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DETERMINATION OF SUGAR COMPOSITION OF SELECTED SUGAR SWEETENED BEVERAGES (SSBs) AND SNACK FOODS IN KELANTAN

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ABSTRACT

Sugars are important ingredients for the sugar sweetened beverages (SSBs) and snack foods industries. All sugars provide sweet taste but the intensity, quality and temporal profile of the sweeteners varies by type of sugar. The objective of this study was to determine sugar composition and it would contribute to the development of Malaysia database sugar composition table. Enzymatic technique was used to determine sugar composition in SSBs and snack foods, where combination of enzymes in sequential was used. The results showed the amount of isomerized sugar was found predominant in some beverages and minor in snack foods. However, the sucrose was the major component of total sugar in all of the SSBs and snack foods. The maltose level was the highest in instant chocolate malt drink and ground peanut cookies for SSBs and snack foods, respectively. The galactose levels in all samples were found to be very little. Lactose content was high in dairy products and snack foods samples such as chocolate coated, chocolate spread, chocolate nugget, chocolate coated wafer, milk chocolate coated wafer and chocolate rice cereal. The highest total sugar was found in instant coffee milk (60.65±3.13 g/100ml) for SSBs and milk chocolate coated (63.69±2.25 g/100g) for snack foods. In general, these findings suggested that total sugar composition of the food packaging items did not only indicate of sucrose as sugar content but also include either glucose, fructose, maltose, galactose or lactose. This information need to be disseminated to the public to increase awareness about the total sugar on food labels.

Key words: Sugar composition, sugar sweetened beverages (SSBs), snack foods

INTRODUCTION

Nutrient-poor foods which is high in sodium, sugar or fats such as sugar sweetened beverages (SSBs) that categorised by non-alcoholic beverages containing added sugar. SSBs exists due to sugar availability and has been on the rise in its consumption (Scharf & DeBoer, 2016). SSBs overconsumption is supported by intense marketing practices in terms of offer, distribution, price and promotion (Le Bodo *et al.,* 2016).

In term of diet-related, the overconsumption of sugar has been linked to a risk factor for weight gain, cardiovascular diseases and dental caries (Te Morenga *et al.,* 2013). High SSBs intake also has been associated with increased risk of type 2

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diabetes and metabolic syndrome, partially beyond the interaction with obesity (Malik *et al.,* 2010). High or overconsumption of SSBs is due to sugar characteristics which is tasty and pleasurable that easily induce people to consume more sugar than necessary (Takeichi *et al.,* 2012). Besides, increase of glucose in the bloodstream signals the pancreas to secrete insulin, where sugars were removed from bloodstream so it can be used as energy, thus increasing subsequent overall hunger and decreasing satiety levels (Mandel, 2017).

Sugars are highly desired as their role as enhancement of taste and satiety level (Clemens *et al.,* 2016). Most of the sugars are in monosaccharides forms such as glucose, fructose and galactose, whereas disaccharides forms consisted of sucrose, lactose and maltose. Therefore, laboratory analysis of SSBs provides new data which concern about the accuracy of the estimates for total sugar listed on food labels and the type of sugar actually used in beverages as compared to what is listed (Ventura *et al*., 2011).

It is important to look into different sugar specifically because it differs in their individual's characteristics and role in food production. All sugars provide sweet taste but the intensity, quality and changes in intensity over time of the sweetness varies by the type of sugar (Godshall, 2012). Different physiology effect of sugars are well-known (Rippe, 2013). Therefore, it is necessary to determine type of sugar consumption and their effect of on health. Studies show consumption of dietary fructose has increased in conjunction with rising intake of fructose parallel with the increased prevalence of obesity, metabolic syndrome and type II diabetes (Stanhope & Havel, 2008). Researchers hypothesized that fructose consumption could promote weight gain because it does not stimulate insulin secretion or leptin production by adipose tissue (Elliott *et al*., 2002).

