and population involved. As evidence, Du, Zan et al. (2021) only recruited 90 medical health science students. While Naito et al. (2021) included 1016 undergraduate students from various courses, which contributes a more inclusive and reliable finding on sleep duration among university students. Concerning sleep quality, the poor sleep quality rate varied from 32.9% to 70.6% (Lai and Say, 2013; Nurismadiana and Lee, 2018). Overall, due to limited and inconsistent findings, it seems failed to imply that Malaysian university students were sleep-deprived and had a poor sleep quality.

2.4 Sleep Characteristics and SSB Intake

2.4.1 Sleep Duration and SSB Intake

Emerging studies had investigated the association between sleep duration and sugar-sweetened beverage (SSB) intake. It is worth mentioning most prior research were only limited to children and adolescents. Boozari et al. (2020) were the first

group of researchers providing insight into sleep duration in relation to total SSB intake among university students, greatly contributing to the present literatures.

Majority of the studies proposed a significant negative association between sleep duration and sugar-sweetened beverages intake, where short sleepers had a frequent and greater SSB consumption (Kjeldsen et al., 2014; Pérez-Farinós et al., 2017; Sampasa-Kanyinga et al., 2018; Min et al., 2018). In contrast to the earlier findings, Boozari et al. (2020) reported no significant association between sleep duration and SSB intake among university students. The discrepancy in the result might be attributed to differences in study population, implying sleep duration might not be the factor associated with university students' SSB consumption.

Since university students are prone to sleep deprived and SSB intake, the link between sleep duration and SSB intake has not been widely explored among this population, thus, it is worth to investigate the association. In addition, some past studies used secondary data, which was collected using questionnaire about sleep duration and SSB intake with unclear validity (Min et al., 2018; Sampasa-Kanyinga et al., 2018). Therefore, further research is needed to provide a stronger evidence.

From the review of current literatures, the sleep duration classification was not consistent across the studies. As support, Boozari et al. (2020) defined short sleep as less than 6 hours per day whereas Pérez-Farinós et al. (2017) referred less than 9.9 hours as short sleep duration based on study population mean. Some study

defined short sleep duration according to age-appropriate sleep duration recommendation (Sampasa-Kanyinga et al., 2018). On this basis, it is difficult to make comparison about the SSB intake between studies, however, most of the literatures seem to infer that short sleeper had a greater SSB intake (Prather et al., 2016; Sampasa-Kanyinga et al., 2018; Boozari et al., 2020). For instance, Boozari al. (2020) reveals that university students who had less than 6 hours of sleep each day consumed significantly greater amount of SSB than those with 8 hours sleep (P=0.05). Likewise, Prather et al. (2016) depicted adults who slept 5 hours or less each night had a 21% higher likelihood of total SSB intake, whereas those who slept for 6 hours each night was associated with 11% higher likelihood of total SSB intake as compared to 7 to 8 hours sleepers.

In addition to total SSB, some previous research had investigated on sleep duration in relation to specific beverages, offering a thorough understanding about their association (Franckle et al., 2015; Prather et al., 2016; Pérez-Farinós et al., 2017). Franckle et al. (2015) and Pérez-Farinós et al. (2017) indicated that sleep-deprived individuals consumed regular soda frequently. To further explore, Prather et al. (2016) classified the SSBs into caffeinated and de-caffeinated. They revealed that short sleeper tended to seek for sugared caffeinated drinks compared to those with adequate sleep, whereas this significant result was not observed for de-caffeinated drink. Similarly, Sampasa-Kanyinga et al. (2018) also revealed that short duration sleepers were likely to consumed energy drink, which is a caffeinated type SSB.

Overall, past studies seem to infer that those with insufficient sleep are likely to consumed regular soda and caffeinated SSB intake.

Kjeldsen et al. (2014) claimed that sleepiness, following inadequate sleep triggers SSB intake to boost up energy for daily tasks. As evidence to this claim, a negative association between sleep duration and SSB intake was observed after adjusting potential confounders, such as screen time and physical activity level (Kjeldsen et al., 2014). This finding appears to show that sleep duration may be the independent risk factor to high SSB intake.

In brief, the association between sleep duration and SSB intake is still in a contradictory condition. Since there was scarcity of research among university population, it remains unclear that whether sleep duration has impact on SSB intake among university students. Hence, further studies are needed to solve the discrepancies on the current literatures.

2.4.2 Sleep Quality and SSB Intake

Another dimension of sleep is sleep quality. Previous research mostly explored on the relationship between sleep duration and SSB intake, rarely concerned on sleep quality aspect. The existing literatures depicted that higher sleep quality score, indicating poor sleep quality, was positively associated with SSB consumption (Min et al., 2018; Gan et al., 2019; Boozari et al., 2020; Du, Wang et al., 2021).

A consistent finding was noted in the past studies. However, there were limitations in previous studies. The earlier studies mostly focused on correlation between sleep quality and SSB intake, while less attempt was made to investigate the differences in total SSB intake between sleep quality groups (Min et al., 2018; Gan et al., 2019). Boozari et al. (2020) did explore on the difference and revealed a significant high consumption among poor sleep quality group. However, due to limited study and different types of SSB included, further study is needed to ascertain the finding.

Besides, most of the existing studies on sleep quality and SSB intake focused on adolescents or children, while this research area has not been extensively explored among university students. For instance, the finding of Boozari et al. (2020) could not be generalized to the whole university population as it concerned on medical science students only. It is worth to mention, there was lacking study conducted among Malaysian university students. Taken together, it is significant to carry out the present study to explore more about the sleep quality in relation to university students' SSB intake.

2.5 Mechanism on Sleep Deprivation Affects Appetite and Dietary Choices

This section reviews the mechanism on how sleep affects our dietary intake. The mechanism on insufficient sleep triggers sugar craving or SSB intake has not been well established. However, the available literatures revealed that sleep affects our

appetite and dietary choices via hormonal and hedonic pathways, which drive us to make unhealthy dietary choices, including sweet or sugar intake.

Regarding hormonal pathway, sleep deprivation causing dysregulation of hormone ghrelin and leptin. Ghrelin is a hunger-promoting hormone, whereas leptin is a satiety hormone. Both hormones are responsible in appetite control. Spiegel et al. (2004) found that sleep restriction decreased leptin level and elevated hormone ghrelin. As a result, a significant increase in hunger and appetite towards energy dense and carbohydrate-rich foods, such as sweet, salty, and starchy foods was observed. This finding provides first insight into the impact of sleep loss on hormonal changes and appetite control, resulting in a shift in dietary preference.

Similar finding was revealed by Broussard et al. (2016), where a positive correlation between increase ghrelin level during sleep restriction and sweet consumption was observed. Other than appetite regulation, ghrelin also activates the mesolimbic pathway (central rewards system), which triggered motivation to food and was associated with sucrose consumption, suggesting a possible association between sleep and SSBs intake (Skibicka et al., 2011). It is worth to note the hormonal pathway caused by insufficient sleep was not well-supported by recent literature. As evidence, past study found an increase in food intake after sleep restriction, despite no changes in appetite-regulating hormone, suggesting hedonic factors overrode the hormonal factor in affecting dietary choices (Calvin et al., 2013).

Regarding hedonic pathway, sleep deprivation activated brain region that are responsible for rewards and motivation in response to food (St-Onge et al., 2012; Greer et al., 2013; St-Onge et al.,2014). The finding suggested sleep loss enhances individual's hedonic perception to food, eventually driving to excess energy intake and shifting to unhealthy dietary choices.

Neuroimaging data revealed that sleep deprivation diminished the activity of appetitive evaluation region, such as frontal cortex and insula cortex in response to food stimulus. Meanwhile, the activity of amygdala, which governs motivation to eat was amplified (Greer et al., 2013). The finding implies that sleep-restricted individuals prone to eating, regardless of hunger or satiety. Additionally, Greer et al. (2013) also found that sleep-restricted individuals sought for high calorie food, suggesting these neuronal changes exaggerated the food salience in sleep-deprived individuals, shifting their dietary preference to calorie-dense food, including sweet food intake. This finding was supported by St-Onge et al. (2014), who revealed that brain rewards and pleasure-seeking region was greatly activated by unhealthy food stimuli under sleep restriction, whereas no significant activation in these regions was observed in response to healthy food under sleep restriction.

