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ORIGINAL ARTICLE

Consumption of sugar-sweetened beverages: A cross-sectional study among university students in Sarawak

Whye Lian Cheah[1] Leh Shii Law[2] Myat Su Bo[3] Abigail Eleanor Anak Gani[4]
Andy Lau Yueh Lee[4] Mechyle Anak Abing[4] Nur Nadhirah Aisyah Binti Mohd Yasin[4]

[1]Assoc. Prof., Department of Community Medicine and Public Health, Faculty of Medicine and Health Sciences, University Malaysia Sarawak, Sarawak, Malaysia
[2]Lecturer, Department of Community Medicine and Public Health, Faculty of Medicine and Health Sciences, University Malaysia Sarawak, Sarawak, Malaysia
[3]Senior Lecturer, Department of Basic Medical Sciences, Faculty of Medicine and Health Sciences, University Malaysia Sarawak, Sarawak, Malaysia
[3]Medical student, Faculty of Medicine and Health Sciences, University Malaysia Sarawak, Sarawak, Malaysia

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Abstract

Objective: This study aimed to examine the prevalence and type of Sugar-sweetened Beverages (SSB) consumption among students at a public university in Sarawak.

Methods: This was a cross-sectional study conducted among undergraduate students in a public university in Malaysia. Using questionnaires, data on socio-demographics, SSB consumption, family and personal history of diabetes, as well as knowledge of SSB intake was collected. Anthropometry measurement was also taken in the survey. Data were analyzed using IBM SPSS version 22.0.

Results: A total of 208 respondents participated in the study. About one-fourth of the respondents consumed SSB at least once daily (83.6%) and as high as 72.1% consumed SSB more than three times a week. The top three most consumed types of SSBs were coffee, flavored milk, and 3-in-1 sachet drink (53.4 to 76.0%). Malay and other ethnic groups (Bumiputra Sarawak, Bumiputra Sabah, Indian, and other ethnic groups) recorded a significantly higher daily consumption of SSB (≥1 time) compared to Chinese respondents.

Conclusions: Understanding the pattern of SSB consumption among young adults is important to establish an effective intervention strategy. The findings highlighted the need for targeted interventions aimed at different ethnicities in view of their dietary consumption patterns in a multicultural society like Malaysia.

Keywords: Sugar-Sweetened Beverages, Young Adults

Correspondence: Assoc. Prof. Whye Lian CHEAH, Department of Community Medicine and Public Health, Faculty of Medicine and Health Sciences, University Malaysia Sarawak, Sarawak, Malaysia. **E mail:** wlcheah@unimas.my, **Phone:** +6082 581000
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INTRODUCTION

Sugar-sweetened beverages (SSB) are defined as all types of beverages containing free sugars such as monosaccharides and disaccharides[1] These include cordials, carbonated soft drinks, flavored mineral water, energy drink, sports drinks, electrolyte drinks, vitamin-fortified juice drinks, fruit and vegetables-based drinks with added sugar, as well as sweetened tea and coffee.[2] Even though many sweeteners in the market are marketed as healthier and prepared from natural and organic ingredients, these claims may be misleading as these sweeteners remain sugar-based compounds that produce excessive calories and virtually no other beneficial nutrients for body metabolism.[3]

The worsening obesity epidemic has gained the attention of public health and clinical practitioners worldwide. Recently, local studies reported a high prevalence of obesity ranging from 20 to 30%among Malaysian university students.[15,16] The high prevalence of overweight and obesity among university students is a public health concern as excessive weight gain leads to various comorbidities such as diabetes, hypertension, and cardiovascular diseases.[17] Consumption of SSB can be one of the contributing factors to such health concerns. Increased consumption of SSB has been linked with obesity, high blood pressure, dental caries, type 2 diabetes, cardiovascular disorders (CVD), inflammation, insulin resistance, metabolic syndrome with impaired glucose tolerance, and impaired β-cell function among both pediatric and adult age groups.[8,9,10,11] Besides that, SSB consumption was also reported to predispose to a higher risk of psychological health problems such as depression.[12,13,14]

