



## Original Research

# The nexus of Sugar-Sweetened Beverages: Insights on demographics, enablers and barriers

Khamis Al-Alawy, MSc<sup>a,\*</sup>, Reem Gaafar, MBBS, MPH<sup>a</sup>, Immanuel Azaad Moonesar, PhD, R.D.<sup>a</sup>, Shatha Muhsineh, MPH<sup>b</sup>

<sup>a</sup> Mohammed Bin Rashid School of Government, Dubai, United Arab Emirates

<sup>b</sup> Independent Researcher, United Arab Emirates



## ARTICLE INFO

## Keywords:

Sugar-sweetened beverages  
Enablers  
Barriers  
Nexus  
Public health policy  
Health promotion  
UAE

## ABSTRACT

**Objectives:** The study objectives were to a) explore the association between household income and nationality and Sugar-Sweetened Beverage (SSB) enablers and barriers, and b) inform public health policy and health promotion. **Study design:** A Cross-sectional Study in the UAE. **Methods:** Nationally representative population survey was used to capture demographic and SSB behaviour data. **Results:** We recruited 7500 participants into the study and received 1290 responses (17.2% participation rate). We report statistically significant associations between household income, nationality, and enablers and barriers. In some instances, similar enablers and barriers were reported by household income and nationality. **Conclusions:** There are several associations between household income, nationality and SSB enablers, and barriers. These associations should be considered for future public health policy and health promotion decision-making to reduce SSB consumption. In addition, further research is needed to explore how other demographic factors (modifying variables) are associated with SSB enablers and barriers.

## What is Already Known on this Subject

- Sugar-Sweetened Beverages (SSB) are associated with childhood and adult obesity;
- Although some studies show a reduction in SSB sales and consumption following taxation, there is limited evidence on sustainability and reduction of obesity prevalence; and
- Comprehensive, innovative and sustained strategies to promote healthy lifestyles are needed to reverse the obesity pandemic.

## What does this Study Add?

- There is evidence that suggests further work is needed to sway participant viewpoints on SSB enablers and barriers;
- Policymakers should consider how demographic factors influence SSB enablers and barriers;
- The Health Belief Model can offer new ways to understand SSB behaviours and the development of bespoke interventions for health-promoting behaviours; and
- Further research on how other demographic factors (modifying variables) influence SSB behaviour should be pursued.

## 1. Introduction

The number of people with a Body Mass Index (BMI) greater than 30 has tripled globally since the 1980s and now exceeds 650 million (WHO, 2021a) [1]. This rise coincides with an increase in non-communicable diseases associated with obesity, such as cardiovascular disease, stroke, and type 2 diabetes (IDF, 2021a; and Zhang et al., 2008) [2,3]. In 2017, high BMI led to 2.4 million deaths and 70.7 million Disability-Adjusted Life Years (DALYs) in females and 2.3 million deaths and 77.0 million DALYs among males (Dai H et al., 2020) [4]. The leading cause of high-BMI-related DALYs was cardiovascular diseases, diabetes, kidney diseases, and neoplasms (Dai H et al., 2020) [4].

Obesity also costs money; in 2014, the global economic impact from obesity was estimated at \$2.0 trillion or 2.8% of global GDP (McKinsey Global Institute, 2021) [5]. In the United Arab Emirates (UAE), 70% of the population were reported overweight, and 34% obese, with a higher proportion among women (WHO, 2021b) [6]. Deaths attributable to diabetes were reported to have increased from 1080 in 2010 to 2093 in 2019 (IDF, 2021b) [7]. The rise in obesity and attributable deaths and disease has partly manifested due to socioeconomic growth and unhealthy lifestyles (Fox, A., Feng, W. & Asal; Kushner RF and Choi SW;

\* Corresponding author. Mohammed Bin Rashid School of Government Health Administration and Policy Convention Tower. Level 13 P.O. Box 72229, Dubai, United Arab Emirates

E-mail address: [Khamis.Alalawy@mbrsg.ac.ae](mailto:Khamis.Alalawy@mbrsg.ac.ae) (K. Al-Alawy).