Prior study revealed sleep-restricted adolescent found sweet foods more appealing than healthy and non-sweet food, given there was no significant difference in hunger level between sleep-restricted and habitual sleep (Simon et al., 2015). This finding implies hedonic pathway was dominant than hormonal pathway in

regulating food intake under sleep loss. In brief, sleep restriction alters neural activity and increases the rewarding value of food cues, particularly unhealthy, calorie-dense, and sweet food.

Taken together, as shown in Figure 2.1, the hormonal and hedonic pathways triggered by insufficient sleep seem to be the underlying mechanism that triggers excess food intake, particularly calorie-dense and sweet foods in sleep-deprived individuals (Chaput and St-Onge, 2014). Although the mechanism on sleep in relation to sugar craving or SSB intake was lacking, these pathways revealing a possible link between sleep and SSB intake, which is a calorie dense and sweet beverage, establishing a basic to explore on this area.

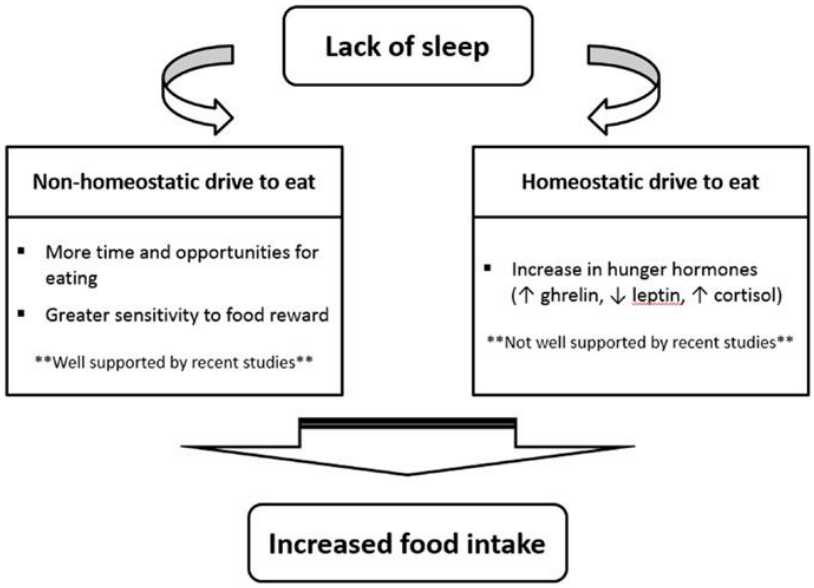


Figure 2.1: Overview of Non-homeostatic and Homeostatic Drive to Food Consumption Caused by Insufficient Sleep.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Study Design

The present study was conducted from February 2022 to June 2022. A cross-sectional research design was employed in this study to determine the prevalence of SSB intake, sleep duration and sleep quality of targeted population. This study design was selected as it is cost-effective and less time-consuming.

3.2 Study Location

Due to COVID-19 pandemic, this study was conducted online among university students studying in Universiti Tunku Abdul Rahman (UTAR) Kampar or Sungai Long campus. Both campuses located in different districts. UTAR Kampar is in Perak state, whereas UTAR Sungai Long located in Kajang, Selangor. In total, there are 9 faculties, 3 institutes as well as 3 centres of studies in these two campuses.

3.3 Ethical Approval

The target population was university students studying in UTAR. Ethical approval letter was obtained from the UTAR Ethics committee prior to conducting the study (Appendix A). Respondents were informed about the purpose of the study and data

confidentiality. Their participation was completely voluntary, and the consent of respondents was obtained prior to data collection. Respondents were allowed to withdraw from the study at any time.

3.4 Sample Recruitment

3.4.1 Sampling Method

Snowball sampling was used in sample selection. It is a non-probability sampling method, which relies on existing respondents in recruiting other participants. It is often used in recruiting those respondents who are difficult to be approached (Berndt, 2020). In this study, the questionnaire was distributed to the respondents via Microsoft Teams and WhatsApp, then the existing respondents distributed the questionnaire to their friends. The purpose of using snowball sampling is to approach students from other faculties.

3.4.2 Sample Size Calculation

Cochran' formula was used to determine the sample size. It is used to estimate the sample size for proportion in a large population, which is applicable in this study (Singh and Masuku, 2014). The Cochran's formula was shown as follow:

$$Sample\ size = \frac{(Z_{\frac{\alpha}{2}})^2(p)(q)}{e^2}$$

Where, $Z_{\frac{\alpha}{2}}$ refers to critical value, e is margin of error, p is the estimated population proportion of SSB intake and q refers to 1-p. 5% significant level and 5% of margin

of error were used in sample calculation. The estimated population proportion of SSB intake was 89.3%, which was adopted from Ahmad et al. (2019) who investigated SSB intake among university students in one of the Malaysian universities. The minimum sample size required for the present study was 147 respondents. Concerning non-response from respondents, a 20% non-response rate was considered in sample size calculation, hence, 176 respondents were targeted.

The sample size calculation was presented as follow:

$$Sample\ size = \frac{(Z_{\frac{\alpha}{2}})^2(p)(q)}{e^2}$$

$$= \frac{(1.96)^2(0.893)(1-0.893)}{0.05^2}$$

$$= 146.8 \approx 147 \text{ respondents}$$

Account for 20% non-response rate

Sample size =147 ÷ 100 x 120

=176.4 ≈ 176 respondents

3.4.3 Sampling Criteria

The inclusion criteria including Malaysian citizen, within age 18-29 years old, full-time undergraduate or postgraduate students who are currently studying in UTAR Kampar or Sungai Long campuses. All the eligibility criteria must be met, those who failed to meet any one of the criteria were excluded. For instance, those who are not enrolled in UTAR, non-Malaysian, those who are not within age range of

18-29 years old, foundation students, international students, part-time undergraduate or postgraduate students as well as graduated UTAR students were excluded from this study.

3.5 Research Questionnaires

An online, self-administered questionnaire was developed using Survey Monkey (Appendix B). There were three sections included in the questionnaire, including socio-demographic data, SSB intake and PSQI. The questionnaire was constructed in English.

3.5.1 Section A: Socio-demographic Data

There were 8 questions in this section, including age, gender, nationality, ethnicity, height, weight, UTAR campus, faculty, and level of study. This section consists of open-ended and multiple-choice questions. Age, height, and weight were in the form of open-ended questions, whereas the remaining questions were in multiple-choice. Self-reported height and weight were used to calculate the Body Mass Index (BMI) of participants, which was calculated as weight (kg) ÷ height^2 (m^2). The BMI classification was based on the WHO guideline (WHO, 2010). BMI below 18.5 kg/m^2 was classified as underweight, whereas BMI of 18.5 kg/m^2 to 24.9 kg/m^2 was classified as normal weight. Overweight and obese were classified based on BMI 25.0 kg/m^2 to 29.9 kg/m^2 and BMI 30.0 kg/m^2 and above respectively.

3.5.2 Section B: Sugar-sweetened Beverage (SSB) Intake

Beverage Intake Questionnaire (BEVQ-15) was adopted to assess the SSBs intake of UTAR students in the past one month (Fausnacht et al., 2020). A pilot study was conducted to pre-test the questionnaire. There was a total of 17 beverages included the questionnaire. Only 14 of the beverages included were SSBs. The remaining beverages were non-SSBs, such as diet soda, homemade tea without sugar or creamer and homemade instant coffee without sugar or creamer. Besides, respondents were allowed to report the other SSB consumed which were not included in the questionnaire.

