

Plain water and beverage consumption patterns among university students in Puncak Alam, Malaysia

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ABSTRACT

Introduction: Data on water and sugar sweetened beverages (SSB) intake among young adults in Malaysia is sparse. This study aimed at measuring the intake of plain water and SSB among undergraduate students in a Malaysian university and examine its association with body mass index (BMI). **Methods:** A total of 376 undergraduate students aged 18-30 years were recruited. A self-administered questionnaire was used to determine the SSB consumption pattern. The questionnaire consisted of five sections that included the background of the participants, knowledge about SSB, SSB preferences, frequency and portion size. **Results:** 23.9% of subjects in this study were overweight. Almost all of the subjects took outside food (93.1%) and drink (74.2%). The highest daily consumption was plain water (92.3%), with a majority drinking more than two cups at each intake. Caffeinated drinks (coffee or tea) were the most popular SSB among the students (18.4%). Most students (79.7%) did not consume SSB on a daily basis. A significant association was found between the proportion of plain water consumption and BMI ($p < 0.05$). Those who were overweight consumed a greater amount of plain water as compared to those underweight. **Conclusion:** Our findings of low plain water intake among the underweight may be used to tailor intervention efforts to increase its intake and reduce that of SSB, especially among underweight young adults.

Keywords: Sugar sweetened beverages, SSB, plain water, obesity, undergraduate students

INTRODUCTION

The prevalence of obesity has increased drastically to epidemic proportions in Malaysia. Based on a systematic analysis for the Global Burden of Disease Study (2013), 44.2% of Malaysian adults have been found to be overweight or obese (Ng *et al.*, 2014). Similar trends have been seen among Malaysian children and adolescents.

These trends could lead to serious health complications in adulthood. Various public health co-morbidities are associated with overweight and obesity, including hypertension, cardiovascular disease, diabetes, depression and multiple type of cancers. Generally, obesity arises from an imbalance of energy homeostasis with the complex interaction between genetic, metabolic,

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cultural, environmental, socioeconomic, and behavioural factors (Heitmann *et al.*, 2012). Recent highlights from the Prospective Urban Rural Epidemiology (PURE) study showed that the intake of carbohydrates is high among Malaysians (Dehghan *et al.*, 2017). National survey data has indicated that the consumption of carbohydrates in the form of added sugars has also increased (Amarra, Khor & Chan, 2016; Dehghan *et al.*, 2017).

Multiple studies have reported that current estimates of added sugar intake among Malaysian children and adults range from 9.0% to 28.4%, with the highest intake found among adolescents (Amarra *et al.*, 2016). The reported intake is worrying, as it exceeds World Health Organization (WHO) (2015) recommendations which state that added sugar must not exceed 10% of the total intake of energy. This WHO guideline also recommended to further reduce the intake of free sugars to below 5% of total energy, if conditions warrant this. This recommendation translates into 25 grams of added sugar or approximately six teaspoons of sugar per day for a 2000 kcal diet. Fructose and non-fructose-rich corn syrups, cane and sucrose, honey and other edible sugar are common types of sugar added to food or beverages.

In the United States, soft drinks are the leading source of added sugar, each serving of which is a high glycaemic load that increases the risk of type 2 diabetes mellitus (T2DM) (Hu & Malik 2010). However, in Malaysia, the Malaysian Adult Nutrition Survey (MANS) 2003 has pointed out that intake of sweetened beverages such as coffee, *teh tarik*, and chocolate beverages are the highest contributors to the consumption of added sugar in the daily dietary intake of Malaysian adults' (Norimah *et al.*, 2008).

Water consumption is important for adequate hydration, body function and health. Increased water consumption,

specifically plain water, is used as a key message in many weight reduction programmes (Muckelbauer *et al.*, 2013). The Malaysian Dietary Guidelines has recommended drinking 6-8 glasses of plain water daily (NCCFN, 2010). Studies have reported that substituting SSB with plain water plays a significant role in reducing energy intake, and thus can aid in weight management and diabetes prevention (Muckelbauer *et al.*, 2013). As Malaysian's prevalence of T2DM in 2015 (17.5%) has doubled since 1996, in parallel with obesity, it has become important to identify the extent of SSB intake in the population (Cheah *et al.*, 2018).

