ORIGINAL ARTICLE

Unraveling the Sugar Rush: A Cross-sectional Study of Knowledge, Attitudes, and Practices Related to Sugar- Sweetened Beverages Consumption among Malaysian Young Adults

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ABSTRACT

Introduction: The consumption of sugar-sweetened beverages (SSBs) among young adults in Malaysia has witnessed a notable increase in recent years, giving rise to concerns regarding the potential adverse health effects, including obesity and diabetes. Despite the urgent need for targeted interventions, there is a dearth of research examining the knowledge, attitudes, and practices (KAP) related to SSBs among Malaysian young adults. To address this research gap, the present study aims to assess the level of KAP concerning SSB intake and its associated factors in this specific population. **Methods:** A cross-sectional study was conducted involving 408 Malaysian young adults aged between 15 and 29 years. Respondents completed an online questionnaire survey, which encompassed the assessment of socio-demographic characteristics and KAP regarding SSB consumption. The collected data were analyzed using IBM's Statistical Package for the Social Sciences (SPSS) version 22.0. Spearman correlation tests were performed at a significance level of 0.05. **Results:** The majority of respondents demonstrated moderate knowledge (60%) and practices (60%), while exhibiting a high positive attitude (100%) towards reducing SSB consumption. Significant correlations were observed between knowledge and attitude ($p = 0.003$, $rs = 0.148$) and between knowledge and practice ($p = 0.005$, $rs = 0.138$). Moreover, the attitude scores were found to be significantly associated with gender (χ^2 (1, N = 408) = 10.421, $p = 0.001$) and locality (χ^2 (1, N = 408) = 4.106, $p = 0.043$), while the practice scores exhibited a significant association with ethnicity ($p = 0.006$). **Conclusion:** This study provides valuable insights into the relationship between KAP related to SSB consumption and socio-demographic factors among Malaysian young adults. The findings underscore the importance of utilizing these insights to develop strategic interventions that aim to curtail SSB consumption and promote a healthy lifestyle, ultimately contributing to the reduction of non-communicable diseases. Health authorities are encouraged to capitalize on these findings to design targeted interventions tailored to the unique needs and circumstances of this population.
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INTRODUCTION

Most studies commonly define sugar-sweetened beverages (SSBs) as liquids sweetened with various forms of added sugars, including brown sugar, corn sweetener, corn syrup, dextrose, fructose, glucose, high-fructose corn syrup, honey, lactose, malt syrup, maltose, molasses, raw sugar, and sucrose (1-3). Based on the Malaysian Adults Nutrition Survey (MANS) in 2014, approximately 55.9% of Malaysian adults consume sugar daily, with an average intake of 4 teaspoons per day through added sugar in beverages like tea, coffee, and chocolate-based milk (4). Numerous studies have highlighted the association between SSB consumption and various health issues such as type 2 diabetes, cardiovascular disease, high uric acid levels, gout, dental cavities, and overweight and obesity (2,5). In Malaysia, the prevalence of SSB consumption among young adults is particularly high, with rates reported at 51.6% (6). Previous research conducted in Western countries has shown a low level of knowledge, attitude, and practices (KAP) regarding SSBs, which corresponds to higher SSB consumption rates (7,8). However, there is a limited number of studies specifically focused on SSB KAP, and in Malaysia, research on SSBs has predominantly focused on consumption trends, with limited detail on KAP (9). Knowledge, attitude, and practices (KAP)

surveys have proven effective in identifying the need for targeted preventive and educational interventions (10). Prior research, as underscored by Asharani et al. (10), has compellingly demonstrated the efficacy of KAP surveys in pinpointing specific areas that necessitate targeted preventative and educational interventions. Given this, conducting a KAP study focused on the consumption of SSBs among Malaysia's young adult population emerges as a critical endeavor. This study would provide healthcare authorities with baseline data on the KAP related to SSB consumption among this demographic, equipping them to design and implement a community intervention program aimed at enhancing areas that require substantial improvement. This is a pivotal step towards reducing the prevalence of diet-related diseases within this group, thus improving their overall health outcomes. Consequently, this study aims to determine the level of knowledge, attitude, and practices among young adults in Malaysia regarding SSB consumption, as well as explore the relationships with sociodemographic factors.