Respondents were required to indicate the frequency and amount consumed each time for each beverage. There were seven choices of response for frequency of beverage intake were in multiple choices, including “never or less than 1 time per week”, “1 time per week”, “2 to 3 times per week”, “4 to 6 times per week”, “1 time per day”, “2 times per day” and “3 times or more per day”. As for amount of drinks consumed each time, respondents were required to indicate the amount of drinks in cup or ml. One serving (1 cup) was equivalent to 200ml according to the standard measurement used in MDG 2020 (National Coordinating Committee on Food and Nutrition, 2021). The choices of response for amount consumed each time were in the form of multiple choices, which include less than 3/4 cup (150ml), 1 cup (200ml), 1½ cups (300ml), 2 cups (400ml), 2½ cups (500ml) and specify the amount consumed each time in cup or ml if more than 2½ cups (500ml).

Respondents were not required to indicate the amount consumed each time for a beverage if they had “never or less than one time per week” consumption.

The outcome variables were daily frequency and daily amount of total SSB intake. Total SSB only included 14 SSBs out of 17 beverages. Non-SSBs, such as diet soda, homemade tea without sugar or creamer and homemade coffee without sugar or creamer were excluded from total SSB. The daily frequency of consumption for each beverage was obtained by dividing the weekly frequency by 7, as shown in Table 3.1.

Table 3.1 Conversion of Weekly Frequency of SSB Intake into Daily Frequency

Frequency of SSB Consumption	Daily Frequency of SSB Consumption
Never or less than 1 time per week	0 time per day
1 time per week	0.1 time per day
2-3 times per week	0.4 times per day
4-6 times per week	0.7 times per day
1 time per day	1 time/day
2 times per day	2 times/day
3 times or more per day	3 times or more per day

Daily frequency of total SSB intake was obtained by summation of daily frequency of each SSB intake. It was used to classify SSB intake into three groups, which were low, moderate, and high intake, as shown in Table 3.2. The SSB classification was adopted from previous study done by Ahmad et al. (2019). Regarding daily amount of total SSB intake, it was obtained by ∑(daily frequency of SSB intake x amount consumed each time) for each SSB.

Table 3.2 Classification of SSB Intake by Daily Frequency of Total SSB Intake

SSB Intake	Daily Frequency of Total SSB Intake
Low	0 SSB intake/ Less than 1 time per day
Moderate	1 to 2 times per day
High	3 times or more per day

3.5.3 Section C: Pittsburgh Sleep Quality Index (PSQI)

PSQI was adopted to assess the sleep duration and quality of the respondents in the past one month. It is a validated and self-administered questionnaire developed by Buysse et al. (1989), with Cronbach's alpha of 0.83, indicating greater internal consistency reliability.

This questionnaire consisted of 19 self-rated questions and 5 questions evaluated by roommate or bedpartners (if available). Only self-rated questions were evaluated in scoring system of sleep quality. The self-rated questions covered the seven components related to sleep, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction in determining sleep quality status.

The score of each component ranged from 0 to 3. The sum of the score of all the components (termed as Global PSQI score) ranging from 0 to 21, which was used to classify the respondents into good and poor sleep quality, as shown in Table 3.3. Global PSQI score of less than or equal to five (≤ 5) indicated good sleep quality, whereas global PSQI score of more than five (>5) indicated poor sleep quality

(Buysse et al., 1989). Global PSQI score >5 has 89.6% sensitivity and 86.5% of specificity in differentiating good and poor sleep quality individuals.

Table 3.3 Classification of Sleep Quality by Global PSQI Score

Classification of Sleep Quality	Global PSQI Score
Good	≤5
Poor	>5

Apart from sleep quality, one of the questions in PSQI was used to assess sleep duration, from which the respondents were asked to report the actual hours of sleep per night during the past one month. As shown in Table 3.4, sleep duration was classified into three groups, which are short, normal, and long sleep duration based on the recommended sleep duration for age group of 18 to 64 years old. Seven to nine hours sleep per night is recommended for young adults and adults aged 18 to 64 years old, which is applicable to the target population (Hirshkowitz et al., 2015). Less than 7 hours of sleep each night was termed as sleep deprived.

Table 3.4 Sleep Duration Classification

Classification of Sleep Duration	Sleep Duration
Short	Less than 7 hours per night
Normal	7 to 9 hours per night
Long	More than 9 hours per night

3.6 Flowchart of Study

Data was collected after getting ethical approval letter from UTAR ethical committee, started from 11 February 2022 to 9 June 2022. A weblink to access the questionnaire was generated and distributed to UTAR students through online platform, such as Microsoft Teams and WhatsApp. The study flow chart is presented in Figure 3.1.

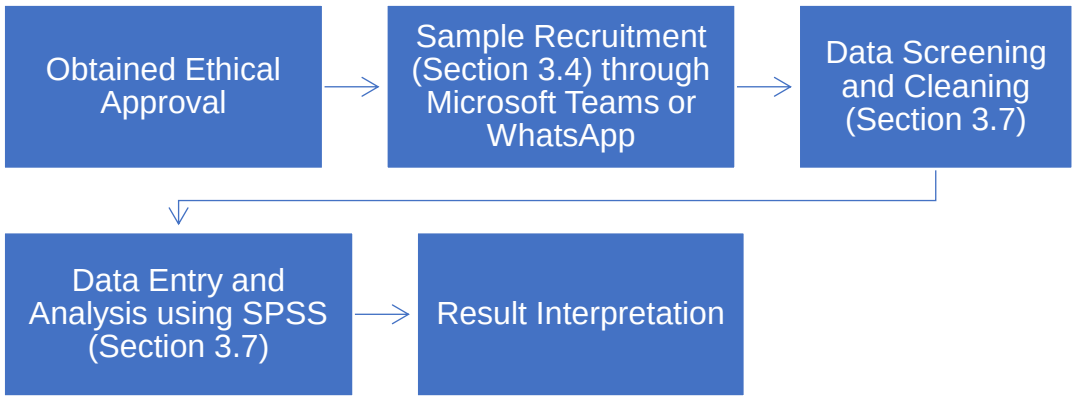


Figure 3.1 Flowchart of Study

3.7 Data Analysis

Data screening was done prior to data analysis. Responses from those who did not meet the selection criteria, such as UTAR foundation students and non-Malaysian were excluded. For unclear or ambiguous response, respondents were contacted via Microsoft Team to clarify their responses. Data cleaning was performed for the "other" options in BEVQ-15 and PSQI to remove the duplicated responses. In addition, the extreme values of daily amount of total SSB intake were removed.

Upon data screening and cleaning, 147 respondents out of 176 respondents were included in this study, which met the minimum sample size requirement.

Descriptive statistic was used to present the sociodemographic data and the prevalence of SSB intake, sleep duration and sleep quality of university students. Categorical data was presented in frequency and percentage, whereas continuous data was presented in mean ± standard deviation. Daily amount of total SSB intake was the dependent variable, whereas sleep duration and sleep quality were the independent variables. Normality test was performed using skewness and kurtosis to test the normality of the data (Appendix C). Since the skewness and kurtosis value was between ±2, indicating the data was normally distributed. Hence, parametric test was used for hypothesis testing.

Independent t-test was performed to assess the difference in mean daily amount of total SSB intake between genders and between sleep quality groups. One-way ANOVA was used to assess the difference in mean daily amount of total SSB intake between BMI categories and between sleep duration groups. Pearson correlation was applied to examine the correlation between age, BMI value, sleep duration, sleep quality (Global PSQI score) with daily amount of total SSB intake. The strength of correlation was shown in Table 3.5. All the data was analysed using Statistical Package for Social Science (SPSS) version 26, with $p < 0.05$ was considered as statistically significant.