This study specifically aimed to determine plain water and SSB intake, and their association with body mass index (BMI), among university undergraduate students in an urban area in Malaysia.

MATERIALS AND METHODS

Participants

Undergraduate students at the Puncak Alam campus of Universiti Teknologi MARA, were invited to participate in this cross-sectional study. We advertised the study by using flyers and also approached students at the common areas of the university such as library, student lounge and cafeteria. As there were approximately 16000 registered students, we estimated that a sample size of 376 was needed by using the Raosoft Calculator Software (95% of confidence level with a 5% margin error). The participants were required to be free from diet-related disease, mental disorder and physical disabilities. Those who met the study criteria were recruited as subjects and asked to complete a self-administered questionnaire and consent form. The study was approved by the Ethics Committee of Universiti Teknologi MARA.

Instruments

SSB was defined as any beverage with added sugar or calories. This definition covered fruit drinks, milk, carbonated/soft drinks, coffee/tea and sports and energy drinks.

A self-administered questionnaire that was adapted from a study by Hedrick *et al.* (2010) was used to obtain data about plain water and SSB consumption pattern. We modified the questionnaire to better reflect local drinking habits in Malaysia, and ran a pilot study to assess the reliability of the modified questionnaire. A Cronbach's alpha of >0.7 was obtained for all sections in

the questionnaire, which indicated a good reliability. The questionnaire was entirely in English, and definitions or explanations about the food items were also given. The questionnaire consisted of four sections, which included the background participants' (including self-reported weight and height), SSB preferences, frequency of SSB consumption and portion size.

Statistical analysis

All analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 22. We reported the data descriptively and used the

Table 1. Characteristics and background of the students (N=376)

<i>Characteristic (mean±SD)</i>	<i>Frequency (n)</i>	<i>Percentage (%)</i>
Age (22.23±1.17)		
≤ 22	260	69.1
> 22	116	30.9
Gender		
Male	44	11.7
Female	332	88.3
Faculty		
Health science	188	50.0
Non-health science	188	50.0
Marital status		
Single	374	99.5
Married	2	0.5
Year of Study		
1 st -year student	41	10.9
2 nd -year student	125	33.2
3 rd -year student	187	49.7
Final year student	23	6.1
Place of living		
With family	23	6.1
Hostel resident	324	86.2
Non-resident/rental house	29	7.7
Body mass index (BMI)		
Underweight	68	18.1
Normal	218	58.0
Overweight	90	23.9
Physical activity		
Not exercise	203	54.0
Irregular exercise	157	41.8
Regular exercise	16	4.3

chi-square test to compare between categorical variables. The significance level was defined as $p < 0.05$.

RESULTS

A total of 376 subjects aged 18-30 years participated in this study. There was an equal number of subjects ($n=188$) from both the health science and non-health sciences faculties. More than half of them had normal BMI (58.0%) and 54% of the total did not exercise. The prevalence of overweight among the subjects was high at 23.9%. Table 1 summarises the characteristics and background of our subjects.

Most of the subjects eat outside food (93.1%) and did not prepare their food (92.2%). They showed a similar preference between buying outside drinks (74.2%) and preparing their own drinks (52.4%) (Table 2).

Table 3 reveals the beverage consumption patterns of the subjects.

Plain water (92.3%) was the most commonly consumed beverage. A majority of the subjects drank >2 cups each time. This was followed by sweetened coffee or tea (18.4%) and full cream milk (9.6%). Besides plain water, most of the subjects consumed only ≤ 1 cup of the beverage each time. The lowest frequency of intake was alcoholic drinks, with 97.1% of subjects consuming such beverages either once or not at all in a week. The low intake may have been because of religious reasons since most of the subjects were Muslims who are forbidden from consuming alcohol. Based on Table 3, soft drinks and milk were least favourable among our subjects.