MATERIALS AND METHODS

Research design

This study utilized a cross-sectional design, amassing data pertaining to socio-demographic factors and the knowledge, attitudes, and practices (KAP) with regard to Sugar-Sweetened Beverages (SSBs) via an online questionnaire survey. The focus was on respondents aged 15-29 years old, a definition of 'young adults' ratified at a Malaysian Youth Policy Town Hall meeting on July 10th, 2015, aligning with definitions used by other Commonwealth nations. Respondents were required to be proficient in either English or Malay, ensuring the questionnaire was comprehensible to a broad range of respondents, further improving the representativeness of the findings. The sampling strategy adopted was convenience sampling, which involved respondents from all Malaysian states, including Sabah and Sarawak. This technique, characterized by the recruitment of easily accessible respondents, is efficient, cost-effective, and simple to implement (9). A subject information sheet was provided to potential respondents, and informed consent was obtained before data collection began. In the interest of confidentiality, all personal details, including phone numbers and email addresses, as well as the data collected during the survey, were accessible only to the research team and not included in the reported results. Ethical approval for the study was granted by the Universiti Malaysia Terengganu (UMT) Human Research Ethics Committee, with the approval number UMT/JKEPM/2021/74. Drawing from a previous study where poor SSB practices were recorded at 40.5% (9), and factoring in a standard error of 0.05 with a value for z of 1.96 (11), the calculated sample size was 371 respondents. However, accounting for a potential attrition rate of 10%, this study aimed for and successfully recruited 408 respondents from across the 14 Malaysian states. The data collection took place from August to October 2021. Invitations to participate in the survey were distributed via social media platforms, and respondent consent was voluntarily obtained prior to survey commencement. The online questionnaire, hosted on Google Forms, was designed to be completed within a 10–15-minute time frame. Upon completion, responses were automatically saved to the investigator's Google Drive. Once the targeted number of responses was reached, the survey link was deactivated. The data were then downloaded, extracted into a Microsoft Excel file, and recoded in preparation for analysis.

Research Instruments

In this study, respondents were provided with a set of validated questionnaires that encompassed socio-demographic factors and the knowledge, attitudes, and practices (KAP) regarding Sugar-Sweetened Beverages (SSBs). In this study, an adopted questionnaire from Teng et al. (12) has been utilized. Teng et al. conducted a highly regarded study on the development and validation of a questionnaire assessing the knowledge, attitudes, and practices (KAP) of young adults in Malaysia towards sugar-sweetened beverages (SSBs). The questionnaire designed by Teng et al. serves as the foundation for this study data collection instrument, ensuring its established validity and reliability. The incorporation of the adopted questionnaire into this study has been approved through the necessary permissions, further enhancing the credibility and relevance of this research. The socio-demographic section captured essential variables such as gender, age, ethnicity, educational level, residential locality, and family monthly income. The KAP questions, structured on a dichotomous scale, consisted of 20 items—10 related to knowledge, 5 to attitudes, and 5 to practices. This scale, which offered a Yes/No or Agree/Disagree response option, not only streamlined the design process but also provided clear and straightforward choices for respondents (13,14). The knowledge domain was crafted using factual information about SSBs, while the attitude domain assessed awareness levels regarding daily SSB consumption and healthy SSB selection practices (12). In the knowledge domain, there is a mix of positive and negative statements. Specifically, items 2, 6, and 9 are framed as negative statements, while the rest of the items are presented as positive statements. The practice domain evaluated the actions and behaviors adopted during daily beverage selection and preparation (12). The practice domain comprises both positive and negative statements, with items 1 and 4 being positive statements and the remaining items being negative statements. The questionnaire, available in both English and Malay, has been stringently validated for reliability and validity. Cronbach's Alpha values of 0.733, 0.737, and 0.742 were observed for each KAP domain, indicating robust internal consistency. Furthermore, high Pearson Correlation Coefficients (r) of 0.986, 0.973, and 0.988 were recorded for the KAP domains, attesting to