Table 3.5 Strength of Relationship for Pearson Correlation

Coefficient of correlation, r	Strength of relationship
Less than or equal to 0.20	Very weak
0.21 to 0.40	Weak
0.41 to 0.60	Moderate
0.61 to 0.80	Strong
Greater than 0.80	Very strong

CHAPTER 4

RESULTS

4.1 Socio-demographic Characteristics of Participants

The sociodemographic characteristics were presented in Table 4.1. A total of 147 UTAR students who met the inclusion criteria were recruited in this study. The mean age of participants was 21.4 years old (±1.2 years old). Majority of them were female (n=112, 76.2%), Chinese (n=139, 94.6%) and studying in UTAR Kampar campus (n=117, 79.6%). Regards to faculty, most of the participants (n=76, 51.7%) were from the Faculty of Science (FSC), followed by 12.2% (n=18) of them from Faculty of Information and Communication Technology (FICT) and 9.5% (n=14) of them from Faculty of Business and Finance (FBF). Besides, only undergraduate students participated in this study, none of them were postgraduate students. Furthermore, the mean BMI value was 20.6 kg/m^2 ± 3.5kg/m^2. Most of the participants (n=96, 65.3%) were having a normal BMI, followed by 27.2% (n=40) of them were underweight. Only a minority of them were classified under overweight (n=6, 4.1%) and obese (n=5, 3.4%) categories.

Table 4.1 Socio-demographic Characteristics of Participants (n=147)

Socio-demographic Variables	n	%	Mean	SD
Age			21.4	1.2
Gender				
Male	35	23.8		
Female	112	76.2		
UTAR Campus				
Kampar	117	79.6		
Sungai Long	30	20.4		
Ethnicity				
Malay	4	2.7		
Chinese	139	94.6		
Indian	4	2.7		
Body Mass Index (kg/m^2)			20.6	3.5
Underweight (<18.5kg/m^2)	40	27.2		
Normal (18.5 – 24.9kg/m^2)	96	65.3		
Overweight (25.0 – 29.9kg/m^2)	6	4.1		
Obese (≥ 30.0kg/m^2)	5	3.4		
Faculty				
FSC	76	51.7		
FICT	18	12.2		
FBF	14	9.5		
LKC FES	11	7.5		
FAM	8	5.4		
FAS	7	4.8		
FMHS	6	4.1		
FCI	5	3.4		
FEGT	1	0.7		
ICS	1	0.7		
Educational Level				
Bachelor's degree	147	100		

Note: n=number of respondents; SD=standard deviation.

4.2 Prevalence of SSB Intake of UTAR Students

On average, UTAR students consumed 0.97 times (± 0.64 times) SSB and 230.4ml (±151.3ml) of SSB in a day. As shown in Table 4.2, majority of the respondents (n=79, 53.7%) had a low intake of SSB, followed by 45.6% (n=67) of them had one to two times of SSB consumption, which was defined as moderate intake. Only a minority of them (n=1, 0.7%) had a high SSB consumption, which was 3 times or more SSB consumption in a day. Taken together, the results indicating UTAR students had a low SSB intake, suggesting SSB consumption was not prominent among this population.

Table 4.2 Prevalence of SSB Intake of UTAR Students (n=147)

Total SSB Intake	**n (%)**	**Mean Daily Frequency of SSB Intake ± Standard Deviation**
Low	79 (53.7%)	0.97 ± 0.64
Moderate	67 (45.6%)	
High	1 (0.8%)	

Note: n=number of respondents.

Besides, as shown in Table 4.3, it is found that UTAR students had a low intake for each individual SSB. Despite the modest intake for each SSB, the finding shown that respondents were prone to consumption of cultured milk or yogurt drink and chocolate or malted drink, with 4.1% and 3.4% of them were having a moderate intake of these drink. Besides, the results also indicated that respondents were prone to tea and coffee consumption, but they were likely to choose tea and coffee without added sugar. For instance, 4.1% and 4.8%of them had homemade unsweetened

coffee and tea at least once a day respectively, while none of them consumed sugar-sweetened tea and less than 2% of them consume sugar-sweetened coffee in a day.

Table 4.3 Types of SSB Consumed Based on Daily Consumption Frequency (n=147)

Types of SSB	Low	Moderate	High
		n (%)	
1. Regular Soft Drinks	146 (99.3)	1 (0.7)	0 (0.0)
2. Botanical Beverages Mix	147 (100.0)	0 (0.0)	0 (0.0)
3. Ready-to-drink Tea	147 (100.0)	0 (0.0)	0 (0.0)
4. Homemade Tea (With Sugar/Creamer)	147 (100.0)	0 (0.0)	0 (0.0)
5. Ready-to-drink Coffee	146 (99.3)	1 (0.7)	0 (0.0)
6. Homemade Instant Coffee (With Sugar/Creamer)	145 (98.6)	2 (1.4)	0 (0.0)
7. Sweetened Fruit Juice	147 (100.0)	0 (0.0)	0 (0.0)
8. Chocolate, Malted Drink	142 (96.6)	5 (3.4)	0 (0.0)
9. Soybean Drink	147 (100.0)	0 (0.0)	0 (0.0)
10. Energy Drink	147 (100.0)	0 (0.0)	0 (0.0)
11. Sport Drink	147 (100.0)	0 (0.0)	0 (0.0)
12. Syrup and Cordial Drink	147 (100.0)	0 (0.0)	0 (0.0)
13. Cultured Milk and Yogurt Drink	141 (95.9)	6 (4.1)	0 (0.0)
14. Flavoured Milk	147 (100.0)	0 (0.0)	0 (0.0)
15. Diet Soda [a]	146 (99.3)	0 (0.0)	1 (0.7)
16. Homemade Tea (Without Sugar/Creamer) [a]	140 (95.2)	6 (4.1)	1 (0.7)
17. Homemade Instant Coffee (Without Sugar/Creamer) [a]	141 (95.9)	5 (3.4)	1 (0.7)

Note: Drinks labelled with superscript [a] are not categorised as SSB; SSB=sugar-sweetened beverage; n=number of respondents.

4.3 Sleep Characteristics of UTAR Students

4.3.1 Sleep Duration of UTAR Students

On average, UTAR university students had 6.8 hours (±1.3 hours) of actual sleep each night. The ideal sleep duration for university students is between seven to nine hours of sleep per night (Hirshkowitz et al., 2015). Based on Table 4.4, majority of the respondents obtained the ideal amount of sleep (n=82, 55.8%), whereas 41.5% (n=61) of them had less than 7 hours sleep each night, indicating sleep deprived. Only 2.7% (n=4) of them slept for more than 9 hours per night.

Table 4.4 Sleep Duration Classification of UTAR Students (n=147)

Classification of Sleep Duration	**n (%)**	**Average Sleep Duration ± SD**
Short	61 (41.5%)	6.8 hours ± 1.3 hours
Normal	82 (55.8%)	
Long	4 (2.7%)	

Note: n=number of respondents, SD=standard deviation

4.3.2 Sleep Quality of UTAR Students

The mean global PSQI score of UTAR university students was 5.7 ± 2.6, which was considered marginally good sleep quality. As shown in Table 4.5, majority of university students (n=79, 53.7%) had a good sleep quality. Despite this, it is found that nearly half of the university students (n=68, 46.3%) were having a poor sleep quality, suggesting sleep quality problem of university students should be addressed.

Table 4.5 Sleep Quality of UTAR Students (n=147)

Sleep Quality	n (%)	Average Global PSQI Score
Good	79 (53.7%)	5.7 ± 2.6
Poor	68 (46.3%)	

Note: n=number of respondents

Besides, Table 4.6 shows the mean score of each PSQI components. The PSQI subscale score range from 1 to 3. Higher subscale score of PSQI component reflects the greater difficulty or severity of a particular sleep components. Among seven PSQI components, daytime dysfunction possessed the highest subscale score, which was 1.14 ± 0.81, whereas the use of sleep medication had the lowest subscale score at 0.06 ± 0.29. The results indicating that UTAR students had certain degree of daytime dysfunction, such as trouble staying awake for daily activity and having problem to keep up enough enthusiasm. On the contrary, the use of sleep medication was less prevalent among this population.