<https://doi.org/10.1016/j.puhip.2021.100189>

Received 17 June 2021; Received in revised form 31 August 2021; Accepted 6 September 2021

Available online 1 October 2021

2666-5352/© 2021 The Authors. Published by Elsevier Ltd on behalf of The Royal Society for Public Health. This is an open access article under the CC

BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Mabry et al., 2016; Blecher et al., 2017; Sharara et al., 2018; and Khalil et al., 2018) [8–13]. Overweight or obesity among school boys and girls was reported to have increased between 2005 and 2016 from 21.2% to 42.1%; and 21.7%–36.5%, respectively (Pengpid and Peltzer, 2020) [14]. Previous studies have highlighted the relationship between Sugar-Sweetened Beverage (SSB) consumption with weight gain and obesity, and there is a tendency for this relationship to stem from early childhood (Malik VS, Schulze MB and Hu FB, 2006; Hu FB, 2013; and Statista. 2021; Bray and Popkin, 2014; Sandrine Lioret et al., 2020; and Simmonds, M et al., 2016) [15–20]. In 2017, an excise tax (50% on any product with added sugar or other sweeteners and 100% on energy drinks) on Sugar-Sweetened Beverages (SSB) was announced and was fully implemented in 2019 (UAE Federal, 2019) [21].

For several decades, social cognitive and psychology models have been at the forefront of understanding health behaviours (Conner and Norman, 1996) [22]. Self-motivation toward the desired behaviour is often driven by social factors and the psychological state of benefits, losses, threats, and ability to act (Rutter and Quine, 2002) [23]. The Health Belief Model (HBM) is a key framework used to understand and predict health-promoting behaviours (Rosenstock, 1974a, and Rosenstock, 1974b) [24,25]. As seen in Fig. 1, the model includes several constructs relevant to the SSB behaviours (Rosenstock et al., 1998; Laurenhan, 2013; Austin, 2002; and Becker, 1997) [26–29]. Emerging literature suggests that household income and nationality influence SSB behaviour and health inequalities; however, there is limited research in the UAE (Benitez et al., 2017; Newens and Walton, 2016; Cash-Gibson et al., 2018; and Bruce et al., 2018) [30–33]. Understanding the association between key demographic factors such as household income and nationality and the enablers and barriers will aid efforts to tackle SSB consumption. Our Null Hypothesis was that there is no association between household income, nationality, SSB enablers, or barriers. The study objectives were to a) explore the association between household income and nationality and SSB enablers and barriers and b) inform public health policy and health promotion.

## 2. Methods

### 2.1. Study design

A cross-sectional study design was adopted. Cross-sectional studies are observational and useful to capture perceptions, exposures, measures, and outcomes with participants over a particular timeframe. Cross-sectional studies require fewer resources and are useful to describe characteristics in the community, make inferences on potential associations and further research (Wang and Cheng, 2020; and Carlson and Morrison, 2009) [34,35].

### 2.2. Development of survey

Following a review of the evidence, a cross-sectional survey for the UAE was developed and piloted (Rivard et al., 2012; and Miller et al., 2019) [36,37]. The pilot survey was sectioned into three parts demographics, enablers, and barriers. Demographics included age, gender, employment status, household income and nationality. Nationality was divided into Emiratis and Non-Emiratis and Household Income was reported in Arab Emirate Dirhams (AED) and split into seven categories based on local knowledge of earnings (less than 5,000, 5001–10,000, 10,001–15,000, 15,001–20,000, 20,001–25,000, 25,001–30,000 and more than 30,000). For enablers and barriers, a series of questions were asked, and a five-point Likert scale was used to respond to each question from strongly agree to strongly disagree (Cullerton et al., 2016) [38]. Questions for enablers included, for example, ‘SSB is affordable’, ‘SSB is readily available at home’, ‘mobile applications make it easy for me to order’, ‘SSB gives me energy’, and ‘I consume it because it is convenient’. Questions for barriers included, for example, ‘the price of SSB is high’, ‘I worry about my health if I drink SSB’, ‘I have knowledge on the subject that prevents me from drinking SSB’, ‘SSB is not available when I go out’, ‘drinking SSB stresses me out’, ‘I always have alternatives that are cheaper or free’,

