ORIGINAL ARTICLE

PREVALENCE OF CARBONATED SOFT DRINK CONSUMPTION AND ASSOCIATED FACTORS AMONG MALAYSIAN ADOLESCENTS: A NATIONWIDE CROSS-SECTIONAL STUDY 2017

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ABSTRACT

Carbonated soft drinks (CSD) consumption is one of the contributing factors to weight gain, dental caries and non-communicable diseases among adolescents. This study aims to determine CSD consumption among Malaysian adolescents and their associated factors. The Adolescent Health Survey 2017, was a nationally representative survey sampled school-going adolescents aged 13 to 17 years. Findings reported that 36.9% of adolescents reported CSD consumption at least once daily in the past 30 days, and the prevalence was higher than a similar study conducted in 2012. Boys, schools in rural areas, lower secondary schoolers, not physically active, consuming fast food, having food insecurity, and truancy problem reported significantly higher odds of consuming CSD compared to their counterparts. By ethnicity, Bumiputera Sarawak adolescents showed the highest odds of consuming CSD and followed by Bumiputera Sabah. Thus, interventions to limit CSD consumption among Malaysian adolescents should consider the factors highlighted in this study.

***Keywords**: Carbonated soft drink, Adolescent, Malaysia, Prevalence, Risk factors, Adolescent Survey 2017.*

INTRODUCTION

Generally, carbonated soft drinks (CSD) are non-alcoholic beverages that contain carbonated water, sweetener (sugar, high-fructose corn syrup, sugar substitutes, fruit juice or combination of these) and flavouring. CSD presented a fizzy taste due to carbon dioxide content, and most CSD in Malaysia is high in sugar between 6 to 9 teaspoons per can. CSD is a major source of sugar, high in calories, low in calcium and low in other healthful nutrients important for adolescent's body development. Adolescents reported consuming CSD to enjoy the flavor, and to quench thirst.1 But, high intake of CSD are considered as sugar-sweetened beverages (SSB), and the high sugar content contributed to weight gain, dental caries and high risk of chronic diseases (e.g. diabetes) among adolescents.2,3 The World Health Organization (WHO) recommends added sugar intake should be limited to less than 10% of total energy intake (i.e., <50 g of sugar /day among most adults and less among children).4 Further, the American Heart Association advised restricting added sugar intake among children to less than 25 gms/day.5 As an alternative, sugar-free carbonated drinks (SFCD) are available in the market. SFCD were initially introduced for diabetics but later marketed for people who are dieting or trying to reduce their sugar consumption. SFCDs are sweetened with non-calorie sweeteners such as aspartame, saccharin, and cyclamate.

In Malaysia, The Global School Health Survey 2012 (GSHS) reported that 29.3% of the students consumed CSD at least once daily in the past 30 days and it was significantly higher among male students (32.0%) compared to female students (26.7%).6 Previous studies reported gender (boys)7,8, family habit7, snacking8,9, television viewing8, fast food consumption8, convenient to buy8,9, parenting style7,10 and breakfast skipping9,11 as predictors of CSD consumption. In the current study, to examine the prevalence of CSD consumption among school-going adolescents in Malaysia and its association with socio-demography, physical activity, fast food intake, food insecurity and truancy problem.

METHODOLOGY

Sampling

The Adolescent Health Survey 2017 (AHS) utilised a two-stage stratified cluster sampling design to represent school-going adolescents aged 13 to 17 years old (Form 1 to Form 5). The nationwide cross-sectional study was conducted at all 16 states, including three federal territories (Federal

Territory of Kuala Lumpur, Putrajaya and Labuan) in Malaysia. The sampling frame was a list of secondary schools from the Ministry of Education. The first stage of sampling was random selection of secondary schools with probability proportional to school enrolment size, resulted in 212 secondary schools were selected to participate. The second stage of sampling was the selection of classes. All classes in each selected school were included in the sampling frame, and systematic random sampling was used to determine classes. All students in the selected classes were eligible to participate in the survey12. Ethical approval was obtained from the Ministry of Health's Medical Research and Ethics Committee. Approvals were also obtained from the Ministry of Education at state, district, and school levels.

Definition of Variables

All questionnaires used in this survey were adapted from the Malaysian GSHS 2012. The WHO and the Center for Disease Control and Prevention (CDC) developed those questionnaires in 2001. Local adaptation and validation of the questionnaire was made before running the actual nationwide survey in Malaysia.