Table 4.6 Mean Score of Each PSQI Components

Variables	Mean ± SD
PSQI components	
Subjective sleep quality	1.04 ± 0.58
Sleep latency	1.05 ± 0.95
Sleep Duration	0.85 ± 0.73
Habitual sleep efficiency	0.54 ± 0.88
Sleep disturbances	0.99 ± 0.43
Use of sleep medication	0.06 ± 0.29
Daytime dysfunction	1.14 ± 0.81

Note: SD=standard deviation; PSQI = Pittsburgh Sleep Quality Index.

4.4 Comparison of Mean Daily Amount of Total SSB Intake with Gender, BMI, Sleep Duration and Sleep Quality

4.4.1 Mean Daily Amount of Total SSB Intake Between Gender

Based on Table 4.7, on average, male students consumed 279.4ml ± 158.7ml SSB daily, whereas female students consumed 215.1ml ± 146.3ml SSB per day. The statistical analysis showed that the mean daily amount of total SSB intake was significantly different between genders, with p=0.028. The finding revealed that male university students had a significant higher amount of total SSB intake per day than female students.

Table 4.7 Mean Daily Amount of Total SSB Intake Between Gender (n=147)

Gender	n	Mean ± SD (ml)	t-value	p-value
Male	35	279.4 ± 158.7	2.225	0.028
Female	112	215.1 ± 146.3		

Note: n=number of respondents; SD= standard deviation

4.4.2 Mean Daily Amount of Total SSB Intake Between BMI Categories

One-way ANOVA was performed. Based on Table 4.8, the finding reveals overweight students consumed 326.7ml ± 114.7ml of total SSB intake daily, which was the highest among the BMI categories, followed by underweight and normal weight students. On the other hand, obese students consumed the least amount of total SSB daily, which was 166.0ml ± 184.3ml. The statistical analysis shows that the difference in mean daily amount of total SSB consumed was not significant

between BMI categories, with p= 0.336, suggesting BMI does not influence SSB intake of the study participants.

Table 4.8 Mean Daily Amount of Total SSB Intake Between BMI Categories

BMI Classification	n	Mean ± SD (ml)	F	p-value
Underweight	40	232.9 ± 146.5	1.137	0.336
Normal	96	226.7 ± 153.1		
Overweight	6	326.7 ± 114.7		
Obesity	5	166.0 ± 184.3		

Note: n=number of respondents; SD= standard deviation

4.4.3 Mean Daily Amount of Total SSB Intake Between Sleep Duration

Table 4.9 reveals that the highest daily amount of total SSB intake was observed in short sleep duration group, which was 255.2ml ± 173.5ml per day. Whereas long sleep duration group consumed the least amount of total SSB daily, which was 178.8ml ± 78.1ml per day. The statistical analysis depicted that the difference was not significant with p=0.222. Therefore, the finding indicated sleep duration has no impact on amount of total SSB intake in a day among the UTAR students.

Table 4.9 Mean Daily Amount of Total SSB Intake Between Short, Normal and Long Sleep Duration

Sleep Duration	n	Mean ± SD (ml)	F	p-value
Short	61	255.2 ± 173.5	1.522	0.222
Normal	82	214.5 ± 133.8		
Long	4	178.8 ± 78.1		

Note: n=number of respondents; SD= standard deviation

4.4.4 Mean Daily Amount of Total SSB Intake Between Good and Poor Sleep Quality

Table 4.10 demonstrates that poor sleep quality group consumed a slightly higher amount of total SSB compared to good sleep quality, which was 236.5ml and 225.2ml, respectively. However, the difference in mean amount of total SSB intake between good and poor sleep quality was not statistically significant with p=0.654. This finding suggested sleep quality does not impact the amount of SSB consumed by the study participants.

Table 4.10 Mean Daily Amount of Total SSB Intake Between Poor and Good Sleep Quality

Sleep Quality	n	Mean ± SD (ml)	t-value	p-value
Good	79	225.2 ± 151.5	-0.449	0.654
Poor	68	236.5 ± 152.0		

Note: n=number of respondents; SD= standard deviation

4.5 Correlation Between Age, BMI, Sleep Duration, Sleep Quality and Daily Amount of Total SSB Intake Among UTAR Students

Table 4.11 displays the correlation between age, BMI, sleep duration, sleep quality and daily amount of total SSB intake among UTAR students. The finding reveals that age, BMI and sleep duration had a very weak negative correlation with daily amount of total SSB intake, with r_p value of -0.058, -0.033 and -0.126 respectively. There was no significant correlation between age, BMI, and sleep duration with daily amount of total SSB intake. On the other hand, high PSQI score indicating poor sleep quality. A very weak positive correlation was observed between sleep

quality score and daily amount of total SSB, which was not statistically significant with r_p=0.064, p=0.438. In short, age, BMI, sleep duration and sleep quality were not correlated to amount of SSB consumed, indicating these variables have no influence on daily amount of total SSB intake among university students.

Table 4.11 Pearson Correlation Between Age, BMI, Sleep Duration, Sleep Quality with Daily Amount of SSB Intake in UTAR Students

		Pearson Correlation (n=147)				
		Age	BMI	Sleep Duration	Sleep Quality (Global PSQI Score)	Daily Amount of Total SSB Intake
Age	Pearson Correlation	1.00	-0.049	0.038	0.016	-0.058
	p-value	-	0.553	0.649	0.848	0.487
BMI	Pearson Correlation	-0.049	1.000	0.005	0.003	-0.033
	p-value	0.553	-	0.957	0.971	0.688
Sleep Duration	Pearson Correlation	0.038	0.005	1.000	-0.563**	-0.126
	p-value	0.649	0.957	-	0.001	0.128
Sleep Quality (Global PSQI score)	Pearson Correlation	0.016	0.003	-0.563**	1.000	0.064
	p-value	0.848	0.971	0.001	-	0.438
Daily Amount of Total SSB Intake	Pearson Correlation	-0.058	-0.033	-0.126	0.064	1.000
	p-value	0.487	0.688	0.128	0.438	-

Note: ** Correlation is significant at $p < 0.01$; High PSQI score indicating poor sleep quality.

CHAPTER 5

DISCUSSIONS

5.1 SSB Consumption Among UTAR Students

SSB is heavily marketed towards young adults, which could exert detrimental effect on their overall health. The present study documented the SSB consumption of UTAR students. Indeed, SSB consumption was observed among UTAR students, however, their SSB consumption rate was not in an alarming level. As evidence, the prevalence of daily SSB intake among UTAR students (46.3%) was lower than among university students from other developing countries, such as Jordon (60%) (Bawadi et al., 2019) and Saudi Arabia (67.1%) (Al-Otaibi et al., 2017).

Comparing with Malaysian university students, the present study reported that most of the UTAR students had a low SSB consumption (no SSB intake per day). Meanwhile, only a minority of them had a high SSB intake (at least three times a day). Contrary to previous study, Ahmad et al. (2019) revealed that 89.3% of Universiti Putra Malaysia students had daily SSB consumption, with 51.6% of them had a high SSB intake. The discrepancies in the finding might be attributed to knowledge level, health consciousness as well as environmental factor (Pelletier and Laksa, 2013; Park et al., 2014; Deliens et al., 2015).

In the present study, most of the participants came from the Faculty of Science. Thus, they may have basic knowledge of SSB and its associated negative health

impacts. According to Park et al. (2014), knowledge about health complications of SSB intake was associated with low SSB intake, individuals who had inadequate knowledge on complications on SSB intake had 61% greater odd for SSB consumption. Besides, based on SSB preference of UTAR students, it implies that the study population were health-conscious and did translate their knowledge into practices. As evidence, the study population were more prone to healthier beverage choices, such as cultured milk or yogurt drink, unsweetened homemade tea, and coffee.