Table 4 summarises the factors related to the consumption of SSB's among the subjects. Approximately two-thirds of the subjects (69.7%) did not consume SSB on a daily basis. They preferred cold SSB (66.5%) purchased from

Table 2. Sources of food and drinks (N=376)

<i>Characteristic</i>	<i>Frequency (n)</i>	<i>Percentage (%)</i>
Source of food		
Prepared by family members		
Yes	38	10.1
No	338	89.9
Purchased from the cafeteria/ restaurant		
Yes	350	93.1
No	26	6.9
Self-prepared		
Yes	67	17.8
No	309	82.2
Source of drinks		
Prepared by family members		
Yes	27	7.2
No	349	92.8
Purchased from cafeteria/restaurant		
Yes	279	74.2
No	97	25.8
Self-prepared		
Yes	197	52.4
No	176	47.6

Table 3. Pattern of consumption of beverages (N=376)

Types of beverages	≤ 1 time per week		≤ 6 times per week		Daily	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Plain water	5	1.3	24	6.4	347	92.3
100% fruit juice	259	68.9	87	23.1	30	8.0
Sweetened fruit beverages	247	65.7	106	28.2	23	6.1
Full cream milk	252	67.0	88	23.4	36	9.6
Low fat milk	276	73.4	71	18.9	29	7.7
Skimmed milk	307	81.6	48	12.8	21	5.6
Regular soft drink	303	80.6	56	14.9	17	4.5
Diet soft drink	335	89.1	25	6.6	16	4.3
Sweetened coffee or tea	187	49.7	120	31.9	69	18.4
Energy or sports drinks	283	75.3	74	19.7	19	5.1
Alcoholic drinks	365	97.1	7	1.9	4	1.1
Other beverages	362	96.3	7	1.9	7	1.9

Table 4. Consumption pattern of sugar-sweetened beverages (N=376)

Parameters	Frequency (<i>n</i>)	Percentage (%)
Frequency of consumption		
Daily	114	30.3
Not daily	262	69.7
Types of beverages		
Hot	27	7.2
Cold	262	69.7
Both	87	23.1
Location of purchase		
Supermarket	250	66.5
Cafeteria	198	52.7
Vending machine	133	35.4
Others	2	0.5
Location of consumption		
Home	31	8.2
Outside	262	69.7
Both	83	22.1
Time of consume		
Breakfast	74	19.7
Lunch	192	51.1
Evening tea	119	31.6
Dinner	123	32.7
Reason for consume		
To reduce thirst	164	43.6
To complement a meal	123	32.7
As a refreshment	140	37.2
To stay up	117	31.1
Others	14	3.7
Factors influencing to choice of SSB		
Taste	320	85.1
Price	81	21.5
Brand	69	18.4
Health concerns	55	14.6
Others	3	0.8