The objective of this study was to determine sugar composition (glucose, fructose, sucrose, maltose, galactose and lactose) according to the food group category and it would be very helpful in the development of a database for Malaysia sugar composition table. Selected SSBs and sugary snack foods sample in Kelantan were analysed using rapid enzymatic technique. Currently, there is no study available to identify sugar composition by using rapid technique of enzymatic method in determining sugar composition, and yet there is no such database available on sugar composition table in Malaysia. Therefore, this study would add values on sugar composition information, which would be useful for other purposes such as in estimation for total sugars in our daily intake.

MATERIALS AND METHODS

Sample collection

Selected commonly consumed SSBs and snack foods were obtained from commercial, vendor-made or homemade in the capital city of Kota Bharu, Kelantan from June 2015 to March 2016. Commercial samples were obtained from three different popular top rank brands or food companies. Meanwhile, the highest sold vendor-made beverages were selected from three different locations to obtain the samples. Samples were divided into few categories, such as soft drinks, no sugar added fruit juice, sugar added fruit juice, soymilk, milk group, sugar sweetened milk, chocolate drinks with malt, yogurt drinks and whereas for vendor-made or homemade foods and beverages will be in different group, respectively. Kelantan has been chosen as our study location due to its culturally acceptable of higher degree of sweetness by routinely adding high amount of free sugars in every most of their daily local dishes and SSBs. Nevertheless, there is insufficient evidence to allow an estimation of intake levels of added sugar among different age of groups and types of sugar composition (Amarra *et al.*, 2016).

Sample preparation

An amount of 5 to 10 gram samples were taken directly from each SSBs and snack foods from its original packaging and were transferred to sterile sealed containers before analysis. Samples were prepared in accordance with Carrez clarification procedures on the homogenized sample, which contained protein and fat. Protein later was clarified with Carrez reagents after the extraction of fat with hot water. Samples containing carbon dioxide were degassed whereas strong and thick coloured samples were diluted. Clear, colourless and practically neutral liquid samples were used. All analyses were repeated two times for each sample.

In term of Carrez clarification, 1 g of solid or 1ml of liquid samples were transferred into a volumetric flask which contains 60 ml distilled water and was incubated for 15 minutes in water bath at temperature of 70ºC. Afterward, 5 ml Carrez-I- solution and 5 ml Carrez-II solution were added. The pH of solution were adjusted to 7.5–8.5 with 0.1 M sodium hydroxide and let it precipitated at room temperature for one hour before being filled up to 100 ml with distilled water. Approximately, 1.5 ml solution were transferred to centrifuge tube and was centrifuged at 3000 rpm for 5 minutes.

Reagents and standards

F-kits for sugar analysis consisted of Sucrose/ D-Glucose/D-Fructose F-kit, Lactose/D-Galactose F-kit and Maltose/Sucrose/D-Glucose F-kit were purchased from R-Biopharm Company, Darmstadt, Germany. The assay control solution was used as an internal standard to cross check the determination for correct performance and also to determine whether the sample solution was totally free from interfering substances.

Determination of sugar

Enzymatic test Roche & Enzytec: UV method (Boehringer Mannheim/ R-BIOPHARM, Enzymatic BioAnalysis/ Food Analysis) were performed using UV-Vis Spectrophotometer, Cary 100 Bio for determination of glucose, fructose, sucrose, maltose, lactose and galactose in beverages and foods sample (Yamamoto *et al.,* 2009). Enzymatic tests were measured at 340 nm and plastic cuvette were utilised due to very low adsorption and no disturbance of measurement at this wavelength.

Statistical analysis

Results from the laboratory for beverages and snacks sample were used to calculate total sugar in grams per 100 mL or grams per 100 g by summing up the total of glucose, fructose, sucrose, maltose, galactose and lactose. Statistical analyses were performed using the IBM SPSS version 20. Data were expressed as mean ± standard deviation (SD) by using descriptive analysis.