the questionnaire's construct validity (12). Scoring was straightforward: each correct response earned one point and each incorrect response zero points. The overall score was the sum of correct responses. Given that the maximum score for each domain equaled the number of items, a higher score indicated better performance. Each domain was further divided into 'poor' and 'good' categories based on median scores. Specifically, scores of ≤4 denoted 'poor knowledge,' while scores of ≥5 represented 'good knowledge.' Similarly, scores of ≤4 signified 'poor attitude,' and scores of ≥5 reflected 'good attitude.' Lastly, scores of ≤1 were categorized as 'poor practice,' and scores of 2 were classified as 'good practice' (12). This scoring system, designed to offer clear thresholds for knowledge, attitude, and practice, further enhances the interpretability of the results. In the end, the knowledge, attitude and practice (KAP) scores were calculated by summing up the participant's number of correct responses. The median percentage score was computed by dividing the median score by the maximum score and then multiplying the result by 100.

Data Analysis

Data analysis was performed employing IBM's Statistical Package for the Social Sciences (SPSS), version 22.0. A significance level of 0.05 was set for all statistical evaluations, maintaining rigor in the analytical approach. In the preliminary phase of data analysis, the normality of distribution was tested via the Kolmogorov-Smirnov technique. Given the data exhibited a non-normal distribution, the study opted to utilize median and interquartile range (IQR) for measures of central tendency and dispersion, respectively. Descriptive statistics were applied to decode the socio-demographic information and to discern levels of knowledge, attitudes, and practices associated with sugar-sweetened beverages. This provided an initial overview of the data, with results conveyed in terms of frequencies, percentages, and median values, supplemented by IQR. To delve deeper into the data, the study implemented Spearman's Rank Order correlation, a non-parametric method ideally suited to the dataset, to elucidate the relationships between knowledge, attitudes, and practices vis-a-vis sugar-sweetened beverage consumption. Lastly, the investigation endeavored to determine the relationships between knowledge, attitudes, and practices and their associated factors with respect to sugar-sweetened beverages. Given the categorical nature of the data, the Chi Square test was selected for this purpose, providing an effective tool to explore potential associations or dependencies among various variables within the dataset. However, it is important to note that all assumptions for the Chi Square test were thoroughly checked. In instances where the expected count was less than 5 for more than 20% of the cells, the Fisher's Exact test was employed as a more suitable alternative (11).

RESULTS

Socio-demographic profile, knowledge, attitudes, and practices (KAP) towards SSB among respondent

Majority of respondents were female, between the ages of 21 and 23, Malay, with a degree background or currently pursuing a degree, from rural areas, and belonged to the B40 family (Table I). Table II shows the responses towards knowledge of sugar-sweetened beverages (SSB) among the respondents. An overwhelming 94.1% of respondents were aware that the World Health Organization (WHO) recommends reducing the intake of simple sugars to less than 10% of total energy intake per day, indicating a high level of public awareness regarding global nutritional guidelines. 78.4% of respondents believed that consuming SSBs was an appropriate method for increasing caloric intake among individuals with inadequate energy intake. This result might suggest that some respondents view SSBs as a viable option for addressing undernutrition, despite the potential negative health consequences associated with their excessive consumption. More than half respondents (55.1%) believed that the calories provided by 1 tablespoon of condensed milk are equivalent to half a tablespoon of sugar, revealing some confusion regarding the caloric content of different sweeteners and their sugar equivalents. About 65.4% of respondents understood that a glass of less sweetened teh tarik contains an equivalent of 2 teaspoons of sugar, indicating knowledge of sugar content in specific beverages,

Table I: Socio-demographic of respondents (n=408)