Cultured milk or yogurt drinks are fermented dairy products, which contain probiotics and bioactive peptides that can exert favourable health-promoting properties, such as antioxidative, antimicrobial, antihypertensive as well as immunomodulatory effect to overall health (Savaiano and Hutkins, 2020). Other than that, literatures show that sweetened tea and coffee are frequently consumed by university students (Bawadi et al., 2019; Ahmad et al, 2019; Islam et al., 2020). The present study found that UTAR students were likely to consume unsweetened tea and coffee instead of sweetened tea and coffee. According to Cheng and Lau (2022), university students who had a good practice about SSB consumption were likely to have a low SSB consumption. Taken together, the present findings suggested that low SSB intake among UTAR students could be attributed to their knowledge level and health consciousness that leads them to practice.

Nonetheless, environmental factor may also contribute to the discrepancies in the SSB intake. The present study population were free to choose their accommodation outside university area, whereas the study of Ahmad et al. (2019) was conducted among students who live in a student dormitory. Vending machine was available in university, therefore, students who live at university dormitory can access to SSB easily, leading to high SSB consumption. According to Deliens et al. (2015), the availability of sugary drinks in university was associated with energy drink intake. Meanwhile, university food environment had an impact on diet quality, where students were prone to higher added sugar or fat intake, depending on the accessibility (Pelletier and Laska, 2013). Therefore, environment may also play a role in influencing the SSB consumption among university students.

5.2 Sleep Duration and Quality of UTAR Students

University students are often recognised as a vulnerable population to poor sleep health, most probably due to heavy academic workload and hectic academic schedule (Azad et al., 2015; Ngu et al., 2017). It is noteworthy that the present study found that UTAR students had a good sleep health. Most of the study participants had an adequate sleep (7 hours or more per night) and had a good sleep quality. Despite this, the poor sleep quality rate was in a noticeable level (46.3%), suggesting sleep quality problem should be the immediate concern to be addressed over sleep deprivation.

The current finding is consistent with most of the previous studies, where majority of the students had a minimum 7 hours of sleep. However, their overall sleep quality was poor (Becker et al., 2018; Gruba et al., 2021; Du, Zan et al., 2021). For instance, Du, Zan et al. (2021) who recruited university students from seven countries found that all the participants had an average of 7.5 ±1.2hours sleep. However, majority of them were poor sleepers.

Comparing to previous studies conducted in Malaysia, the present study found that 41.5% of the respondents were sleep-deprived, which was lower than the sleep-deprivation rate reported by Naito et al. (2018) (58.1%). With regards to sleep quality, the prevalence of poor sleep quality of UTAR students (n=68, 46.3%) was lower than previous study, which demonstrated that 70.6% of university students in Malaysia had a poor sleep quality (Nurismadiana and Lee, 2018). On this basis, it implies the study participants had a good sleep health.

Taken together, sleep quality problem should be prioritized over sleep deprivation. While having a sufficient sleep is important, improving sleep quality appears to be a more alarming concern among university students.

5.3 Comparison of Mean Daily Amount of Total SSB Intake

5.3.1 Comparison of Mean Daily Amount of Total SSB Intake Between Gender

In this study, male students consumed significant greater amount of SSB compared to female students ($p < 0.05$). This finding was consistent with most of the previous studies, from which male university students were recognised as the major SSB consumers compared to female students. O'Leary et al. (2012) found that the amount of SSB consumed by male university students was higher than female students, with median daily consumption of 526ml and 300ml respectively. Similarly, previous findings suggested that male students had a significant higher calorie intake from SSB compared to female (Bawadi et al., 2019; Islam et al., 2020). For instance, Islam et al. (2020) revealed that the calorie intake from SSB in male students was 49.17kcal more than female students, with $p < 0.001$. In addition, Ahmad et al. (2019) revealed that male university students were twice as likely to consume SSB compared to female students, which was a significant predictor of high SSB consumption.

It is possible that male students are less concerned on their body weight status and body image compared to female. Therefore, they are prone to consumption of SSB (Kuan et al., 2011; Bibiloni et al., 2017). Besides, Madiba et al. (2017) found that male university students displayed a negative attitude towards SSB intake, indicating male students tended to drink SSB for entertainment and socializing with peers as compared to female. In addition, Bärebring et al. (2020) found that females were more conscious on the healthiness of diet compared to males, thus, female

tended to eat healthier by avoiding added sugar consumption (Bärebring et al., 2020). Taken together, it implies that genders might have impact on SSB consumption.

5.3.2 Comparison of Mean Daily Amount of Total SSB Intake Between BMI Categories

The present study found that the amount of SSB intake has no significant difference between BMI categories. Previous finding reported that the SSB consumption was higher in obese university students, however, it was marginally non-significant as compared to non-obese students (p=0.05) (Islam et al., 2020). Additionally, a study conducted among Malaysian adolescent reported a similar finding, where the SSB intake was comparable between different BMI categories (Salleh et al., 2021). Previous literatures mostly concerned on the difference in BMI value between SSB intake among university students (Bawadi et al. 2019; Aida Aliah Abu Bakar et al., 2020). On this basis, due to limited literature, further study may be needed to warrant the present finding on the mean comparison of amount of SSB intake between BMI categories.

5.4 Sleep Duration in Relation to Daily Amount of Total SSB Intake

The present study revealed that sleep duration has no impact on SSB consumption of university students. The daily amount of SSB consumed by the study participants

was comparable regardless of their sleep duration. In addition, the present study discovered an insignificant negative correlation between sleep duration and amount of SSB intake in the study population (r_p=-0.126, p-value=0.128). The current result was contradicted with the previous findings. Most of the previous studies found that sleep duration was associated with SSB consumption, in which short duration sleepers often consume significantly greater amount of SSB or had a frequent SSB intake (Prather et al., 2016; Kjelsden et al., 2014; Sampasa-Kanyinga et al., 2018; Min et al., 2018). The possible reason for lack of association could be attributed to different in study population who have different sleep duration characteristics.

Previous studies were mostly concerned on children and adolescent who had different sleep characteristics as compared to university students. For university students, the recommended sleep duration is within 7 hours to 9 hours per night, whereas for children, the recommended sleep duration is longer than university students (Hirshkowitz et al., 2015). In the study of Kjeldsen et al. (2014), a significant negative correlation between sleep duration and SSB intake in the cohort of Danish school children was reported, where the minimum sleep duration was 7.47 hour per night. Their sleep characteristic was different from the current study population, where on average, university students had 6.8 hour of sleep, ranging from 2 to 10 hours per night. Likewise, in the study of Pérez-Farinós et al. (2017), children reported an average of 9.9 hours of sleep, which was defined as short sleep duration. Meanwhile, it was found that short sleep duration was associated with

high SSB consumption. On this basis, the previous findings may not be applicable to the university population due to different sleep characteristics.

To further support this claim, Boozari et al. (2020) found that sleep duration had a very weak and no significant negative correlation with the amount of SSB consumed by university students, which was consistent to the current finding. In addition, Boozari et al. (2020) found that short sleep duration groups (6 to 8 hours sleep) had a significant higher amount of SSB intake as compared to normal and long sleep duration group. Despite the current finding shows insignificant difference in mean amount of SSB intake between sleep duration categories, however, the highest amount of SSB was consumed by the short sleep duration group. Previous studies mentioned those who had insufficient sleep tended to consume SSB or caffeinated type SSB to increase their alertness for staying awake (Kjeldsen et al., 2014; Prather et al., 2016). Overall, the possible reason for insignificant and contradicted finding could be attributed to different sleep duration classification was used. It appears to imply that sleep duration was not the determinant factor of SSB intake among university students.