RESULTS

The sugar composition in SSBs and snack foods determined by enzymatic test were glucose, fructose, sucrose, maltose, galactose and lactose. Table 1 shows the content of isomerized sugar (liquid sugar of glucose and fructose) was high in mixed tropical fruit juice (5.24g, 6.42g/100mL), blackcurrant drink (4.78g, 4.90g/100mL), mango drink (4.88g, 5.00g/ 100mL), lemon carbonated drink (6.64g, 6.57g/ 100mL), strawberry carbonated drink (5.43g, 5.40g/ 100mL), lychee drink (5.87g, 5.74g/100mL), flavored energy drink (5.61g, 4.82g/100mL), soda drink (6.11g, 5.93g/100mL) and berries juice (4.69g, 4.87g/100mL). The predominant sugar in cultured drink (13.22g/100mL), cola carbonated drink (10.03g/100mL), mocha drink (10.41g/100mL), vendor-made drinks (ranged between 10.89g to 14.1g/100mL) and powder instant drink (ranged between 20.63g to 60.30g/100g) samples were determined as sucrose.

Maltose content was found in chocolate drink (1.13g/100mL), vendor-made chocolate drink (2.01g/100mL), instant premix coffee (3.43g/100g), instant chocolate drink (7.72g/100g) and instant chocolate malt drink (13.14g/100g). The galactose content was detected in small amount in certain beverages samples. However, instant chocolate malt drink samples contained 2.39g /100g of galactose which represented the highest content compared to other samples of instant chocolate malted drinks. Dairy product provided high content of lactose ranged from 3.49g to 5.97g/100mL. The total sugar contents of the beverages for liquid and powder, as assessed in this study, ranged from 4.52 to 16.89g/ 100ml and 21.50g to 60.65g/100g, respectively.

Sugar concentration of snack foods samples were listed in Table 2. Isomerized sugar was found in pudding (3.40g, 3.56g/100g), gummy (3.34g, 2.98g/100g) and *kacang gula* (2.62g, 1.77g/100g) in small amount compare to SSBs. The predominant sugar in all of the examined snack foods were determined as sucrose except for *roti kismis*, which was highly concentrated of glucose (10.62g/100g). The highest content of maltose was found in ground peanut cookies (10.84g/100g). Galactose content was detected in small amount in all snack foods samples. Lactose content was found very high in milk chocolate coated (7.22g/100g), chocolate spread (5.37g/100g), chocolate nugget (11.05g/ 100g), chocolate coated wafer (7.33g/100g), milk chocolate coated wafer (7.53g/100g) and chocolate rice cereal (7.57g/100g). The total sugar content for snack foods ranged from 6.18g to 63.69g/100g.

DISCUSSION

This study used enzymatic technique to determine the composition of sugars in selected SSBs and snacks. The method used is a combination of enzyme in sequential. Details instruction were followed as enzyme concentration, substrate concentration, concentration of other required reagents, pH and temperature could affected reaction rates and results (BeMiller, 2010). This method was relatively specific for a specific carbohydrate to avoid low limits of detection. In addition, enzymatic analysis provide rapid result (Brummer & Cui, 2005). Walker and Goran (2015) reported that, information of nutrient label grossly under or overestimated of actual sugar content in baby foods. Therefore, such study is very important to determine the type of sugar actually used in commercial foods and beverages.

Findings showed the isomerized sugar, commonly called high-fructose corn syrup (HFCS) was determined in few selected SSBs and snacks samples. Intake from isomerized sugar may lead to health problems. There are concerns about the high intake of isomerized sugar related to obesity, cardiovascular disease and other metabolic