Socio-demographic profile	Frequency (n)	Percentage (%)	Median (IQR)
Gender			
Male	102	25.0	
Female	306	75.0	
Age			
15-17	26	6.4	
18-20	84	20.6	
21-23	268	65.7	22 (2)
24-26	24	5.9	
27-29	6	1.5	
Ethnicity			
Malay	360	88.2	
Chinese	35	8.6	
Indian	5	1.2	
Others	8	2.0	
Educational level			
SPM or below	33	8.1	
Foundation/STPM/Matriculation or equivalent	104	25.5	
Currently pursuing degree/ degree holder	269	65.9	
Others	2	0.5	
Locality			
Rural	216	52.9	
Urban	192	47.1	
Family monthly income[a]			
<RM4850	276	67.6	
RM4851-RM10959	111	27.2	
>RM10960	21	5.1	

Monthly family income is based on the Demographic Statistics First Quarter 2021 (Malaysia) by Department of Statistics Malaysia (DOSM).
RM = Ringgit Malaysia, 1 USD = 4.6 RM

Table II: Knowledge, attitude and practices (KAP) towards sugar-sweetened beverages (n=408)

No.	Knowledge towards sugar-sweetened beverage (SSB)	Yes n (%)	No n (%)
1.	WHO recommends reducing the intake of simple sugar to less than 10% of total energy intake per day.	384 (94.1)	24 (5.9)
2.	Intake of SSB is considered an appropriate strategy for increasing caloric intake in individuals with inadequate energy intake.	320 (78.4)	88 (21.6)
3.	Dextrose is the scientific name of simple sugar.	296 (72.5)	112 (27.5)
4.	15 g (1 tablespoon) of sugar is equivalent to 15g of carbohydrate in our diet.	267 (65.4)	141 (34.6)
5.	Calories provided by 1 tablespoon of condensed milk is equivalent to a half tablespoon of sugar.	225 (55.1)	183 (44.9)
6.	A glass of less sweetened Teh Tarik is equivalent to 2 teaspoons of sugar.	267(65.4)	141 (34.6)
7.	Beverages with corn syrup stated in the list of ingredients classified as SSB.	330(80.9)	78 (19.1)
8.	SSB includes beverages with added honey.	270 (66.2)	138 (33.8)
9.	Fresh fruit juices is classified as SSB.	187 (45.8)	221 (54.2)
10.	Plain malted chocolate drinks are classified as SSB.	249 (61.0)	159 (39.0)
No.	**Attitude towards sugar-sweetened beverages**	**Agree n (%)**	**Disagree n (%)**
1.	It is important to read the list of the ingredients before choosing packed beverages in the market.	402 (98.5)	6 (1.5)
2.	Consumers must know on how to read the label of foods or beverages especially with added sugar.	404 (99.0)	4 (1.0)
3.	Choosing beverages without added sugar is much healthier compared to SSB.	365 (89.5)	43 (10.5)
4.	Consumer should aware of other names of sugar that often added in food.	401 (98.3)	7 (1.7)
5.	I need to have a good knowledge on reading the nutrition facts before choosing or buying foods or beverages in the market.	389 (95.3)	19 (4.7)
No.	**Practices towards sugar-sweetened beverage**	**Yes n (%)**	**No n (%)**
1.	I often identify the amount of sugar added in my drinks before consume.	231 (56.6)	177 (43.4)
2.	I often select flavoured milk compared to fresh milk.	170 (41.7)	238(58.3)
3.	I usually consumed SSB only for breakfast.	105 (25.7)	303 (74.3)
4.	I often compare the calorie contributed by the sugar added for each beverage before buying the item.	182 (44.6)	226 (55.4)
5.	I usually consume 3 in 1 beverage as it is easy to prepare and convenient for my daily schedule.	163 (40.0)	245 (60.0)

