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Increased Consumption of Sugar-Sweetened Beverages Among Malaysian University Students During the Covid-19

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ABSTRACT

Excessive consumption of sugar-sweetened beverages (SSB) increases calories intake, unhealthy weight gain and eventually contributes to obesity. This study aims to determine the SSB intake pattern and the level of knowledge, attitude and practices (KAP) associated with SSB intake among private university students during the Covid-19. A total of 100 university students were enrolled in this study. Self-administered questionnaires were used to determine the SSB intake pattern and KAP. Data were analysed by using SPSS. The most frequently consumed SSB were milk and tea or coffee whereas energy drink being the least consumed. The mean daily sugar intake from SSB among the students was 59.14 ± 51.28 g/day, which is equal to 12 teaspoons of sugar. Multiple linear regression presented that practice is the only factor that significantly associated with SSB intake (adjusted R2= 0.137, F= 3.614, p= 0.003) after adjusting all the variables. In conclusion, the sugar intake from SSB of students was higher than the recommendation level during the Covid-19. Students with good practice scores tends to consume a lower amount of SSB. Effective interventions should focus on reducing SSB intake and practicing a healthy dietary pattern during the Covid-19.

Contribution/Originality: This study is one of very few studies which investigate the consumption of sugar-sweetened beverages among Malaysian university students during the Covid-19. Our study revealed a rising consumption trend and demands future intervention to instill a healthy eating pattern among undergraduate students.

1. Introduction

The Covid-19 pandemic has affected the eating habits of many people around the world. Furthermore, the lockdown measures implemented by the government including university closure, mobility restriction, and closure of the restaurants have significant implications on students' access to food, the location they ate, and how the food was

cooked. Moreover, university students are vulnerable to night eating syndrome (Kwan et al., 2021) and it has been reported that students under stressful condition tend to change their eating behaviours, steering food choices to food with high palatability and calorie content during Covid-19 (Cheng & Kamil 2020; Cheng & Wong, 2021).

Palatable foods are foods that contain a high amount of sugar and fat and give satisfaction when consumed. Sugar-sweetened beverages (SSB) referred to any drinks with added sugar or other sweeteners. Added sugar, also known as free sugar, is a type of sugar that is used as a sweetener, preservative, fermentation substrate, texture modifier, flavouring and colouring agent in food and beverages (Bowman, 2017). SSB is recognised as a major source of added sugar in many people's diets, with the most popular SSB are soft drinks, energy drinks, sports drinks, fruit juices, sweetened tea and coffee (Fadupin, Ogunkunle & Gabriel, 2014).

While it is well accepted that sugar should not be consumed in excess, there is disagreement about the optimal upper limit for sugar consumption. According to the Institute of Medicine (IOM), added sugar should not account for more than 25% of total energy intake (Institute of Medicine, 2005). Whereas World Health Organization (WHO) recommended that free sugars consumption should be less than 10% of the total energy intake. For additional health benefits, WHO also recommended lowering free sugar intake to less than 5% of total energy intake on a daily basis (World Health Organization, 2015).

Adolescents and young adults were the populations more prone to consume SSB. The global SSB intake among adults from 187 countries was 137.2 ml/day, with men and younger adults having the highest SSB intake (Singh et al., 2015). In Malaysia, the current added sugar consumption by children and adults is 9.0% and 28.4%, respectively (Teng et al., 2019). Malaysians have the highest prevalence of sugar consumption in the Asia Pacific region (Hamirudin, Zahari & Badarudin, 2019). Several studies have shown that consuming more SSB leads to excessive calories intake (Mathias, Slining & Popkin, 2013; Schulze, Manson & Ludwig, 2004). It has a detrimental effect on health, such as increasing the risk of obesity, type 2 diabetes, high blood pressure (hypertension), cardiovascular diseases and tooth decay (Malik et al, 2010).

Obesity has been identified as a worldwide health hazard. Overweight people account for 1.9 billion people worldwide, with more than 650 million people categorised as obese in 2016 (World Health Organization, 2021). In a study evaluating the associations between global disease burden and SSB intake, around 184000 deaths were attributable to SSB consumption (Fontes et al., 2020). The National Health and Morbidity Survey (NHMS) 2019 revealed that one in two adults in Malaysia were overweight or obese (Institute for Public Health, 2020). Meanwhile, the prevalence of diabetes among Malaysian adults aged more than 30 years had risen dramatically in the past decades, from 6.3% in 1986, 11.2% in 2011, to 18.3% in 2019 (Institute for Public Health, 2020). Diabetes is a major cause of macrovascular diseases such as stroke and coronary artery disease as well as microvascular diseases such as retinopathy, nephropathy and neuropathy (Fowler, 2008).