Table 1. Sugar composition of selected SSBs

No.	Beverages	g/100ml or g/100g (SD)						
		Glucose	Fructose	Sucrose	Maltose	Galactose	Lactose	Total
Fruit juices								
1.	Mixed tropical	5.24 (1.51)	6.42 (0.40)					11.66 (1.90)
2.	Berries	4.69 (0.12)	4.87 (0.09)					9.55 (0.21)
Fruit drinks								
3.	Blackcurrant	4.78 (0.88)	4.90 (1.01)	0.60 (0.77)				10.27 (2.43)
4.	Orange	1.40 (0.83)	1.51 (0.78)	1.61 (0.75)				4.52 (1.06)
5.	Mango	4.88 (0.25)	5.00 (0.39)	1.02 (0.73)				10.89 (1.37)
6.	Apple	1.36 (1.05)	1.34 (0.49)	6.98 (0.88)				9.68 (1.36)
7.	Lychee	5.87 (0.15)	5.74 (0.24)					11.61 (0.39)
8.	White grape	4.71 (0.83)	1.73 (0.33)					6.43 (0.49)
9.	Lemon	3.84 (0.66)	1.97 (0.37)					5.80 (0.28)
10.	Grass jelly	0.06 (0.03)	0.09 (0.01)	6.98 (1.92)				7.10 (1.86)
Carbonated								
11.	Orange	5.56 (0.17)	3.73 (1.99)					9.29 (1.82)
12.	Cola	0.72 (0.11)	0.37 (0.01)	10.03 (1.36)				11.11 (1.24)
13.	Lemon	6.64 (0.05)	6.57 (0.01)	1.22 (0.08)				14.42 (0.13)
14.	Strawberry	5.43 (0.49)	5.40 (0.06)	1.23 (0.00)				11.44 (1.42)
15.	Soda	6.11 (0.15)	5.93 (0.01)	0.61 (0.13)				12.64 (0.00)
16.	Lemon lime	4.51 (0.34)	1.66 (0.09)					6.17 (0.25)
17.	Sarsaparilla	5.52 (1.46)	1.36 (0.29)					6.88 (1.75)
Cultured drinks								
18.	Plain	0.67 (0.14)		13.22 (2.14)			4.50 (0.16)	16.89 (2.69)
19.	Flavoured	3.79 (0.68)	2.39 (1.19)	1.69 (0.94)			5.97 (0.71)	11.85 (2.63)
20.	Yogurt	0.88 (0.70)	1.26 (0.44)	7.08 (0.37)	0.10 (0.02)	0.05 (0.04)	0.23 (0.00)	9.41 (1.65)
Milks								
21.	Chocolate	0.07 (0.02)	0.14 (0.00)	6.84 (0.01)		0.06 (0.01)	4.71 (0.31)	11.75 (0.46)
22.	Strawberry	0.06 (0.02)	0.09 (0.01)	4.87 (0.02)		0.10 (0.09)	3.80 (0.74)	8.94 (0.62)
23.	Low fat	0.05 (0.02)	0.08 (0.01)	1.70 (0.15)		0.08 (0.02)	4.76 (0.52)	6.69 (0.62)
24.	Fresh	0.05 (0.01)	0.07 (0.00)	1.78 (0.09)		0.06 (0.04)	3.79 (0.63)	5.75 (0.57)
25.	Full cream	0.19 (0.08)	0.11 (0.04)	1.51 (0.10)		0.12 (0.06)	4.03 (0.38)	5.96 (0.11)
26.	Vanilla	0.03 (0.01)	0.07 (0.01)	1.84 (0.13)		0.09 (0.01)	3.49 (0.71)	5.52 (0.56)
27.	Coffee	0.84 (0.06)	0.09 (0.01)	6.42 (0.59)		0.14 (0.05)	3.58 (0.11)	11.06 (0.79)
Soymilk								
28.	Soy drink	0.71 (0.11)		6.71 (0.12)			0.11 (0.02)	7.49 (0.20)
29.	Concentrated soymilk	0.23 (0.35)		8.16 (0.68)				8.38 (0.36)

Table 1 continued...