even when reduced-sugar versions are consumed. A substantial 80.9% of respondents correctly identified that beverages containing corn syrup as an ingredient are classified as SSBs, reflecting awareness of different types of sweeteners used in SSB production and their implications on classification. Approximately 66.2% of respondents recognized that SSBs include beverages with added honey, demonstrating an understanding that SSBs can contain a variety of sweeteners, including natural ones like honey. Fresh fruit juice classification -this statement revealed a misconception, as 45.8% of respondents incorrectly classified fresh fruit juices as SSBs. Fresh fruit juices contain naturally occurring sugars and should not be categorized as SSBs, which contain added sugars. 61.0% of respondents considered plain malted chocolate drinks to be SSBs, suggesting some uncertainty about the classification of certain types of beverages that may have added sugars or other sweetening agents. Table II shows the attitude items towards sugar-sweetened beverages. According to the findings, approximately 99.0% (n=404) of respondents agreed that consumers should read the labels of foods or beverages, particularly those containing added sugar. Overall, this result indicates that most of the respondents were able to agree with the positive statement and disagree towards negative statement towards sugar-sweetened beverages which indicates they have a good attitude. On the other hand, approximately 74.3% (n=303) of respondents' answer 'no' on practise item-3, indicating that they do not consume SSB for breakfast. The highest value 55.4% (n=226) falls for practise item-4, indicating that they do not compare the calories contributed by the sugar added for each beverage before purchasing the item.

Table III presents the distribution and median percentage scores for the levels of knowledge, attitude, and practices regarding sugar-sweetened beverage (SSB) consumption among the 408 respondents. For knowledge, 340 respondents (83.3%) were classified as having good knowledge (score of ≥5), while 68 respondents (16.7%) were categorized as having poor knowledge (score of ≤4). The median knowledge percentage score was 60.0, indicating a moderate level of knowledge among the respondents. In terms of attitude, 348 respondents (85.3%) exhibited a good attitude (score of 5), while 60 respondents (14.7%) had a poor attitude (score of ≤4). The median attitude percentage score was 100.0, indicating a positive attitude towards SSB consumption among the respondents. Regarding practices, 353 respondents (86.5%) demonstrated good practices (score of 2), while 55 respondents (13.5%) had poor practices (score of ≤1). The median practices percentage score was 60.0, suggesting that there is room for improvement in adopting healthier practices related to SSB consumption. Overall, the findings suggest that the majority of respondents had good knowledge and attitude towards SSB consumption, while there is room for improvement in their practices. These results provide valuable insights into the levels of knowledge, attitude, and practices among the respondents, which can inform targeted interventions aimed at promoting healthier

Table III: The level of knowledge, attitude and practices on SSB consumption among respondents (n=408)

Level	Distribution		Median (IQR)	Median percentage score
	Frequency (n)	Percentage (%)		
Knowledge				
Good (score of ≥5)	340	83.3	6 (2)	60.0
Poor (score of ≤4)	68	16.7		
Attitude				
Good (score of 5)	348	85.3	5 (0)	100.0
Poor (score of ≤4)	60	14.7		
Practices				
Good (score of 2)	353	86.5	3 (2)	60.0
Poor (score of ≤1)	55	13.5		

Knowledge score, min. score = 0, max. score = 10
Attitude score, min. score = 0, max. score = 5
Practices score, min. score = 0, max. score = 5
Median percentage score was calculated by dividing the median score with maximum score and multiplying it by 100.

behaviors regarding SSB consumption.