5.5 Sleep Quality in Relation to Daily Amount of Total SSB Intake

Besides sleep duration, sleep quality is also an important sleep component. Most of the previous studies demonstrated that sleep quality score had a significant positive correlation with SSB intake (Gan et al., 2019; Boozari et al., 2020; Du, Wang et al.,

2021). Contrary to most of the previous findings, the present study did not show significant positive correlation between sleep quality score and amount of SSB consumed (r_p=0.064, p-value=0.438). Meanwhile, the amount of SSB consumed by the study population were comparable regardless of their sleep quality. Despite the correlation was not significant, the current study shows the same trend as previous studies, indicating the poorer the sleep quality, the higher the SSB consumed (Gan et al., 2019; Boozari et al., 2020; Du, Wang et al., 2021). The current contradicted result might be attributed to different data collection method, especially on SSB consumption, thus, there may be discrepancies in the SSB included in the study (Boozari et al., 2020).

Although sleep quality was consistently related to SSB intake, there were existing literature suggested sleep quality have no impact on SSB intake, which is in line with the current finding (Kleiser et al., 2017). According to Kleiser et al. (2017), there was no significant association between sleep quality and SSB intake of German population aged 13 to 80 years old. Comparing to university population, Boozari et al. (2020) revealed that sleep quality was recognized as the factor associated to SSB intake among university students. Therefore, more research is needed to consider sleep quality as the primary intervention in regulating the SSB consumption of university students.

5.6 Correlation Between Selected Sociodemographic Variables and Daily Amount of Total SSB Intake of UTAR Students.

The present study indicated age had a non-significant and very weak negative correlation with the daily amount of total SSB consumed (r_p=-0.058, p=0.487). The present finding was consistent with the previous study from Islam et al. (2020), who also demonstrated a non-significant and weak negative relationship between age and SSB intake of university students (r_p = -0.009, p > 0.05). Similarly, Ahmad et al. (2019) revealed that age was not significantly associated with SSB intake (χ^2 = 5.93, p-value=0.204). Besides, previous studies also mentioned that age was not the significant predictor of SSB consumption of university students (Ahmad et al., 2019; Islam et al., 2020; Cheng and Lau, 2022). The insignificant correlation could be attributed to the smaller age gap in the present study.

Other than that, an insignificant and very weak negative relationship between BMI and daily amount of SSB intake was discovered in the present study (r_p=-0.033, p=0.688). The current finding was consistent with the previous study, where BMI was found to have no significant association with SSB intake (Madiba et al, 2017; Ahmad et al., 2019; Cheng and Lau et al., 2022). Likewise, Islam et al. (2020) found that BMI was not significantly correlated to SSB intake of university students. However, it shows a positive correlation which was contradicted to the present finding (r_p=0.44, p-value > 0.05). On the contrary, Gan et al. (2019) found an insignificant and negative relationship between BMI and amount of SSB intake of Malaysian adolescents, which was in line with the current finding.

The insignificant and different direction of the relationship might be due to several limitations. First and foremost, the body weight and height were self-reported, so these measurements might have been underestimated by the respondents (Madiba et al., 2017). Besides, it is also possible that overweight and obese students under-reported their SSB consumption, or they limit the consumption of SSB to reduce their body weight (Park et al., 2012). Moreover, several confounding variables such as dieting, physical activity level and perception of body image could influence BMI status and its relationship with SSB intake were not studied (Madiba et al., 2017; Gan et al, 2019).

5.7 Strengths and Limitations

The present study has several strengths and limitations. First and foremost, the present study determined the prevalence of SSB consumption and their preference among UTAR students, which could contribute to the current limited literatures on SSB consumption status of university students. Besides, the present study could provide insight into the underlying factors associated with SSB consumption of university students. This study was one of the few studies conducted to investigate the relationship between sleep and SSB intake of university students. Overall, the present study could provide evidence for further research and for health program formulation.

There are several limitations in this study. First and foremost, the present study was conducted in UTAR Kampar and Sungai Long Campuses, where majority of the students were from Chinese ethnicity. Therefore, the present finding might not be representative to university students from other ethnicities in Malaysia, such as Malays and Indians. Besides, the use of snowball sampling, which is a non-probability sampling may lead to bias in selecting respondents. Therefore, the representativeness of the sample could not be guaranteed. Next, due to the use of self-administrated questionnaire, respondents might have memory relapse and recall bias in reporting the frequency and amount of SSB consumed, resulting in overreporting, or underreporting the data. Last but not least, the amount of sugar consumed for each SSB could not be assessed due to the nature of the questionnaire. On this basis, 24-hour diet recall or a food diary might be conducted in future to understand on the sugary drinks consumed (Tan et al., 2020).

5.8 Future Recommendations

Future studies that represent large population of Malaysian university students could be conducted to provide a comprehensive understanding on SSB consumption pattern of university students as well as to warrant the correlation between sleep quality and SSB intake of university students. Besides, in future studies, other dimension of sleep on SSB consumption could be assessed, such as sleep latency, sleep efficiency and sleep pattern. Multidimensional sleep studies could provide new and comprehensive insight into the sleep characteristics that

associated with SSB intake. Last but not least, other potential determinants that may be associated with SSB intake of university students, such as peer influence, price, and the availability of SSB in university or at home, could be investigated in future studies, which would be beneficial in developing an effective health program.

CHAPTER 6

CONCLUSION

The present study shows that UTAR students had a low SSB consumption, implying their SSB consumption was not in a concerning level. Besides, most of the students obtained adequate amount of sleep and had a good sleep quality. Despite this, poor sleep quality rate was noticeable, indicating sleep quality of university students requires greater attention. Male university students had a significantly greater amount of SSB consumption, whereas the amount of SSB consumed was not significantly different between BMI, sleep duration and sleep quality.

The present study could not find any significant correlation between age, BMI, sleep duration, sleep quality with daily amount of SSB intake among university students. The finding implies that sleep characteristics are not regarded as the factor associated with SSB consumption of university students. Further study that targeted on a large population of Malaysian university students or young adults are encouraged to provide a more comprehensive understanding on SSB consumption status, warrant the current finding as well as understand the other determinants of SSB intake among local university students.

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APPENDICES

APPENDIX A

Ethical Approval

UNIVERSITI TUNKU ABDUL RAHMAN
Wholly Owned by UTAR Education Foundation (Company No. 578227-M)

Re: U/SERC/302/2021

30 December 2021

Dr Tan Gim Cheong
Head, Department of Allied Health Sciences
Faculty of Science
Universiti Tunku Abdul Rahman
Jalan Universiti, Bandar Baru Barat
31900 Kampar, Perak.

Dear Dr Tan,

Ethical Approval For Research Project/Protocol

We refer to the application for ethical approval for your students' research projects from Bachelor of Science (Hons) Dietetics programme enrolled in course UDDN3108. We are pleased to inform you that the application has been approved under Expedited Review.

The details of the research projects are as follows:

No	Research Title	Student's Name	Supervisor's Name	Approval Validity
1.	Association of Perceived Stress Level with Sugar Sweetened Beverage Consumption Among University Students	Aslinda	Mr Cheah Khang Jin	30 December 2021 – 29 December 2022
2.	Knowledge, Attitude and Practice of University Students in Klang Valley towards Sugar-Sweetened Beverages	Chua Pey Lyn		
3.	Knowledge, Attitude and Practice of University Students in Klang Valley towards Sugar-Sweetened Beverages	Lee Xin Ye		
4.	Knowledge, Attitude, and Practices (KAP) of Sugar-Sweetened Beverages: A Cross-Sectional Study among undergraduate students in Malaysia	Lee Zhen Le		
5.	Association between sleep quality and sugar sweetened beverages consumption among university Students	Tan Mei Xin		
6.	The Association between Diet Quality with Sleep Quality among Malaysian Undergraduate Students	Tan See Thean	Ms Lau Zhi Ch'ng	
7.	Association between caffeine intake and sleep quality among UTAR students	Ung Kah Yeng		
8.	The association of mobile health applications usage with eating behaviour and physical activity among young adult in Malaysia	Wong Ying Wei		
9.	Association between User and NonUsers of Mobile Health Apps on Eating Behavior and Physical Activity Level among White-Collar Workers in Malaysia	Chan Da Wei		
10.	The Prevalence of Mobile Health Apps Usage and the Association with Eating Behaviour and Physical Activity Level among University Students	Loke Yei Kuan		

The conduct of this research is subject to the following:

(1) The participants' informed consent be obtained prior to the commencement of the research;

(2) Confidentiality of participants' personal data must be maintained; and

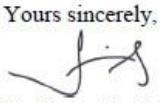
(3) Compliance with procedures set out in related policies of UTAR such as the UTAR Research Ethics and Code of Conduct, Code of Practice for Research Involving Humans and other related policies/guidelines.