Coffee/ tea								
30.	Ice lemon tea	4.17 (1.26)	3.02 (0.78)	4.52 (0.06)				10.20 (2.13)
31.	Green tea			5.73 (0.09)				5.73 (0.09)
32.	Chrysanthemum	0.16 (0.16)	0.04 (0.03)	5.28 (1.61)				5.42 (1.46)
33.	Coffee milk	0.06 (0.03)	0.01 (0.00)	5.02 (0.72)		0.07 (0.04)	1.34 (0.34)	6.03 (0.93)
34.	Black coffee	0.34 (0.00)		8.11 (0.73)		0.02 (0.00)	0.54 (0.00)	8.56 (0.88)
35.	Mocha			10.41 (1.87)		0.08 (0.01)	1.78 (0.01)	11.64 (2.53)
36.	Latte			4.28 (0.12)			2.05 (0.06)	6.32 (0.18)
Malt drinks								
37.	Chocolate	0.62 (0.29)		2.96 (0.34)	1.13 (0.00)		3.57 (0.00)	5.14 (2.63)
Sport drinks								
38.	Isotonic	1.73 (0.47)	2.12 (0.89)	1.78 (0.31)				5.63 (0.60)
39.	Energy	8.98 (0.15)	3.93 (0.97)					12.91 (1.11)
40.	Flavoured energy	5.61 (0.63)	4.82 (0.61)					10.43 (1.24)
41.	Herbalised	7.89 (0.28)	5.65 (0.22)	1.18 (0.38)				14.32 (1.15)
Instant								
42.	*Teh Tarik*	0.73 (0.04)	0.14 (0.06)	20.63 (0.88)				21.50 (0.98)
43.	Coffee milk	0.27 (0.16)	0.09 (0.01)	60.30 (3.32)				60.65 (3.17)
44.	Premix coffee	0.43 (0.04)	0.12 (0.02)	36.47 (2.07)	3.43 (0.60)			40.43 (2.73)
45.	Chocolate drink	0.60 (0.45)	0.08 (0.00)	43.77 (1.52)	7.72 (0.36)			52.16 (0.71)
46.	Chocolate malt drink	1.67 (0.06)	0.15 (0.07)	24.10 (1.58)	13.14 (2.44)	2.39 (0.00)		40.25 (0.81)
Vendor-made								
47.	Rose syrup			10.89 (1.77)				10.87 (1.77)
48.	Ice lemon			7.86 (0.81)				7.86 (0.81)
49.	Coffee milk			14.19 (0.18)		0.03 (0.01)	2.26 (0.40)	15.71 (1.29)
50.	Black coffee			12.25 (0.84)		0.03 (0.01)	2.09 (0.54)	13.66 (0.97)
51.	Hot chocolate			6.40 (0.28)	2.01 (0.17)	0.01 (0.00)	2.00 (0.24)	10.42 (0.17)
52.	Coconut drink	0.22 (0.03)	0.23 (0.04)	6.05 (0.07)				6.50 (0.14)
53.	Grass jelly			7.19 (0.27)				7.19 (0.27)
54.	Ice chocolate			7.21 (0.30)				7.21 (0.30)
55.	Ice milk green tea			6.78 (0.11)				6.78 (0.11)
56.	*Teh tarik*			9.25 (0.35)				9.25 (0.35)
57.	*Kopi tarik*			9.58 (0.11)				9.58 (0.11)
58.	*Cendol*			6.77 (0.09)				6.77 (0.09)
59.	Milk carrot juice			8.02 (0.03)				8.02 (0.03)
60.	Apple juice			6.29 (0.12)				6.29 (0.12)
61.	Orange juice			5.33 (0.47)				5.33 (0.47)
62.	Watermelon juice			4.96 (0.06)				4.96 (0.06)
63.	*Leng chee kang*			8.41 (0.57)				8.41 (0.57)
64.	*Asam boi*			9.33 (0.46)				9.33 (0.46)
65.	*Jagung*			8.04 (0.06)				8.04 (0.06)