Relationship between knowledge, attitude and practices towards SSBs consumption

Table IV presents the associations between knowledge, attitude, and practices towards sugar-sweetened beverages. The results revealed statistically significant but weak relationships between knowledge and attitude (rs =0.148, p=0.003), as well as between knowledge and practice (rs =0.138, p=0.005). However, no significant relationship was observed between attitude and practice (rs =0.049, p=0.321). These findings indicate that individuals' knowledge about sugar-sweetened beverages is modestly correlated with their attitudes towards reducing consumption and their actual practices in this regard. However, it is noteworthy that having a positive attitude towards lowering SSB consumption does not necessarily translate into corresponding changes in actual practices. This suggests that other factors beyond attitude alone may influence individuals' behavior regarding SSB consumption. Overall, the results highlight the importance of considering knowledge alongside attitudes and practices when designing interventions aimed at promoting healthier SSB consumption habits. By targeting both knowledge and attitudes, interventions can potentially have a more comprehensive impact on individuals' actual behaviors related to SSB consumption. It is important to interpret these findings within the context of the study's limitations and the specific characteristics of the study population. Further research is warranted to delve deeper into the factors that contribute to the complex relationship between knowledge, attitudes, and practices regarding SSB consumption.

Table IV: Relationship between knowledge, attitude and practice on SSB consumption among respondents (n=408)

Variables	r_s	p-value
Knowledge and attitude	0.148	0.003*
Knowledge and practice	0.138	0.005*
Attitude and practice	0.049	0.321

*Spearman's test significance at $p < 0.05$ (2-tailed)

Sociodemographic factors on knowledge, attitudes, and practices related to SSBs among respondent

Table V presents the associations between knowledge, attitude, and practices towards sugar-sweetened beverages and various sociodemographic factors. The results indicate the presence or absence of significant associations between these variables. For the association between knowledge and sociodemographic, gender and knowledge were examined, yielding a chi-square of χ^2 (1, n=408) = 3.388, with a p-value of 0.066. The analysis suggests no significant association between gender and knowledge. Similarly, no significant association was found between age and knowledge, as evidenced by a chi-square of χ^2 (1, n=408) = 0.404 and p=0.525. The same holds true for ethnicity (p=0.150) and educational degree (p=0.151), where no significant associations were observed. Additionally, no association between locality and knowledge was found, with a chi-square of χ^2 (1, n=408) = 3.471 and p=0.062. Similarly, family monthly income did not show a significant association with knowledge, as indicated by a chi-square of χ^2 (1, n=408) = 1.115 and p=0.573. In summary, no significant associations were found between sociodemographic factors and knowledge.

Moving to the association between attitude and sociodemographic factors, a significant association was found between gender and attitude, with a chi-square of χ^2 (1, n=408) = 10.421 and p=0.001. Furthermore, locality also showed a significant association with attitude, as reflected by a chi-square of χ^2 (1, n=408) = 4.106 and p=0.043. However, no significant associations were observed between age, ethnicity, educational level, and family monthly income with attitude.

Regarding the association between practices and sociodemographic factors, the analysis yielded non-significant associations between gender (χ^2 (1, n=408) = 0.007, p=0.933) and age (χ^2 (1, n=408) = 0.485, p=0.486) with practices. However, a significant association was found between ethnicity and practices (p=0.006). Educational level did not show a significant association with practices (p=0.110). Similarly, locality was not significantly associated with practices, as indicated by a chi-square of χ^2 (1, n=408) = 0.701 and p=0.403. Lastly, family monthly income did not show a significant association with practices, as evidenced by a chi-square of χ^2 (1, n=408) = 2.220 and p=0.330. In summary, no significant associations were found between gender, age, educational level, location, and monthly family income with practices.

DISCUSSION

The results of this study reveal that a majority of the respondents demonstrated good levels of knowledge, attitude, and practices towards sugar-sweetened beverage (SSB) consumption. The relatively high median score for knowledge suggests that the respondents had

Table V: Association between knowledge, attitude, practices (KAP) and sociodemographic on SSB consumption among respondents (n=408)