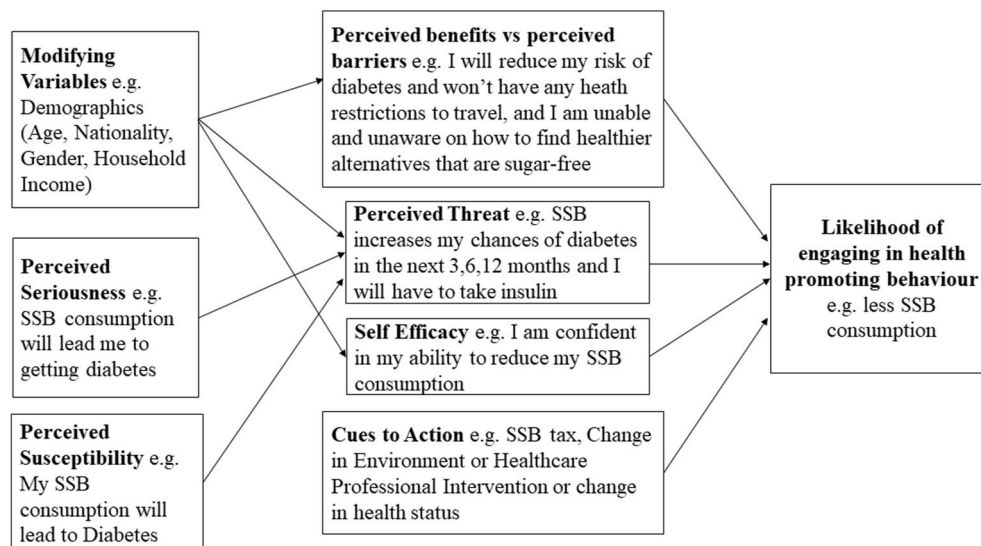


Fig. 1. The Health Belief Model and SSB behaviour [26–29].

**Table 1**  
Demographic distribution of survey participants.

Variable (Age)	Frequency	Percent	Valid Percent	Cumulative Percent
18–25	31	2.4	2.4	2.4
26–30	157	12.2	12.2	14.6
31–35	276	21.4	21.4	36
36–40	254	19.7	19.7	55.7
41–45	270	20.9	21.0	76.7
46–59	274	21.2	21.3	98
Over 60	26	2	2	100
Total	1288 (missing 2)	99.8 (missing 0.2)	100	
Total	1290	100		
<b>Variable (Gender)</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Male	473	36.7	36.7	36.7
Female	817	63.3	63.3	100
Total	1290	100	100	
<b>Variable (Employment Status)</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Yes	1245	96.5	96.5	96.5
No	45	3.5	3.5	100
Total	1290	100	100	
<b>Variable (Nationality)</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Emirati	548	42.5	42.5	42.5
Non-Emirati	742	57.5	57.5	100
Total	1290	100	100	
<b>Variable (Household income)</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
Less than 5000	60	4.7	4.7	4.7
5001–10,000	230	17.8	17.8	22.5
10,001–15,000	245	19	19	41.5
15,001–20,000	206	16	16	57.4
20,001–25,000	144	11.2	11.2	68.6
25,001–30,000	107	8.3	8.3	76.9
Over 30,000	298	23.1	23.1	100
Total	1290	100	100	

and ‘I am happy with the sugar-free alternatives’. Participants were also asked to provide ‘other’ reasons for enablers and barriers using the ‘other’ category as free text. The final survey was coded using Cronbach Alpha Analysis and included SSB definitions as per UAE Law, i.e. products with added sugar or sweeteners, in the form of a beverage or a concentrate, gel, powder, or extract and products converted into a beverage, carbonated or energy drinks and products of sugar (UAE Federal, 2019) [22].

### 2.2.1. Distribution of survey

The survey was distributed electronically by email in Arabic and English through the Qualtrics electronic survey system, including a QR code for mobile applications. A random sampling approach was adopted for survey distribution covering professionals, social media platforms, and government institutions through an up-to-date MBRSG database (Wilson, 2014) [39]. The survey ran for eight weeks (August 1, 2020 to September 30, 2020). The study population was 6,600,000 for the UAE adult population with a confidence level of 95%. The minimum statistical sample was 385 adults (Bell, 2014; and Raosoft, 2021) [40,41].

### 2.3. Data collection and analysis

Data was collected through a survey system (Qualtrics) and saved onto Microsoft Excel for data cleansing and coding. The coded data were then transferred onto Statistical Package for Social Sciences (SPSS) Subscription version 2021 for analysis. Frequency and descriptive analysis were performed for demographic responses, enablers and barriers against household income and nationality. Data was then presented into tables and charts to highlight the demographic

distribution of responses and the reported responses for each variable. Pearson's Chi-square test was performed to determine the associations between the demographic variables and the enablers and barriers. For variables with levels of significance, description analysis was done using the mean scores for further interpretation (Pimentel, 2010; and Sullivan, 2013) [42,43]. We grouped free text ‘other’ responses for enablers and barriers into themes. We then counted the number of words per theme, e.g. sugar taste and presented this information into a word cloud.