Carbonated soft drink consumption

Information on carbonated drinks consumption was obtained using a self-administered questionnaire. This survey studied CSD in the form of sugar-added carbonated drinks. Frequency of CSD consumption was assessed with the question "During the past 30 days, how many times per day did you usually drink CSD. Response options were 'I did not drink carbonated soft drink during the past 30 days, 'less than 1 time per day', '1 time per day', '2 times per day', '3 times per day', '4 times per day', and '5 or more times per day'. We calculated mean CSD consumption (times per day) after transforming responses of 'never or less than 1 time per day' as '0' and '1 time per day or more' as '1'.

Physical activity

Physical activity level was assessed based on a question: 'During the past seven days, on how many days were you physically active for a total of at least 60 minutes?' The choice of answers was '0 days' to '7 days. Those who were physically active were defined as physically active for at least 60 minutes per day, for a minimum of 5 days per week.

Truancy

Truancy was assessed based on a question: During the past 30 days, on how many days did you miss classes or school without permission? The responses were: '0 days', '1 or 2 days', '3-5 days', '6-9 days' and '10 or more days'. A response of '0 days' was recorded as '0' (never missed class), while other responses were recorded as '1' (> 1 days).

Food hunger

Food hunger was assessed based on a question: During the past 30 days, how often did you go hungry because there was not enough food in your home? Those who answered 'never/rarely/sometimes' were recoded as '0' and 'most of the time/always' were coded as '1' Fast food consumption was assessed based on a question: During the past 7 days, how many days did you eat food from a fast-food restaurant? The choice of answers was '0 days' to '7 days. Those who answered '0' to '2 days' were coded as '0' and '3' to '7' days were coded as '1'.

Data Analysis

Data were analysed using SPSS version 20.0 (SPSS IBM, New York, NY). Complex sampling was used to ensure that sample weights and study design were accounted for in the analysis. The estimated prevalence of CSD consumption by socio-demographic characteristics was described in frequencies and percentages. Simple logistic and multivariate logistic regression was applied to determine the associated factors of CSD consumption. We reported unadjusted odds ratios (OR) together with their 95% confidence intervals (95% CI) for the selected associated factors. Findings were then presented as adjusted odds ratio (aOR) with 95% CI considering factors significantly associated with CSD consumption in the simple logistic analysis.

Education level was grouped based on school grades. Lower secondary school constituted of Remove Class (a transition year for students from the Chinese and Tamil medium schools to acquire sufficient proficiency in the Malay language in secondary school), Form 1, Form 2, and Form 3. Upper secondary school constituted of Form 4 and Form 5.

RESULTS

Characteristics of the adolescents and CSD consumption with completed information on fast food intake, physical activity, hunger status and truancy are presented in Table 1. Out of 30,000 adolescents eligible to participate in the survey, 27,462 students successfully responded to the CSD consumption module (response rate of 91.5%). Table 1 presented that 36.9% of adolescents reported consuming CSD at least once daily in the past 30 days. Overall, 23.0% (95% CI = 21.74, 24.24) of adolescents did not consume CSD at all in the past 30 days, 40.1% (95% CI = 38.70, 41.61) consumed less than once daily, 16.3% (95% CI = 15.47, 17.12) consumed once daily, 10.3% (95% CI = 9.64, 10.94) consumed 2 times daily, 5.5% (95% CI = 5.05, 5.97) consumed 3 times daily, 1.9% (95% CI = 1.66, 2.23) consumed 4 times daily and 2.9%

(95% CI = 2.54, 3.38) consumed 5 or more times daily. Adolescents in the rural area, upper secondary schoolers, and males consumed significantly more CSD than their counterparts. By ethnicity, Bumiputera Sarawak reported the highest prevalence of consuming CSD. Those who reported consuming fast food experienced food hunger and had truancy problem had significantly higher CSD consumption. No significant difference in CSD consumption was observed between those who were physically active or not (Table 1).