Variables	Good n	Poor n	χ^2	*p* - value
Knowledge				
Gender				
Male	79	23	3.388	0.066
Female	261	45		
Age				
Below 18	59	14	0.404	0.525
Above 18	281	54		
Ethnicity				
Malay	297	63		
Non-Malay	43	5		0.150[a]
Educational level				
Degree Holder	230	41		0.151[a]
Non-Degree Holder	110	27		
Locality				
Rural	173	43	3.471	0.062
Urban	167	25		
Family monthly income				
<RM4850	227	49	1.115	0.573
RM4851-RM10959	96	15		
>10960	17	4		
Attitude				
Gender				
Male	77	25	10.421	0.001*
Female	271	35		
Age				
Below 18	59	14	1.418	0.234
Above 18	289	46		
Ethnicity				
Malay	308	52		0.409[a]
Non-Malay	40	8		
Educational level				
Degree Holder	237	34		0.058[a]
Non-Degree Holder	111	26		
Locality				
Rural	177	39	4.106	0.043*
Urban	171	21		
Family monthly income				
<RM4850	231	45	2.913	0.233
RM 4851-RM10959	100	11		
>RM 10960	17	4		
Practice				
Gender				
Male	88	14	0.007	0.933
Female	265	41		
Age				
Below 18	65	8	0.485	0.486
Above 18	288	47		
Ethnicity				
Malay	306	54		0.006*[a]
Non-Malay	47	1		
Educational level				
Degree Holder	230	41		0.110[a]
Non-Degree Holder	123	14		
Locality				
Rural	184	32	0.701	0.403
Urban	169	23		
Family monthly income				
<RM4850	239	45	2.220	0.330
RM4851-RM10959	98	13		
>10960	16	5		

* Chi-square significant at $p < 0.05$.
[a]where the expected count was less than 5 for more than 20% of the cells, the Fisher's Exact test was employed.

a good understanding of SSB-related concepts. Their positive attitude and predominantly good practices further indicate a favorable disposition towards healthy behaviors related to SSB consumption. However, it is worth noting that while respondents showed some knowledge of the sugar content in specific beverages, their overall knowledge of SSBs was only moderate, which aligns with previous research highlighting a lack of awareness regarding the calorie composition of beverages consumed (9,15-18). Despite the moderate knowledge levels, the respondents exhibited a positive attitude towards reducing SSB consumption. They demonstrated a conscious effort to limit their SSB intake and make healthier choices, such as opting for beverages without added sugars (9,21). This aligns with the recommendations of health authorities advocating for a reduction in SSB intake (9,22). The positive attitudes towards reducing SSB consumption may indicate a willingness to adopt healthier behaviors, which can be further encouraged through targeted interventions aimed at improving knowledge about SSBs. Regarding the relationships between knowledge, attitude, and practice, the study found a significant but weak relationship between knowledge and attitude, as well as between knowledge and practice. This finding is consistent with previous research suggesting that unfavorable attitudes towards SSB consumption are associated with low knowledge levels of non-alcoholic carbonated soft drinks (23,24). However, no significant relationship was observed between attitude and practice, indicating that positive attitudes may not always translate into actual behavior change. This contrasts with previous findings that have shown a strong association between attitudes and drinking behaviors in other contexts (25). It is important to note that behavior change is a complex process influenced by various factors, including individual beliefs, social norms, environmental factors, and personal motivations. While attitudes play a role in shaping behavior, other factors such as habit, availability, and convenience may also strongly influence actual behaviors. By highlighting the contrast with previous findings, this study aimed to emphasize the complexity of the relationship between attitudes and behavior change and the need for further research to better understand the factors that facilitate or hinder the translation of positive attitudes into actual behavior change in the specific context of SSB consumption among Malaysian young adults. In terms of socio-demographic factors, the study did not find any significant associations between gender, age, ethnicity, educational level, or family monthly income with knowledge. However, gender and locality were significantly associated with attitude. Ethnicity was the only socio-demographic factor that showed a significant association with practices. Specifically, individuals of Chinese ethnicity were found to consume sweet