Due to the adverse implications, SSB consumption behaviors among the younger generation have always been monitored by health practitioners.[4,18,19,20] Globally, the type of SSB consumed by adolescents and young adults varied in different countries. In Australia and New Zealand, the most popular SSB include soda, energy drinks, sports drink, fruit juice, and artificially-sweetened soda.[4] In Brazil, apart from the above-mentioned SSB, the local population also favors the intake of sweetened coffee and tea, as well as milk and milk products.[5] In certain countries like Korea, the type of SSB changes according to season whereby the consumption of fruit juice and carbonated beverages tend to be during summer. SSB consumption was also higher in girls than in boys [6] In Malaysia, based on a local study in one of the public universities, sweetened coffee and tea, as well as 3-in-1 sachet drinks are the most popular type of SSB.[7] Furthermore, the prevalence of SSB consumption also varies worldwide. In the United States (US), the National Longitudinal Study of Adolescents and Adults Health revealed a high consumption of SSB, in which 87.3% of the respondents consumed SSB in the previous week and 47.8% of them consumed eight or more such beverages.[19] In addition, the findings from the National Health and Nutrition Examination Survey 2007-2008 also reported a high consumption of SSBs (≥500kcal/day) among adolescents and young adults (36%). In Malaysia, the National Health and Morbidity Survey (NHMS) 2017 showed that 36% of Malaysian adolescents consumed at least a can of carbonated drinks every day.[21] The findings were consistent with other local studies. A study among 401 undergraduate students reported that 89.3% of them consumed SSB at least once

a day while another 53.3% consumed three or more SSBs in one day (high level of SSB consumption).[7] Similar pattern was observed in another study by Reid et al.[22] whereby 86% of their respondents (college students) consumed energy drinks. In Jordan, Bawadi et al.[23] reported that 60% of college students consumed an average of 1.53 servings of SSB daily.

SSB consumption is influenced by a wide range of factors. Sociodemographic characteristics such as younger age, being a male, being from low household income, and a lack of interest in health have been associated with a higher prevalence of SSB consumption.[24,25,26] In addition, body weight status was also linked with SSB consumption in a recent study[27]. However, the same association was not observed in a local study.[28] In view of the inconsistent findings, further exploration into the issues is warranted to obtain a better understanding of SSB consumption so that a more strategic intervention program can be customized for adolescents and young adults. The purpose of this study was to examine the prevalence and type of SSB consumed by students in a public university in Sarawak. We aimed to find out if the consumption pattern of SSB in Sarawak differs from other parts of the country and whether the knowledge of SSB among local adolescents and young adults is sufficient to guide them in making the correct choice in beverage selection.

METHODS

This was a cross-sectional study conducted among undergraduate students who stayed in the residential colleges of the university. Two residential colleges with the highest occupancy (2,016 and 1,998 respectively) were selected based on a sampling frame of 10. For each of the residential colleges, three blocks were randomly selected. The sample size was calculated using OpenEpi (version 3) based on a prevalence of at least one daily SSB intake (89.3%) by Ahmad et al.[7], giving rise to a minimum sample size of 189 after considering an attrition rate of 30%.

The questionnaire was adapted from Ahmad et al.[7] and it included socio-demographic characteristics, SSB consumption, and knowledge of SSB intake. Sociodemographic characteristics included age, gender, ethnicity, family income, parental educational status, personal and family history of diabetes. Knowledge of SSB was ascertained based on five questions: (1) Do you know what is SSB?; (2) Do you know the various types of SSB?; (3) Are commercially prepared fruit drinks a healthier choice?; (4) Does drinking three or more SSB per day have physical and health hazards?; (5) Can frequent consumption of SSB lead to overweight and obesity? Each correct answer was given a score of one. The total knowledge score was categorized into high level (≥4 questions answered correctly) and low level (≤3 questions answered correctly). The frequency of SSB consumption was captured based on the past seven days and within the past one day by using the adapted Beverage Intake Questionnaire (BEVQ).[29] By referring to Ahmad et al.[7], a total of eight types of SSB - soda, coffee, diet soda, sports drink, energy drink, flavored milk, processed fruit juice, and 3-in-1 sachet drink were listed as the options. Respondents were then classified into two groups based on the frequency of SSB consumption, namely high (three or more times per day) and moderate (one to two times per day).[30]