Due to the increasing prevalence of obesity and diabetes prevalence among Malaysian adults, it is imperative to focus on the SSB intake pattern of the young populations in Malaysia. However, determining the SSB intake pattern is challenging due to the scarcity of research on sugar consumption among Malaysian university students. Thus, the main

purpose of this study is to determine the pattern of SSB consumption and the factors that influence SSB consumption among university students during the Covid-19.

2. Methodology

2.1. Study design and subjects

A cross-sectional study was conducted at University of Nottingham Malaysia (UNM) starting from Jan 2020 to May 2020. Malaysian students aged 18 years and above were recruited in this study. Data was collected via google forms, and participants were recruited via university email and social media by the researcher. Students with chronic illness, on medications, and pregnant were excluded from this study. All students were given an online informed consent form before participating in the study. This study was approved by the University Science & Engineering Research Ethics Committee.

2.2. Questionnaire and data collection

Participants are required to complete a set of pretested and self-administered questionnaire consist of four parts including socio-demograhic characteristics, anthropometry measurements, Beverages Intake Questionnaire, knowledge, attitude and practice of SSB intake.

2.2.1. Part A: Sociodemographic Characteristics

Sociodemographic data including the age, gender, students 'residency, ethnicity, current year of study, household income status, smoking status, family history of diabetes and physical activity level were collected.

2.2.2. Part B: Anthropometric assessments

Participants were requested to self-report their body weight in kilograms (kg) and their height in meters (m). The body mass index (BMI) of the participants was calculated using the formula $weight/height^2$ (kg/m^2) and they were categorised into underweight (< 18.5 kg/m^2), normal weight (18.5 – 24.9 kg/m^2), overweight (25 – 29.9 kg/m^2), and obese (≥ 30 kg/m^2) using the WHO classification of BMI (World Health Organization, 2010).

2.2.3. Part C: Beverages Intake Questionnaire (BEVQ)

BEVQ is used for the evaluation of SSB intake of the students by frequency and amount of intake per week (Hedrick et al., 2010). BEVQ comprised of different categories of SSB. To evaluate the SSB intake, students were asked how often and how much they consumed the beverages over the past 7 days. According to the recommendation by World Health Organization (2015), the maximum sugar intake for adults is 50 g per day. Thus, this study defined high sugar intake when a person consumed more than 50 g of sugar from SSB per day. While low SSB intake is referred to no SSB intake and consumption ≤ 50g of sugar from SSB per day. The standard serving sizes of beverages in Malaysia are 1 glass equivalent to 250 ml, 1 can equivalent to 330 ml and 1 bottle equivalent to 500 ml. The total volume of SSB intake per day is calculated by the formula recommended by Gan, Mohamed and Law (2019):

$$Volume\ \left(\frac{ml}{day}\right) = \frac{(number\ of\ days\ x\ total\ amount\ of\ beverages\ intake)}{7\ days}$$

By referring to the study of Gan, Mohamed and Law (2019), the most frequently consumed SSB among all the beverages is determined by deducting the percentage of non-consumer (none) from the total percentage (100%).

2.2.4. Part D: Knowledge, Attitude and Practice (KAP) of SSB intake

The questionnaire used in this study is according to the study by Teng, Nordin and Muhammad Shah (2019). The first section was related to nutrition knowledge on the nutritional information of SSB and the health consequences of consuming more SSB. Students were asked whether the statements were true or false. The correct answer is awarded one mark, whereas the incorrect answer received a zero mark. The second and third sections used a dichotomous scale (agree or disagree) to assess the attitude and behaviours or actions when consuming SSB.

2.3. Statistical Analysis

All analyses were performed using Statistical Package for the Social Sciences (SPSS) version 25. Categorical data was analysed by chi-square test and data was presented as count (n) and percentage (%). While continuous data was performed with independent-samples t test and presented with mean and standard deviation. Chi-square test was performed to identify the association between sociodemographic characteristics with gender and sugar intake from SSB. Independent-samples t test was performed in the comparison of anthropometry measurements and KAP by gender and sugar intake from SSB. Simple and multiple linear regression was used to identify the factors related to SSB intake. Factors that showed a p-value of <0.25 in simple linear regression were involved in multiple linear regression. A p-value of <0.05 was indicated as significant.