Table 5. Portion size of beverage consumption according to BMI status

	BMI								<i>p</i> -value [†]
	Total (<i>N</i> =376)		Underweight (<i>n</i> =68)		Normal (<i>n</i> =218)		Overweight (<i>n</i> =90)		
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Plain Water									
≤1 cup each time	49	13.0	19	27.9	26	11.9	4	4.4	0.000*
≤2 cups each time	70	18.6	10	14.7	45	20.6	15	16.7	
>2 cups each time	257	68.4	39	57.4	147	67.4	71	78.9	
100% fruit juice									
≤1 cup each time	291	77.4	55	80.9	172	78.9	64	71.1	0.319
≤2 cups each time	75	19.9	10	14.7	41	18.8	24	26.7	
>2 cups each time	10	2.7	3	4.4	5	2.3	2	2.2	
Sweetened fruit beverages									
≤1 cup each time	280	74.5	50	73.5	164	75.2	66	73.3	0.809
≤2 cups each time	87	23.1	15	22.1	50	22.9	22	24.4	
>2 cups each time	9	2.4	3	4.4	4	1.8	2	2.2	
Full cream milk									
≤1 cup each time	300	79.8	54	79.4	178	81.7	68	75.6	0.572
≤2 cups each time	72	19.1	13	19.1	39	17.9	20	22.2	
>2 cups each time	4	1.1	1	1.5	1	0.5	2	2.2	
Low fat milk									
≤1 cup each time	312	83.0	57	83.8	182	83.5	73	81.1	0.815
≤2 cups each time	58	15.4	9	13.2	33	15.1	16	17.8	
>2 cups each time	6	1.6	2	2.9	3	1.4	1	1.1	
Skimmed milk									
≤1 cup each time	336	89.4	63	92.6	194	89.0	79	87.8	0.650
≤2 cups each time	38	10.1	5	7.4	22	10.1	11	12.2	
>2 cups each time	2	0.5	0	0.0	2	0.9	0	0.0	
Regular soft drink									
≤1 cup each time	304	80.9	55	80.9	183	83.9	66	73.3	0.103
≤2 cups each time	62	16.5	13	19.1	28	12.8	21	23.3	
>2 cups each time	10	2.7	0	0.0	7	3.2	3	3.3	
Diet soft drink									
≤1 cup each time	337	89.6	62	91.2	198	90.8	77	85.6	0.614
≤2 cups each time	36	9.6	6	8.8	18	8.3	12	13.3	
>2 cups each time	3	0.8	0	0.0	2	0.9	1	1.1	
Sweetened coffee or tea									
≤1 cup each time	252	67.0	51	75.0	140	64.2	61	67.8	0.511
≤2 cups each time	103	27.4	15	22.1	65	29.8	23	25.6	
>2 cups each time	21	5.6	2	2.9	13	6.0	6	6.7	
Energy or sports drink									
≤1 cup each time	278	73.9	51	75.0	164	75.2	63	70.0	0.322
≤2 cups each time	87	23.1	17	25.0	48	22.0	22	24.4	
>2 cups each time	11	2.9	0	0.0	6	2.8	5	5.6	
Alcoholic beverages									
≤1 cup each time	367	97.6	67	98.5	213	97.7	87	96.7	0.742
≤2 cups each time	9	2.4	1	1.5	5	2.3	3	3.3	
>2 cups each time	0	0.0	0	0.0	0	0.0	0	0.0	
Others									
≤1 cup each time	373	99.2	67	98.5	217	99.5	89	98.9	0.665
≤2 cups each time	3	0.8	1	1.5	1	0.5	1	1.1	
>2 cups each time	0	0.0	0	0.0	0	0.0	0	0.0	

[†]Analysis using χ^2 test

* $p < 0.05$

supermarkets (66.5%), and they typically consumed these when away from home or in their rooms (69.7%). The preferred time for SSB consumption was during lunch (51.1%), in order to reduce thirst (43.6%), as that was the prime time for hot weather. SSBs were predominantly chosen based on taste (85.1%).

Further analyses on the association between beverage consumption and BMI showed significant differences between plain water consumption portion size and BMI ($p < 0.05$) (Table 5). Those who were overweight consumed a significantly higher amount (> 2 cups) of plain water each time (78.9%) compared to those who were underweight (27.9%), who typically drank < 1 cup of water each time.

DISCUSSION

This study evaluated plain water and SSB consumption patterns among undergraduates from a Malaysian university. Vella-Zarb & Elgar (2009) have reported that college and university students were susceptible to unhealthy weight-related behaviours including consumption of SSB. Various studies in multiple countries have shown that the trend of increasing SSB intake among university students is worrying (Vilaro *et al.*, 2018; Joh, Lim & Cho, 2015). Highly urbanised countries such as the United States and Australia have reported high intakes of sweetened beverages, at 40-50% of university students who were studied (O'Leary *et al.*, 2012; Block *et al.*, 2013). Similar trends have also been reported among Turkish university students (Deliens *et al.*, 2015). Thus, the trend affects the students' intake on plain water. Presently, studies on sugary beverages and plain water consumption within Malaysia remain scarce.

Most of the students consumed foods and drinks from outside their homes. The result is to be expected, as

most of the subjects lived on campus, with limited access to food preparation facilities. As discussed by in a previous study (Greaney *et al.*, 2009), food choices of students were influenced by the availability and accessibility of foods and cooking facilities. It has also been shown that such living arrangements, particularly when living outside of their family home, are associated with unhealthy dietary habits, including increased SSB consumption (An, 2016). In line with one study (Vilaro *et al.*, 2018), our subjects also reported taste as one of the determinants in choosing type of SSB. Taste is an important reason for high SSB consumption and unhealthy diets.