Table 2. Sugar composition of selected Snack Foods

No.	Snacks	g/100g (SD)						
		Glucose	Fructose	Sucrose	Maltose	Galactose	Lactose	Total
1.	Yogurt	0.71 (0.80)	0.64 (0.86)	8.72 (2.04)		0.31 (0.01)	3.44 (0.18)	13.82 (0.19)
2.	Pudding	3.40 (0.13)	3.56 (0.08)	12.46 (0.65)				19.41 (0.86)
3.	Jelly	0.33 (0.04)	0.48 (0.03)	9.51 (0.16)				10.32 (0.17)
4.	Chocolate biscuit	0.11 (0.01)	0.10 (0.00)	20.95 (1.34)	0.24 (0.06)			21.40 (1.41)
5.	Cheese sandwich	0.24 (0.06)		13.00 (1.41)	0.69 (0.27)		1.87 (0.09)	15.79 (1.82)
6.	Peanut butter sandwich	0.14 (0.05)	0.12 (0.02)	16.91 (0.13)	0.83 (0.24)		0.65 (0.07)	18.64 (0.23)
7.	Milk chocolate coated	0.08 (0.04)		56.40 (1.98)			7.22 (0.30)	63.69 (2.25)
8.	Rice crackers	0.13 (0.04)		9.22 (0.30)	0.02 (0.00)			9.36 (0.34)
9.	Coconut biscuit	1.86 (0.08)	2.25 (0.35)	28.42 (0.59)	1.58 (0.11)			33.70 (1.70)
10.	Chocolate chips		0.07 (0.04)	31.18 (3.28)				31.25 (3.24)
11.	Cheese crackers	0.09 (0.02)	0.06 (0.01)	6.04 (0.05)				6.18 (0.04)
12.	Layer cake	0.76 (0.08)	1.05 (0.07)	27.69 (0.97)	1.20 (0.28)			30.69 (1.40)
13.	Corn stick		0.09 (0.01)	13.94 (0.08)				14.03 (0.07)
14.	Chocolate stick	0.54 (0.66)	0.41 (0.13)	36.48 (2.09)			0.94 (0.08)	38.36 (1.22)
15.	Chocolate cream biscuit	0.61 (0.10)	0.60 (0.04)	34.76 (0.58)		0.03 (0.02)		36.00 (0.50)
16.	Chocolate spread	0.13 (0.04)	0.07 (0.04)	22.67 (0.94)		0.02 (0.00)	5.37 (0.28)	28.34 (0.52)
17.	Popcorn	1.08 (0.11)	0.60 (0.14)	31.84 (1.19)	3.62 (0.17)	0.01 (0.00)	0.08 (0.04)	37.27 (1.23)
18.	Chocolate wafer	0.04 (0.01)	0.08 (0.00)	31.79 (1.18)				31.87 (1.11)
19.	Milk chocolate wafer	0.11 (0.02)	0.05 (0.04)	18.19 (0.27)				18.34 (0.28)
20.	Caramel wafer	0.11 (0.01)	0.12 (0.03)	22.38 (3.37)	1.40 (0.14)	0.73 (0.38)	3.93 (0.11)	28.67 (2.78)
21.	Marshmallow	7.58 (0.42)	0.13 (0.02)	22.76 (1.94)			0.62 (0.16)	31.08 (2.23)
22.	Gummy	3.34 (0.01)	2.98 (0.05)	30.43 (0.15)		0.03 (0.01)		36.77 (0.23)
23.	Chocolate nugget	0.84 (0.04)	0.12 (0.01)	26.94 (4.06)	4.02 (0.00)	0.04 (0.02)	11.05(0.88)	40.99 (0.27)
24.	Oat biscuit	0.40 (0.14)		14.59 (0.58)	0.93 (0.10)			15.92 (0.82)
25.	*Kuih bangkit*	0.03 (0.00)	0.28 (0.18)	22.54 (0.76)				22.83 (0.60)
26.	Chocolate coated wafer	3.68 (0.25)	0.11 (0.01)	23.95 (2.75)		0.02 (0.01)	7.33 (0.46)	35.12 (3.42)
27.	Milk chocolate coated wafer			30.43 (0.61)		0.55(0.64)	7.53 (0.74)	38.50 (0.71)
28.	Chocolate rice cereal	0.49 (0.01)	0.11 (0.01)	34.75 (2.47)	1.38 (0.54)		7.57 (0.81)	44.29 (3.80)
29.	Ground peanut cookies	5.01 (0.01)	2.32 (0.36)	22.05 (1.48)	10.84 (1.18)			40.21 (2.31)
30.	*Kacang gula*	2.62 (0.17)	1.77 (0.33)	16.74 (1.05)				21.13 (0.89)
31.	*Kuih belanda*	0.10 (0.01)	2.10 (0.14)	38.56 (0.78)	0.37 (0.18)		4.18 (0.26)	45.30 (1.00)
32.	*Ais jem*		0.22 (0.04)	48.44 (3.44)				48.66 (3.40)
33.	*Roti kismis*	10.62 (0.54)	1.15 (0.22)	4.60 (0.57)				16.36 (1.33)
34.	Kaya spread	0.25 (0.08)	0.79 (0.30)	47.49 (3.51)				48.52 (3.14)
35.	Creamy caramel nougat	7.29 (0.41)	0.13 (0.04)	32.67 (3.30)				40.09 (2.85)
36.	Plain biscuit	0.04 (0.01)	0.54 (0.08)	18.88 (0.18)				19.46 (0.28)
37.	Wafer bar	0.03 (0.00)	0.05 (0.00)	35.26 (4.02)	0.24 (0.00)	0.02 (0.00)	4.27 (0.37)	39.70 (3.51)