3. Result

3.1. Sociodemographic characteristics and sugar intake from SSB

Table 1 displays the sociodemographic characteristics based on the sugar intake from SSB. The results indicated that 52% of the students had a low sugar intake and 48% had a high sugar intake from SSB. There was no significant difference between sociodemographic characteristics and sugar intake from SSB, except for age ($p<0.05$). It showed that students with an older age consumed more SSB than students of a younger age.

Table 1: Sociodemographic characteristics based on the sugar intake from SSB (n=100).

Sociodemographic characteristics	**Sugar intake from SSB**			**p-value**
	Low n= 52	**High n= 48**	**Total n= 100**	
	n (%)	**n (%)**	**n (%)**	
Age	20.62 ± 1.46	21.17 ±	20.88 ±	**0.043***
18- 20 years	22 (42.3)	1.21	1.37	0.356
21-24 years	30 (57.7)	16 (33.3)	38 (38)	
		32 (66.7)	62 (62)	
Gender				
Male	22 (42.3)	25 (52.1)	47 (47)	0.328

Female	30 (57.7)	23 (47.9)	53 (53)	
Ethnicity				
Malay	3 (5.8)	0	3 (3)	0.156
Chinese	47 (90.4)	45 (93.8)	92 (92)	
India	2 (3.8)	3 (6.2)	5 (5)	
Residency				
With parents	19 (36.5)	16 (33.3)	35 (35)	0.740
Hostel	28 (53.8)	25 (52.1)	53 (53)	
Off campus	5 (9.6)	7 (14.6)	12 (12)	
Household income status				
Less than RM 3000	15 (28.8)	15 (31.3)	30 (30)	0.795
RM 3001-RM 6000	13 (25)	14 (29.2)	27 (27)	
RM 6001 or higher	24 (46.2)	19 (39.6)	43 (43)	
Physical activity level				
None	22 (42.3)	25 (52.1)	47 (47)	0.522
Light	21 (40.4)	13 (27.1)	34 (34)	
Moderate	9 (17.3)	10 (20.8)	19 (19)	
Smoking status				
Yes	1 (1.9)	2 (4.2)	3 (3)	0.511
No	51 (98.1)	46 (95.8)	97 (97)	
Family history of diabetes				
Yes	20 (38.5)	10 (20.8)	30 (30)	0.055
No	32 (61.5)	38 (79.2)	70 (70)	

*p<0.05.
Independent-samples t test was used for continuous variables and chi-square test was used for categorical variables

The factors associated with sugar intake from SSB, including anthropometry measurements, knowledge, attitude and practice is demonstrated in Table 2. Students who had a greater knowledge and practice about SSB were significantly associated with low sugar intake from SSB. Nevertheless, students with high sugar intake had a higher weight, height, but there was no significant relationship between them. The majority of the students had normal BMI.

Table 2: Association between anthropometry measurements, knowledge, attitude, practice and sugar intake from sugar-sweetened beverages (n= 100).

Factors	**Sugar intake from SSB**			**p-value**
	Low n= 52	**High n= 48**	**Total n= 100**	
Weight (kg)	56.12 ± 9.99	60.00 ± 11.57	57.98 ± 10.90	0.075
Height (m)	1.65 ± 0.08	1.67 ± 0.09	1.66 ± 0.08	0.137
Body mass index (kg/m²)	20.52 ± 2.59	21.32 ± 2.88	20.90 ± 2.75	0.148
Underweight	10 (19.2)	7 (14.6)	17 (17)	0.522
Normal	40 (76.9)	36 (75)	76 (76)	
Overweight	2 (3.8)	4 (8.3)	6 (6)	
Obese	0	1 (2.1)	1 (1)	
Knowledge	71.35 ± 12.84	65.00 ± 15.16	68.30 ± 14.29	**0.026***
Attitude	81.20 ± 14.48	78.91 ± 12.93	80.10 ± 13.74	0.407
Practice	75.48 ± 19.01	65.36 ± 17.72	70.63 ± 19.00	**0.007***

*Independent-samples t test was performed with p<0.05.

Table 3 presents the frequency of all types of SSB consumption in a week. Except for non-consumer, milk (59%) was the most frequent consumed beverage, followed by tea or coffee with cream and/or sugar (56%) and soft drink (44%). About one-tenth of the students drank tea or coffee with cream and/or sugar every day. Energy drink was the least consumed beverage, as majority of the students (99%) did not consume energy drink in a week.

Table 3 Weekly frequency of sugar-sweetened beverages intake.