Weight and height measurements were carried out using calibrated weighing scale and stadiometer before being computed to obtain body mass index (BMI). The height was measured using a SECA 213 stadiometer. The stadiometer was suspended upright against a straight wall. The participants were asked to stand upright barefooted on a flat surface with the back of the heels and occiput against the stadiometer before the measuring beam was pushed down to rest on top of the participant's head. The visual display recorded the height to the nearest 0.5 cm. After that, each participant was weighed in their lightweight clothing without shoes by using a calibrated SECA weighing scale. Weight was recorded to the nearest 0.1 kg. Their BMI status was classified as underweight: below 18.5kg/m^2, normal weight: 18.5kg/m^2 to 22.9kg/m^2, overweight: 23.0kg/m^2 to 24.9kg/m^2, or obese: more than 25.0kg/m^2 .[31]

Data collection was conducted after obtaining permission from the university and college administration offices. All the students who stayed in the selected blocks of the residential college were invited to participate in the study. Data collection was conducted every Friday from 11 am to 4 pm between 14th February and 6th March 2020. The researchers first explained the nature and purpose of this study to respondents. Respondents who met the criteria and agreed to participate were then asked to fill in the consent form. Questionnaires were handed out to respondents after that. Their weight and height were measured after they completed the questionnaire.

All data were entered and analyzed using Statistical Package for Social Science Progress (SPSS IBM) version 22.0. Descriptive analysis was conducted and numerical data were reported as mean and standard deviation. The Chi-square test of independence was applied to examine the association between sociodemographic characteristics and body weight status with the consumption of SSB. The significance level was set as p-value < 0.05.

Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine and Health Science (FMHS), UNIMAS [(UNIMAS/NC-21.02/03 Jld.4 (20)]. Written informed consent was obtained from respondents before data collection. Respondents were allowed to withdraw from the study without any penalty. All the information obtained was kept confidential.

RESULTS

Table 1 shows the socio-demographic characteristics of the respondents. The majority of them were females, Malays, and older than 21 years. More than half of them came from B40 households. A high proportion of their parents had at least a secondary school education or higher. One-fourth of the respondents reported a family history of diabetes. Collectively, about half of them were either overweight (13.5%) or obese (33.2%). The majority of them (88.9%) reported a high level of knowledge about SSB.

Table 1. Socio-demographic characteristics and BMI of the respondents (n= 208)

	Mean (SD)	n	%
Age (years)	21.2 (1.29) Min: 19, Max: 27		
≤21		145	69.7
>21		63	30.3
Gender			
Male		62	29.8
Female		146	70.2
Ethnicity			
Malay		86	41.3
Chinese		42	20.2
Bumiputera Sarawak		35	16.8
Bumiputera Sabah		27	13.0
Indian & others		18	8.6
Family Income			
B40 (<RM4360)		149	71.6
M40 (RM4360-RM9619)		45	21.6
T20 (>RM9619)		14	6.7
Father Educational Level			
No formal education		6	2.9
Primary school		19	9.1
Secondary school		100	48.1
Certificate/ Diploma & higher		83	40.0
Mother Educational Level			
No formal education		8	3.8
Primary school		17	8.2
Secondary school		124	59.6
Certificate/ Diploma & higher		59	28.3
Family history of diabetes		48	23.1
Father		32	15.4
Mother		23	11.1
Siblings		6	2.8
Type 1 Diabetes		4	1.9
Knowledge Score	4.4 (0.8) Min:1, Max:5		
Low (≤3 questions correct)		23	11.1
High (≥4 questions correct)		185	88.9
BMI			
Underweight (<18.5)		27	13.0
Normal (18.5-22.9)		84	40.4
Overweight (23-24.9)		28	13.5
Obese (>25.0)		69	33.2

Table 2 presents the SSB consumption pattern among respondents. About one-fourth of the respondents consumed SSB at least one time daily (83.6%) and as high as 72.1% consumed SSBs more than three times a week. The top three most consumed types of SSBs were coffee, flavored milk, and 3-in-1 sachet drink (53.4 to 76.0%)(Table 3).