foods and beverages more frequently but experience less craving for these treats compared to their Malay and Indian counterparts (26). The distinct behaviours within different ethnic groups in Malaysia, such as the Chinese, Malays, and Indians, warrant targeted interventions instead of broad-based approaches. The Chinese ethnicity was found to consume sweet foods and beverages more frequently, yet interestingly, they experience less craving for these items than their Malay and Indian counterparts. This could potentially indicate a habitual pattern of consumption among the Chinese group rather than a craving-driven behavior. As such, an intervention approach for this group could focus on breaking habitual consumption patterns. For instance, educational programs could be implemented to inform this group about the adverse health effects of frequent consumption of sugar-sweetened foods and beverages. Strategies could include introducing healthier alternatives, promoting a balanced diet, and teaching methods to monitor and reduce sugar intake. Moreover, restructuring the environment to make healthier options more accessible, such as promoting sugar-free beverages in places where they frequently consume these items, could help break the habitual consumption. On the other hand, the Malay and Indian ethnicities, who reported higher cravings but lower consumption, may require different intervention strategies. Their cravings may be driven by factors like emotional eating or misconceptions about diet and health. Interventions could aim to increase awareness about the psychological aspects of eating and offer practical methods for managing cravings, such as mindfulness training or cognitive behavioural therapy. In summary, acknowledging these different consumption and craving patterns among various ethnic groups is critical in tailoring interventions. We propose the use of behavioural, educational, and environmental strategies, specific to each ethnic group, to effectively manage the consumption of sweet foods and beverages. This nuanced approach should help in creating more impactful interventions that cater to the unique needs of each ethnic group and ultimately lead to a decrease in the prevalence of diet-related diseases. This suggests the importance of targeted interventions that focus on specific ethnic groups rather than broad-based approaches when addressing practices related to SSB consumption. While this study had limitations, such as overrepresentation of certain age groups and the use of convenience sampling, the findings provide valuable insights into the knowledge, attitudes, and practices regarding SSB consumption among Malaysian young adults. Moving beyond our initial focus, future research could integrate variables like socio-economic status, education level, physical activity levels, and even genetic predispositions towards sweet preference. Socio-economic and educational factors could significantly influence an individual's dietary choices, their awareness of nutritional information, and their ability to access healthier alternatives. Physical activity levels might offer insights into an individual's overall health-conscious behaviour and how it correlates with their SSB consumption. Furthermore, incorporating genetic predispositions towards sweet preference can provide an understanding of the biological factors influencing SSB consumption. In terms of statistical analysis, model analysis techniques, such as structural equation modeling or path analysis, could be employed in future research. These techniques would allow us to identify the strength and direction of relationships among multiple variables and their association with SSB consumption. This approach would also enable us to uncover potential latent variables or underlying factors that might not be directly measurable but significantly impact SSB consumption, such as cultural influences or the effectiveness of health education received.

To summarize, our study opens up several avenues for future research. An expanded set of variables and the application of model analysis techniques would offer a more nuanced understanding of SSB consumption and its drivers, which could significantly enhance the design of targeted interventions. Overall, these findings highlight the need for interventions that reinforce positive attitudes towards reducing SSB consumption and target specific ethnic groups. By improving knowledge, attitudes, and practices related to SSB consumption, interventions can help reduce the prevalence of obesity, type 2 diabetes, and other health problems associated with high sugar intake. Healthcare providers and policymakers can utilize these findings to develop targeted interventions and strategies to address the health consequences associated with SSB consumption.

CONCLUSION

The findings of this study reveal that Malaysian young adults generally possess a positive attitude towards sugar-sweetened beverages, along with a moderate level of knowledge and practices concerning these beverages. Furthermore, the study identified significant relationships between knowledge and attitude, and between knowledge and practice. These findings have important implications for future interventions and policies. By examining knowledge, attitude, and practices related to sugar-sweetened beverages and their associations, this study uncovers potential misconceptions or barriers that could hinder behavior change regarding SSB consumption. Given the current scarcity of data on the knowledge, attitude, and practices and their associations with SSB consumption, our study addresses a gap in the literature and highlights the need for healthcare providers and other stakeholders to take advantage of this opportunity. A strategic approach can be implemented to reduce non-communicable diseases (NCDs) and promote overall well-being, ultimately leading to the discovery of more effective ways to address SSB consumption and its related health consequences.

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