Types of beverages	Frequency			
	None (0 day)	**Rarely (1-2 days)**	**Frequent (3-5 days)**	**Daily (6-7 days)**
Soft drink	56 (56)	35 (35)	8 (8)	1 (1)
Fruit juice	62 (62)	34 (34)	4 (4)	0 (0)
Energy drink	99 (99)	1 (1)	0 (0)	0 (0)
Sport drink	94 (94)	4 (4)	2 (2)	0 (0)
Flavoured juice drink	79 (79)	18 (18)	3 (3)	0 (0)
Tea or coffee with cream and/or sugar	44 (44)	24 (24)	21 (21)	11 (11)
3 in 1 instant coffee/ tea	81 (81)	10 (10)	5 (5)	4 (4)
Malted drink	64 (64)	23 (23)	11 (11)	2 (2)
Milk/ chocolate milk	41 (41)	28 (28)	24 (24)	7 (7)
Cultured milk/ yogurt drink	54 (54)	32 (32)	12 (12)	2 (2)
Soya bean drink/ soya drink milk	66 (66)	32 (32)	1 (1)	1 (1)
Packet drink	86 (86)	13 (13)	1 (1)	0 (0)
Syrup/ cordial	96 (96)	4 (4)	0 (0)	0 (0)
Bubble milk tea	68 (68)	31 (31)	1 (1)	0 (0)

Table 4 presents the amount of SSB consumed by the students in a day. The total mean volume of SSB consumption was 357.45 ± 217.92 ml/day, which was approximately equivalent to 1.4 servings of intake per day (1 serving= 250 ml). The highest amount of SSB consumption was in the form of tea or coffee with cream and/or sugar (73.04 ± 92.55 ml/day), followed by milk (61.43 ± 72.25 ml/day) and soft drink (38.21 ± 61.29 ml/day).

Table 4: Average volume of sugar-sweetened beverages consumed in a day.

Types of beverages	**n**	**Volume of SSB consumption (ml/day)**
Tea or coffee with cream and/or sugar	56	73.04 ± 92.55
Milk/ chocolate milk	59	61.43 ± 72.25
Soft drink	44	38.21 ± 61.29
Cultured milk/ yogurt drink	46	35.16 ± 53.19
Malted drink	36	30.71 ± 51.02
Fruit juice	38	23.43 ± 37.53
3 in 1 instant coffee/ tea	19	22.86 ± 67.63
Soya bean drink/ soya drink milk	34	22.25 ± 41.28
Bubble milk tea	32	19.43 ± 38.10
Flavoured juice drink	21	14.57 ± 34.07
Packet drink	14	8.32 ± 22.78
Sport drink	6	5.68 ± 24.52
Syrup/ cordial	4	1.79 ± 9.33
Energy drink	1	0.71 ± 7.14

Total amount of SSB	357.45 ± 217.92

3.2. Factors associated with sugar intake from SSB

Table 5 shows the outcomes of simple and multiple linear regression that presented to identify the factors associated with SSB intake. Multiple linear regression revealed that practice (β= -0.371, p<0.001) was the only factor that significantly related to SSB intake among university students. The prediction model from multiple linear regression was statistically significant (F= 5.459, p= 0.001). It suggested that students who were having good practice consumed a lower amount of SSB.

Table 5: Factors associated with sugar-sweetened beverages among the students.

Factors	Simple Linear Regression			Multiple Linear Regression		
	βeta	t	p-value	βeta	t	p-value
Age	0.138	1.380	0.171	0.123	1.321	0.190
Body mass index	- 0.039	- 0.386	0.700	NA	NA	NA
Knowledge	- 0.141	- 1.414	0.161	- 0.109	- 1.151	0.253
Attitude	- 0.168	- 1.689	0.094	- 0.066	- 0.682	0.497
Practice	- 0.387	- 4.151	<0.001*	- 0.371	- 3.901	<0.001*

Multiple linear regression model summary: R= 0.432, R^2= 0.187, Adjusted R^2= 0.153, F= 5.459, p= 0.001.
*Multiple linear regression was performed with p<0.05.

4. Discussion

According to Recommended Nutrient Intake (RNI) for Malaysia, the average amount of added sugar intake for adults should be limited to not greater than 10% of total energy, which equivalent to 10 teaspoons of sugar (50 g) per day (RNI, 2017). However, the current study demonstrated that nearly half of the students were exceeded the recommendations intake and the estimated mean sugar intake from SSB was 59.14 ± 51.28 g/day, equivalent to 12 teaspoons of sugar. Our finding showed a higher sugar consumption than a local study that showed mean sugar intake from SSB among public Malaysian university students was 30.90 g of sugar (6 teaspoons) of sugar per day (Hamirudin et al., 2018). This result is in line with other studies, which found that university students had poor dietary habits, including a low fruits and vegetables consumption and a higher consumption of SSB (Bawadi et al., 2019; Lo et al., 2022).