Table 2 presented findings from logistic regression analysis on factors associated with CSD consumption. In simple logistic regression, all predictor parameters studied were significantly associated with the risk of CSD consumption. Multiple logistic regression analysis suggests that boys had higher odds of consuming CSD (aOR = 1.47) compared to girls. Bumiputera Sarawak adolescents showed the highest odds of consuming CSD (aOR = 3.15), followed by Bumiputera Sabah (aOR = 1.82). Surprisingly, adolescents living in rural area had significantly higher odds (aOR = 1.22) of consuming CSD compared to those living in the urban area. Lower secondary (aOR = 1.39) and not physically active (aOR = 1.17) adolescents reported higher odds of consuming CSD compared to their counterparts. Those who reported consuming fast food (aOR = 2.46), experienced hunger (aOR = 1.37) and experienced truancy (aOR = 1.56) had higher odds of consuming CSD compared to their counterparts.

Table 1: Prevalence of carbonated soft drink intake in the past 30 days among Form 1 to Form 5 students in Malaysia*a

Study characteristics	Carbonated Soft Drink Intake			
	Unweighted Count	Prevalence (%)	95% Confidence Interval	
			Lower	Upper
Overall	9827	36.90	35.04	38.79
Sex				
Boys	5299	41.45	39.17	43.76
Girls	4528	32.41	30.15	34.76
Ethnicity				
Malay	6504	22.26	20.37	24.26
Chinese	1059	27.47	23.90	31.36
Indian	556	43.56	37.39	49.94
Bumiputera Sabah	870	47.35	41.25	53.53
Bumiputera Sarawak	576	63.61	54.71	71.67
Others	262	48.20	42.37	54.08
Locality of school				
Urban	5275	33.71	30.69	36.87
Rural	4552	41.03	38.39	43.72
School Category				
Lower secondary	6559	39.83	38.02	41.67
Upper secondary	3268	32.32	29.58	35.18
Fast Food Intake				
Yes	1726	59.62	56.44	62.73
No	8084	34.05	32.31	35.83
Physically active				
Yes	1976	35.57	33.19	38.02
No	7812	37.19	35.26	39.16
Gone Hungry				
Yes	474	45.34	40.58	50.19
No	9344	36.54	34.68	38.44
Truancy				
Yes	3510	45.00	43.13	46.88
No	6297	33.48	31.50	35.52

*Prevalence of CSD intake is defined as CSD consumption of at least once daily in the past 30 days

Table 2: Factors associated with carbonated soft drink intake among school-going adolescents in Malaysia

	Simple Logistic Regression				Multivariable Logistic Regression			
	Crude OR	95% CI		p-value	Adjusted AOR	95% CI		p-value
		Lower	Upper			Lower	Upper	
Sex								
Boys	1.47	1.40	1.54	<0.001	1.47	1.40	1.55	<0.001
Girls	1.00	-	-		1.00	-	-	
Ethnicity								
Malay	1.53	1.42	1.65	<0.001	1.41	1.30	1.53	<0.001
Chinese	1.00	-	-	-	1.00	-	-	-
Indian	1.83	1.61	2.01	<0.001	1.71	1.71	1.50	0.001
Bumiputera Sabah	2.74	2.44	3.02	<0.001	2.57	2.27	2.90	<0.001
Bumiputera Sarawak	4.78	4.11	5.56	<0.001	4.44	3.80	5.20	<0.001
Others	2.57	2.15	3.10	<0.001	2.32	1.93	2.80	<0.001
School location								
Urban	1.00	-	-		1.00	-	-	
Rural	1.30	1.24	1.37	<0.001	1.22	1.15	1.28	<0.001
School Category								
Lower secondary	1.38	1.31	1.45	<0.001	1.39	1.32	1.47	<0.001
Upper secondary	1.00	-	-		1.00	-	-	
Fast Food Intake								
Yes	2.63	2.44	2.84	<0.001	2.46	2.27	2.66	<0.001
No	1.00	-	-		1.00	-	-	
Physically active								
Yes	1.00	-	-		1.00	-	-	
No	1.10	1.03	1.17	0.003	1.17	1.10	1.25	<0.001
Gone Hungry								
Yes	1.48	1.30	1.67	<0.001	1.37	1.20	1.56	<0.001
No	1.00	-	-		1.00	-	-	
Truancy								
Yes	1.64	1.56	1.73	<0.001	1.56	1.47	1.65	<0.001
No	1.00	-	-		1.00	-	-	