Table 2. Consumption of SSB by day and by week (n=208)

	n	%
SSB intake by day		
None	32	15.4
At least 1 time	97	46.6
More than 3 times	79	38.0
SSB intake by week		
None	6	2.9
At least 1 time	52	25.0
More than 3 times	150	72.1

Table 4 present the association of daily SSB intake with socio-demographic characteristics and other independent variables. Based on the findings, only ethnicity showed a significant association with a daily intake of SSB. Students who were Malay and of other ethnic groups (Bumiputra Sarawak, Bumiputra Sabah, Indian, and other ethnic groups) recorded a

Table 3. Frequency of SSB consumption per week and day (n= 208)

	Weekly						Daily					
	None		1-3 times		>3 times		None		1-3 times		>3 times	
	n	%	n	%	n	%	n	%	n	%	n	%
Soda	95	45.7	108	51.9	5	2.4	125	60.1	81	38.9	2	1.0
Coffee	50	24.0	106	51.0	52	25.0	75	36.1	117	56.3	16	7.7
Diet Soda	161	77.4	44	21.2	3	1.4	169	81.3	38	18.3	1	0.5
Sport drink	131	63.0	73	35.1	4	1.9	152	73.1	53	25.5	3	1.4
Energy drink	193	92.8	14	6.7	1	0.5	194	93.3	12	5.8	2	1.0
Flavoured milk	73	36.1	118	56.7	14	6.7	97	46.6	101	48.6	10	4.8
Processed fruit juice	135	64.9	66	31.7	7	3.4	148	71.2	56	26.9	4	1.9
3-in-1 sachet drink	58	27.9	109	52.4	41	19.7	78	37.5	114	54.8	16	7.7

higher daily consumption (≥1 times) of SSB compared to Chinese respondents. Other independent variables such as age, gender, family income, parents' education level, family history of diabetes, knowledge score, and BMI showed no significant difference between those who did not consume SSB and those who consumed SSB more than once per day.

Table 4. Association of daily SSB intake with socio-demographic characteristics and other factors (n=208)

	Per Day				
	None		≥1 time (moderate to high)		p-value
	n	%	n	%	
Age (years)					0.837
≤21	23	71.9	122	69.3	
>21	9	28.1	54	30.7	
Gender					1.000
Male	10	31.3	52	29.5	
Female	22	68.7	124	70.5	
Ethnicity					<0.01**
Malay	9	28.1	77	43.8	
Chinese	15	46.9	27	15.3	
Others[a]	8	25.0	72	40.9	
Family Income					0.286
B40 (<RM4360)	25	78.1	124	70.5	
M40 (RM4360-RM9619)	7	21.9	38	21.5	
T20 (>RM9619)	0	0	14	8.0	
Father education level					0.523
No and Primary	5	15.6	20	11.4	
Secondary	17	53.1	83	47.2	
Tertiary	10	31.3	73	41.4	
Mother education level					0.293
No and Primary	2	6.3	23	13.1	
Secondary	23	71.9	101	57.4	
Tertiary	7	21.8	52	29.5	

Table 4. Association of daily SSB intake with socio-demographic characteristics and other factors (n=208)

Family history of diabetes					0.820
No	24	75.0	136	77.3	
Yes	8	25.0	40	22.7	
Knowledge score					0.392
Low (≤3 questions correct)	2	6.3	21	11.9	
High (≥4 questions correct)	30	93.8	155	88.1	
Body mass index					0.482
Underweight (<18.5)	3	9.4	24	13.6	
Normal (18.5-22.9)	16	50.0	68	38.6	
Overweight and obese (≥23.0)	13	40.6	84	47.7	

[a] Bumiputra Sarawak, Bumiputra Sabah, Indian and others; *significant at p<0.05; **significant at p<0.01

DISCUSSION

Based on the findings, the frequency of SSB consumption was considered high among the university students in this study. Our results are consistent with Bipasha et al.[32] in Bangladesh whereby almost all (99.3%) of their students reported that they consumed SSB at least once per week. The prevalence of high SSB intake per day (38.0%) in our study was lower compared to a local study (51.6%) by Ahmad et al.[7]. However, for high SSB intake per week, our study reported a higher percentage of 72.1% compared to 53.3% by Ahmad et al.[7] Such findings are not surprising as our study respondents were students who stayed in the residential colleges on campus. They have limited access to food preparation facilities and are more likely to adopt unhealthy dietary habits such as the consumption of SSB.[33] In addition, most of the residential colleges are equipped with vending machines that dispense affordable SSB and unhealthy snacks. Unlike some workplaces or public buildings, there are no policies that regulate the items or their content for vending machines in universities, thus further increasing the likelihood of SSB purchase and consumption.[34]