Caffeinated drinks and sweetened fruit beverages (including cordial drink) were the most consumed SSBs among our subjects. This is in line with a study by Norimah *et al.* (2008) which reported a high consumption of coffee and tea among Malaysians. In Malaysia, such beverages are often prepared with added sugar and condensed milk, which eventually contributes to high fat and calorie. Our study found that although most of the subjects did not consume SSB on a daily basis, almost 70% consumed SSBs multiple times in a week. Again, this may be related to the high frequency (74.2%) of students who bought their drinks from outside at cafeteria/restaurants. As reported by previous study, eating/drinking out was the largest contributor to SSBs intake (An, 2016). Frequent SSB consumption is associated with an increased risk of obesity and related non-communicable diseases (NCDs). There have been many reports over this decade of the early onset of NCDs among Asians (Dans *et al.*, 2011; Misra & Khurana, 2011). Thus, strategies to prevent the onset of NCDs must start earlier as a healthy lifestyle during childhood and youth can prevent the onset of NCDs later in adulthood.

This study revealed that overweight students were highly cautious of their dietary intake, particularly of SSBs. They drank significantly more plain water compared to the underweight subjects. This is consistent with previous study, which reported that overweight and obese young adults were found to be high water consumers (Lee, Park & Kim, 2014). Obese persons attempt to reduce their energy intake by substituting plain water for SSBs (Park *et al.* 2012). In contrast, there were fewer underweight subjects who did not take plain water at all on a daily basis. This is unfortunate, as having normal or underweight BMI should not be taken to mean that healthy eating is to be ignored. A randomised controlled trial among 646 children reported that the reduction of sweets and sweetened beverages observed in the intervention group significantly reduced their BMI and blood pressure (Chan & Woo, 2010). Another recent study conducted in Japan on water intake revealed that there was an inverse correlation between high water intake and risk of cardiovascular diseases (Cui *et al.*, 2018). Therefore, a high intake of water particularly plain water must be promoted seriously in our community lifestyle. In Malaysia, the consumption of 1ml of water for each calorie eaten is recommended (NCCFN, 2010). This amount is equivalent to 7 to 11 glasses of water or fluid per day.

Another result that is of concern in this study is the very low intake of milk. Fewer than 10% of our subjects drank milk on a daily basis. The revelation is in agreement with studies by Norimah *et al.* (2008) & Talaei *et al.* (2018), who also reported a low level of milk intake among the Malaysian and Asian populations. As milk is the primary source of calcium, it is critical to ensure that the recommended level of daily calcium intake is fulfilled. However, previous study have shown

that calcium intake among Malaysians is low and does not meet recommended nutrient intake (RNI) (Alam, 2012). Low calcium and vitamin intake, together with a sedentary lifestyle, are risk factors for osteoporosis. Therefore, an innovative approach should be made to promote proper nutrition and physical activity for healthy bones among young adults.

Many studies have compared dietary intake of SSBs with gender (Grimes *et al.*, 2013; Ha *et al.*, 2016; Ranjit *et al.*, 2010). However, our study did not find any gender differences in SSB consumption.

An important limitation of this study was the preponderance of females over males. More than 80% of the subjects were female. In general, females are more concerned about their calorie intake. This may explain the low intake of daily SSBs among them. Another limitation was that we did not take into account the food intake habits by way of daily total calorie intake of the subjects.

CONCLUSION

Understanding trends in plain water and SSB consumption, together with healthy and balanced dietary intake among young adults is imperative to formulate effective nutritional intervention strategies to achieve a healthy lifestyle. Ultimately, this may help to prevent the risk of obesity and related diseases later in life. The present study highlights that lowering SSB intake and increasing plain water intake, especially among the underweight, is crucial. The results from this study may help by providing information for future intervention studies. In addition to SSB, future interventions should also focus on a strategy to increase calcium intake among young adults.

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Authors' contributions

TNIMF, principal investigator, conceptualised and designed the study, prepared the draft of the manuscript and reviewed the manuscript; NJN, assisted in design the study, assisted in drafting the manuscript, reviewed the manuscript; ASM conducted the study, data analysis and interpretation, and prepared the draft of the manuscript.

Conflict of interest

There is no conflict of interest to declare.

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