syndromes (Parker *et al.,* 2010). Isomerized sugar is increasing worldwide because it is cheap and easy to use in commercial beverages and chilled or frozen snacks as it is in liquid form (Shikanai, 2014).

Sucrose has been the most commonly used natural occurring sweeteners in the food industry and household. Result shows vendor-made, instant SSBs and all our selected snacks samples contained sucrose as the highly added sugar representing of total sugar content. Maltose content was found in SSBs and snacks sample that contained cocoa and glucose syrup as ingredients. Maltose has highest glycemic index, therefore its consumption would rapidly supplied glucose to the bloodstream (Clemens *et al.,* 2016). In addition to sweetness, maltose increased viscosity including humectant and color stabilization to food material (Brown, 2014).

On the other hand, our analysis of SSBs and snacks samples indicated very little of galactose content. Apart from its presence in lactose hydrolysate syrup, galactose was seldom found in the diet, although it has been identified as a trace component of some seeds and pulses (Williams, 2003). Results showed that the lactose content of samples was found high in dairy products as the sweetness of milk comes from its lactose content. Dairy products contribute not only in reaching recommended calcium intake for the benefit of bone health but it has been suggested in reducing the risk for metabolic syndrome (Ohlsson *et al*., 2017).

Even though SSBs and snacks sample are high in certain types of sugar and low in one particular type of sugar, the total sugar content is still high. WHO (2015), recommends a reduction of intake of free sugars throughout the life course and in both adults and children. WHO recommends to reducing the intake of free sugars to less than 10% of total energy intake. Malaysian Dietary Guidelines (2013) has stated to consume foods and beverages low in sugar (key message 12), and dietary advice on how to achieve the goals. However, for example, a 500 ml carbonated drinks available in our market contains about 50 g of sugar, which is above WHO daily recommendation for sugar intake from total calorie (WHO, 2015).

Energy intake from SSBs increased by 135% between 1977 and 2001 in all age groups (Nielsen & Popkin, 2004). In term of age group, adolescent and young adults were reported as the highest age group who frequently consumed SSBs than younger children and older adults. However, unfortunately, very few studies existed regarding the dietary sources in particular of beverages and snacking among Malaysian as there is no database of specifically on sugar composition table (Amarra *et al*., 2016). Hence, it is not able to look into the trend of different types of sugar consumption through dietary pattern in Malaysia. Recently, a systematic review analyses, showed that the number of surveys on consumption of SSBs, fruit juice and milk conducted in East Asia, Southeast Asia and South Asia was too lacking where only 12 studies were conducted (Singh *et al.,* 2015).

There are several limitations in this study. Considering that the samples were only purchased in Kota Bharu, Kelantan, our findings were not able to represent the whole SSBs and snacks in Malaysian food and beverages item, but would be very meaningful as an initial exploratory of sugar content and composition as a pilot study. Further testing could be conducted with new samples of the similar SSBs and snacks to address some of the potential error, and analysis could be conducted to explore potential variation by analysis technique. In addition, future testing of samples purchased from others study locations in Malaysia would give useful information about the potential variation. However, the results of the current analysis are useful for future extensive sugar analysis research in able to develop sugar database for Malaysia.

CONCLUSION

In conclusion, this study provides sugar composition (glucose, fructose, sucrose, maltose, galactose and lactose) of selected SSBs and snack foods. This pilot study on sugar composition by using enzymatic technique will be helpful for the future studies related to determination of sugar composition of SSBs and snack foods to shorten the time of analysis. Given this finding, future analysis should be conducted to examine more sugar composition in SSBs and snack foods and it would contribute to the development of Malaysia database sugar composition table.

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