Milk and tea or coffee were the most frequently consumed SSB among the participants, with almost 10% of the participants consumed tea of coffee daily. However, this is in contrast with the other studies in Jordan (Bawadi et al., 2019), Saudi Arabia (Otaibi & Kamel, 2017) and United States (West et al., 2006) which found that soft drink were the most popular SSB consumed by students. The high prevalence of milk consumption probably due to the health benefits provided by milk as it contains essential nutrients that helps to improve bone strength, maintain healthy blood pressure and reduce the cholesterol production (Rizzoli, 2014). The reason of many participants preferred consumed tea or coffee was most likely due to the caffeine from tea or coffee can help them enhance concentrations and keep them from feeling sleepy when having an early class, doing assignments or preparing for an exam at night. It is supported by the research of Lee et al. (2009) which reported that more than half of the students consumed caffeine for academic purposes.

The mean total amount of SSB intake was 357.45 ml/day (1.4 servings). It appears to be higher than a local study by Loh et al. (2016), which reported a mean daily SSB intake of 177.50 ml/day (0.7 serving) among students. The variations in the outcomes of previous study and the present study should be attributed to differences in the description, measurement and categorisation of SSB. For instance, the SSB in Loh et al. (2016) consisted of sugar-sweetened fruit drinks, non-dairy beverages, carbonated drinks, and tetra-packed drinks, while present study consisted more groups of SSB, including malted drink, milk, soya, packet drink, syrup and bubble milk tea. In addition, it has been shown that students tend to alter their eating behaviours, favouring foods with a high calorie content when they are stressed during Covid-19 (Cheng & Wong 2021).

The present study indicated that no significant relationship was presented between SSB intake with BMI. The current result is consistent with the findings of numerous studies (Ahmad et al., 2019; Gan, Mohamed & Law, 2019; Vanderlee et al., 2014). The possible explanation could be explained by participants underreporting or overreporting their frequency and amount of SSB intake. The same finding was shown in a Canadian study (Vance et al., 2009), which indicated that more females underreported their energy intake than males, and that increased BMI status in both males and females is associated with increased underreporting levels.

Generally, the majority of the participants had adequate knowledge and a positive attitude towards SSB intake. This is consistent with the study conducted in Nigeria by Fadupin, Ogunkunle and Gabriel (2014) and in South Africa by Bhayat, Madiba and Nkambule (2017). Our findings indicated that knowledge and attitude were not significant predictors of SSB intake. Bhayat, Madiba and Nkambule (2017) also found that no correlation between knowledge and attitude towards SSB intake among university students. This could be explained by the fact that higher levels of knowledge do not contribute to changes in practice. Study has showed that despite the high knowledge, students still had a moderate to high daily SSB intake (Ahmad et al., 2019). Therefore promoting health education alone is insufficient to change people's habits in decreasing SSB intake.

Our study highlighted that only practice was a significant determinant in the SSB intake of the participants among all the factors (age, BMI, knowledge, attitude and practice). The findings suggested that participants who had a good practice tends to consume lower amount of SSB. It shows that they were well aware of the detrimental effects of excessive SSB consumption and hence good habits was implemented in their dietary practices. The results from current study provide evidence that good dietary practice is an important factor in reducing the excessive consumption of SSB among university students.

5. Conclusion

In conclusion, the prevalence of SSB intake was high among university students during the Covid-19, with nearly half of the participants (48%) consumed higher amount of SSB. The sugar intake from SSB was greater than the recommendation intake by WHO and RNI from Ministry of Health Malaysia, and thus it warrants the attention from public health authorities. This study highlighted that practice was the only factor associated with SSB intake. Milk and tea or coffee were the major contributors of SSB consumption. Excessive consumption of SSB would result in obesity, type 2 diabetes and other relevant diseases, therefore it is critical to promote various health interventions to

prevent the elevation of the obesity prevalence among Malaysian young adults. This can also assist the young population in adopting a healthy dietary pattern, especially in reducing SSB intake and increasing physical activity levels. Further research is needed to identify the effective interventions in lowering SSB intake.

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Conflict of Interests

The authors declare no conflict of interest in this study.

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