(4) Written consent be obtained from the institution(s)/company(ies) in which the physical or/and online survey will be carried out, prior to the commencement of the research.

Should the students collect personal data of participants in their studies, please have the participants sign the attached Personal Data Protection Statement for records.

Thank you.

Yours sincerely,



Professor Ts Dr Faidz bin Abd Rahman
Chairman
UTAR Scientific and Ethical Review Committee

c.c Dean, Faculty of Science
Director, Institute of Postgraduate Studies and Research

APPENDIX B

Questionnaire

*** 3. Age**

*** 4. Gender**

- Male
- Female

*** 5. Nationality**

- Malaysian
- Non-Malaysian

*** 6. Ethnicity**

- Malay
- Chinese
- Indian
- Other (please specify)

*** 7. Height (m)**

*** 8. Weight (kg)**

*** 9. UTAR campus**

- Kampar
- Sungai Long

*** 10. Faculty**

- Faculty of Arts and Social Science (FAS)
- Faculty of Business and Finance (FBF)
- Faculty of Engineering and Green Technology (FEGT)
- Faculty of Information and Communication Technology (FICT)
- Faculty of Science (FSc)
- Faculty of Accountancy and Management (FAM)
- Faculty of Medicine and Health Science (FMHS)
- Faculty of Creative Industries (FCI)
- Lee Kong Chian Faculty of Engineering and Science (LKC FES)
- Institute of Postgraduate Studies and Research
- Institute of Chinese Studies (ICS)
- Other (please specify)

*** 11. Level of study**

- Bachelor's degree
- Master
- Doctor of Philosophy (PhD)

*** 12. Sugar-sweetened beverage intake**

	How often	How much each time
Regular Soft Drinks (e.g., Coca-cola, Pepsi, 7-up, etc.)		
Diet Soft Drinks (e.g., Diet coke, Sprite Zero, Pepsi Black, etc.)		
Botanical beverages mix (e.g., Chrysanthemum tea, Winter melon tea, etc.)		
Ready-to-drink tea (e.g., Lipton Iced Tea, Green Tea, Red Tea, Bubble Tea, etc.)		
Homemade tea (e.g.,Tea bag, Teh Tarik, etc.) **with** sugar/ creamer		
Homemade tea (e.g.,Tea bag, Teh Tarik, etc.) **without** sugar/ creamer		
Ready-to-drink coffee (e.g., Nescafe, 3 in 1, in cafe)		
Homemade instant coffee (e.g. 2 in 1) **with** sugar/ creamer		
Homemade instant coffee (e.g. 2 in 1) **without** sugar/ creamer		
Sweetened fruit juice/drink (e.g., Fruit punch, Fruit smoothie, etc.)		
Chocolate, Malted drinks (e.g., Milo, Horlick, etc.)		
Soya bean drink/Soya bean milk		
Energy drink (e.g., Redbull, Monster, Livita, etc.)		
Sport drink (e.g., 100 plus, Revive, Gatorade, etc.)		
Syrup/Cordial drink (e.g., Ribena, Sunquick, F&N, etc.)		
Cultured milk, yogurt drink (e.g., Bliss, Vitagen, Yakult, etc.)		
Flavored Milk (e.g., Strawberry milk, Chocolate milk, etc.)		

Other beverage(s) (Please list the SSB consumed and indicate "how often" and "how much each time" in ml using only the options provided in the drop down menu above)
(e.g., Herbal tea, 1 time per week, 200ml each time) OR State NONE if this is N/A

PITTSBURGH SLEEP QUALITY INDEX (PSQI)

INSTRUCTIONS: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, when have you usually gone to bed at night?

   USUAL BED TIME _____

2. During the past month, how long (in minutes) has it usually take you to fall asleep each night?

   NUMBER OF MINUTES _____

3. During the past month, when have you usually gotten up in the morning?

   USUAL GETTING UP TIME _____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)

   HOURS OF SLEEP PER NIGHT _____

INSTRUCTIONS: For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you...

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
(a) ...cannot get to sleep within 30 minutes	☐	☐	☐	☐
(b) ...wake up in the middle of the night or early morning	☐	☐	☐	☐
(c) ...have to get up to use the bathroom	☐	☐	☐	☐
(d ...cannot breathe comfortably	☐	☐	☐	☐
(e) ...cough or snore loudly	☐	☐	☐	☐
(f) ...feel too cold	☐	☐	☐	☐
(g) ...feel too hot	☐	☐	☐	☐
(h) ...had bad dreams	☐	☐	☐	☐
(i) ...have pain	☐	☐	☐	☐
(j) Other reason(s), please describe _____ _____				
How often during the past month have you had trouble sleeping because of this?	☐	☐	☐	☐

	Very good	Fairly good	Fairly bad	very bad
6. During the past month, how would you rate your sleep quality overall?	☐	☐	☐	☐

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
7. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?	☐	☐	☐	☐
8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	☐	☐	☐	☐

	No problem at all	Only a very slight problem	Somewhat of a problem	A very big problem
9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	☐	☐	☐	☐

	No bed partner or roommate	Partner/ roommate in other room	Partner in same room, but not same bed	Partner in same bed
10. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	☐	☐	☐	☐

If you have a roommate or bed partner, ask him/her how often in the past month you have had...

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
(a) ...loud snoring	☐	☐	☐	☐
(b) ...long pauses between breaths while asleep	☐	☐	☐	☐
(c) ...legs twitching or jerking while you sleep	☐	☐	☐	☐
(d) ...episodes of disorientation or confusion during sleep	☐	☐	☐	☐
(e) Other restlessness while you sleep; please describe	☐	☐	☐	☐

_____

_____

APPENDIX C

Normality Test

Variables	Mean	SD	Skewness	Kurtosis
Daily Amount of Total SSB Intake	230.4	151.3	0.585	-0.289
Sleep Duration	6.8	1.3	-0.250	1.034
Global PSQI score (Sleep Quality)	5.7	2.6	0.558	0.053
Age	21.4	0.1	-0.191	-0.663
BMI	20.6	0.3	1.197	1.735

Note: SD=standard deviation; SSB=Sugar-sweetened Beverages; SD (skewness)=0.200; SD (kurtosis)=0.397

APPENDIX D

Turnitin Originality Report

Universiti Tunku Abdul Rahman			
Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)			
Form Number: FM-IAD-005	Rev No.: 1	Effective Date: 3/10/2019	Page No.: 1of 1

FACULTY OF SCIENCE:

Full Name(s) of Candidate(s)	TAN MEI XIN
ID Number(s)	18ADB06930
Programme / Course	DIETETICS
Title of Final Year Project	RELATIONSHIP BETWEEN SLEEP DURATION, SLEEP QUALITY WITH SUGAR-SWEETENED BEVERAGE INTAKE AMONG UNIVERSITI TUNKU ABDUL RAHMAN (UTAR) STUDENTS

Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)**
Overall similarity index: 6 % **Similarity by source** Internet Sources: N/A % Publications: 6 % Student Papers: N/A %	No comment.
Number of individual sources listed of more than 3% similarity: 0	No comment.
Parameters of originality required and limits approved by UTAR are as follows: **(i) Overall similarity index is 20% and below, and** **(ii) Matching of individual sources listed must be less than 3% each, and** **(iii) Matching texts in continuous block must not exceed 8 words** ***Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.***	

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

Signature of Supervisor

Name: Mr Cheah Khang Jin

Date: 1/9/2022

Signature of Co-Supervisor

Name: _____

Date: _____

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