Abbreviations: OR, odds ratio; CI, confidence interval; AOR, adjusted odds ratio

Discussion

Overall, more than one-third of the Malaysian adolescents (36.9%) consumed CSD at least once per day during the past 30 days. The current prevalence of CSD consumption among Malaysian adolescents is considerably lower than the prevalence in other Asian countries such as the Philippines (42.4%) and Cambodia (45.5%)[13] While one meta-analysis of Global School-Based Student Health Surveys conducted in Africa, Asia, Oceania, and Latin America between 2008 and 2015 showed that consumption of carbonated soft drinks at least once per day was 42.8% while Latin America showed high consumption of soft drink[18]. Although the prevalence is lower in Malaysia, and the findings need to be interpreted carefully. In the previous GSHS 2012, the CSD consumption among adolescents was 29.4%, and it was noted that the current prevalence is higher than the previous survey.[6] The increasing trend of the consumption of CSD among adolescents in Malaysia appears to be alarming. The dietary habits among adolescents in Malaysia may have changed in the past 5 years due to rapid urbanisation and modernisation. Moreover, changes of food-related lifestyles such as availability of CSD at home, family dietary habits, parenting style, television viewings or exposure to social media could be the contributing factors to high consumption of CSD among the adolescents.[14-16] Many of these variables are not included in the present study and need to be investigated further in other research.

We also found that the frequency of CSD consumption differ significantly between boys and girls, whereby the consumption of CSD was higher among boys (41.5%), among those in the urban area and lower secondary (aged 13-15 years old). Other studies in Belgium, Italy and Sri Lanka also reported similar findings.[15,17] In Sri Lanka, boys

who were active in sports and exercise consumed more CSD compared to girls. It is available in most of the shops, either in the urban or rural area.[15] Sports drinks are formulated to replenish athletes and is comprised of water for proper hydration, carbohydrate (Sucrose, dextrose, fructose and glucose) for energy and electrolytes (sodium, potassium and chloride) for muscle function. Flavours and colours are also added to attract athletes to drink it. Due to the special formulation, sports drinks are more expensive than CSD. Hence, CSD is more preferred than sports drinks among adolescents in Sri Lanka.

There is also a high possibility that Malaysian adolescents have access to CSD during non-school hours and even at home. Adolescents might go to fast-food restaurants or convenience stores on the way back from school while hanging out with friends during the weekend or after tuition class. Some fast-food restaurants are opening 24 hours, and carbonated soft drinks are also easily available from those convenience stores which are usually located not far from the school compound as well. Consumption habits among friends and family also could affect the consumption of CSD among Malaysian adolescents.[17]

The present study found a positive association between frequency of CSD consumption and eating in fast-food restaurants, truancy problems and hunger. Fast food restaurants are the main sources of CSD, and the price of CSD is much lower than other types of drinks. There is a high possibility that the adolescents had easy access to fast-food restaurants due to the location of the premises. Some fast-food restaurants always have their doors open 24 hours daily. In the urban area in Malaysia, the fast-food restaurants are not far from the school compound, and students who were absent from school are likely to use fast-food restaurants as a place of gathering. Some fast-food restaurants also offer a free flow of CSD at their premises. Some convenience stores are also located near schools. Further, adolescents with hunger problems (representing low socio-economic status families) are likely to purchase CSD as they are much cheaper than other healthy drinks such as fruit juices, milk and other beverages.

Limitations

There are several limitations to the findings of the present study. The consumption of CSD was assessed by the daily frequency, not the actual amount of the CSD taken by the adolescents. There are different types of CSD available in Malaysia with other packaging and sugar content. Therefore, only a gross estimation of the daily consumption of the CSD was captured in the present study. Another limitation is that the results are based on the self-report from the adolescents. Although the self-report questionnaire is quick and easy to administer, non-response biases and recall biases are quite common and may have some effect on the data of the present study.

CONCLUSION

The results have shown an increasing trend of CSD consumption throughout the 5 years study cycle and the harmful health impacts related to the intake of these drinks to adolescents have become a concern. CSD consumption was associated with gender (boys), Bumiputera Sabah and Sarawak ethnicity, adolescents from rural areas, lower secondary schoolers, not physically active, eating in fast-food restaurants, having truancy and food hunger problems. This is an important issue that needs to be addressed as part of the strategies to control sugar intake in the CSD among school-going adolescents. Considering the negative outcomes resulting from excessive intake of CSD, policymakers and stakeholders should emphasize intervention to reduce CSD intake in the school-going adolescents at the community level, school levels and health campaigns (media coverage). Further research is needed to identify the causal relationship between these associated factors.

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Declaration of Conflicting Interests

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