In terms of the types of SSB consumed, coffee and 3-in-1 sachet drinks were the most popular SSBs among the respondents. In other studies, soda was the most common SSB.[5,32] Fontes et al.[5] found that the consumption of sweetened coffee and tea were major contributors to energy intake besides soda. In Malaysia, such sweetened coffee and tea are often packaged in the form of 3-in-1 sachet drinks that consist of coffee or tea, sugar, and creamer. A study at the University of New Hampshire found that their students consumed a lot of caffeinated beverages, particularly coffee because it was the most affordable and readily available product on campus. Furthermore, coffee is perceived as beneficial for them in performing school-related tasks as it can boost their energy throughout the day, making them more alert and productive. Some students even rely on coffee to stay up late and study.[36] Such findings mirrored a local study among university students in Peninsular Malaysia in which caffeinated drinks (coffee or tea) were the most popular SSB whereby 18.4% of the respondents consumed it daily and another 31.9% consumed six times or less per week.[37]

Interestingly, our study shows a significant variation in daily SSB consumption between students of different ethnicities. Malays and other ethnic groups (bumiputra Sarawak and Sabah, Indian, and others) consumed more SSB than Chinese students. Similarly, Tasevska et al.[38] also reported an ethnicity disparity whereby non-Hispanic black race/ethnicity was associated with high SSB consumption. Such disparity may reflect the food intake or dietary differences in various socio-cultural practices. For example, a local study that explored the dietary patterns among major ethnic groups showed that Malay adolescents had a lower intake of health-based food such as SSB when compared to Chinese.[39] Apart from ethnicities, many studies have also compared SSB intake with age, gender, income, education, and BMI.[4,5,38] However, there were no significant differences between these variables with SSB intake in this study. This was aligned with another local study that was conducted at a public university in Malaysia in which no significant association was observed between age, sex, and parental education with SSB consumption.[26] This also indicated that other factors such as physical availability and economic accessibility of the SSB might play a more important role in determining the unhealthy behavior of SSB consumption.[40]

Last but not least, family history of diabetes and knowledge of SSB did not show any association with SSB consumption. This was consistent with the results in Norliza et al.[26] and Park et al.[41] Family history and SSB knowledge did not increase the uptake of healthy lifestyles among family members. This can be extrapolated from cancer research. For example, among respondents with a family member diagnosed with cancer, protective health behaviors such as involvement in regular screening, quitting smoking, and being physically active did not show any increment.[42] In other words, greater knowledge of certain conditions does not always result in the uptake and practice of healthy behaviors.[43]

Limitations

Some limitations of this study should be taken into consideration. As a cross-sectional study, the causality between variables cannot be ascertained. In addition, the estimation of SSB intake relied on self-reporting and recall bias could be present, leading to potential over- or under-overestimation. A food diary will be a more comprehensive and accurate method to determine SSB intake. Furthermore, the involvement of only dormitory students from a single university might limit the generalization of the findings to all university students in Malaysia.

CONCLUSION

In conclusion, an in-depth understanding the SSB consumption among young adults is important to formulate an effective intervention strategy, especially in view of the distinctive eating cultures of different ethnicities in a multicultural society like Malaysia. Adolescence is a timely period for the adoption and consolidation of sound dietary habits so that healthy nutritional behaviors from young adulthood can lead to better adult health. More importantly, it will be a golden opportunity to correct any nutritional inadequacies and ease various disease burdens later on. In addition, universities should collaborate closely with public health personnel in educating students on how to reduce the consumption of SSB. A more environmental-centered and population-

based approach will be more effective in achieving a more successful response from the university community in the efforts to reduce the availability and acceptability of SSB.

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Availability of data and material: The datasets collected, used, and analyzed during the current study are available from the corresponding author on reasonable request.

Authors' Contributions: Concept: CWL, MSB, Design: CWL, MSB, Supervising: CWL, MSB, Data collection and entry: AEAG, ALYL, MAAbing, NNAM, Analysis and interpretation: CWL, AEAG, ALYL, MAAbing, NNAM SA, Literature search: CWL, AEAG, ALYL, MAAbing, NNAM, Writing: CWL, LLS, AEAG, ALYL, MAAbing, NNAM, Critical review: CWL, MSB, LLS, AEAG, ALYL, MAAbing, NNAM.

Abbreviations

Sugar-sweetened beverages (SSB)

Cardiovascular disorders (CVD)

National Health and Morbidity survey (NHMS)

Beverage Intake Questionnaire (BEVQ)

Body mass index (BMI)

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