## 3. Results

### 3.1. Demographic characteristics of survey participants

We recruited 7500 participants into the study and received 1290 responses (participation rate = 17.2%). For demographic factors, two responses were reported missing for age. The highest response for age was in the 31–35-year-old category (N = 276, 21.4%), and the lowest age group was reported in the over 60-year-old category (N = 26, 2%). For gender, we report a higher proportion of female responses (N = 817, 63.3%) versus males (N = 473, 36.7%). Most of the participants were employed (N = 1245, 96.5%), and a small proportion was unemployed (N = 45, 3.5%). The demographic profiles for income, age, gender, employment status, nationality and household income are presented in [Table 1](#).

### 3.2. Household income and SSB enablers

We report 1061 (82.2%) valid responses for household income and enablers ([Table 2](#)). Out of fifteen questions, seven enablers were

**Table 2**  
Statistically Significant SSB Enablers.

No.	Household Income and SSB Enablers	Nationality and SSB Enablers
1.	SSB is affordable (P-value <.001) - mean 3.18 (Neither agree or disagree)	SSB is readily available at home (P-value 0.002) - mean 3.18 (Neither agree or disagree)
2.	SSB is readily available at home (P-value 0.025) - mean 3.18 (Neither agree or disagree)	SSB is readily available when I go out (P-value <0.001) - mean 3.80 (Agree)
3.	SSB is readily available when I go out (P-value 0.005) - mean 3.80 (Agree)	I like drinking SSB around my family and friends (P-value <0.03) - mean 2.92 (Neither agree or disagree)
4.	Mobile platforms make it easy for me to order (P-value 0.003) - mean 3.09 (Neither agree or disagree)	Mobile applications make it easy for me to order (P-value 0.003) - mean 3.09 (Neither agree or disagree)
5.	SSB helps me deal with stress (P-value 0.011) - mean 2.50 (disagree)	The label and packaging does not suggest it is harmful for my health (P-value 0.039) - mean 3.46 (Agree)
6.	SSB gives me energy (P-value 0.010) - mean 2.69 (Neither agree or disagree)	There are no healthy alternatives that I like (P-value <.001) - mean 2.78 (Neither agree or disagree)
7.	There are no healthy alternatives that I like (P-value 0.002) - mean 2.78 (Neither agree or disagree)	The alternative drinks will affect my health more (P-value <.001) - mean 2.93 (Neither agree or disagree)
8.		It is portable and easy to take around (P-value 0.024) - mean 3.24 (Neither agree or disagree)

**Note:** Similar colours or arrows are used to show the observed pairs between Household Income and Nationality.

statistically significant by household income. Mean household income was 15,001–20,000 AED. Across the Likert scale, the analysis showed statistical significance on specific points (see Table 2).

### 3.3. Nationality and SSB enablers

We report 1061 (82.2%) valid responses received for nationality and enablers. Out of fifteen response questions, eight enablers were statistically significant by nationality. Across the Likert scale, the analysis showed statistical significance on specific points (Table 2).

### 3.3.1. Other SSB enablers

The top three enabler words reported in the ‘other’ category included SSB availability and ease of access (n = 184), SSB taste (n = 94), and price/affordability (n = 32); refer to Fig. 2.

### 3.4. Household income and SSB barriers

We received a range between 956 (74.1%) and 967 (75%) valid responses. Eight barriers were statistically significant by household income. Mean household income was 15,001–20,000 AED. In addition, the analysis showed statistical significance on specific points across the Likert scale (Table 3).



Fig. 2. Word cloud for ‘other’ enablers.

**Table 3**  
Statistically Significant SSB Barriers.

No.	Household Income and SSB Barriers	Nationality and SSB Barriers
1.	I worry about my health if I drink SSB (P-value 0.015) mean - 4.06 (Agree)	There are no good deals/promotions to buy SSB (P-value 0.034) - mean 2.81 (Neither agree or disagree)
2.	There are no good deals/promotions to buy SSB (P-value 0.009) mean - 2.81 (Neither agree or disagree)	There are in-store promotions on healthy alternatives (P-value <.001) - mean 3.09 (Neither agree or disagree)
3.	I have knowledge on the subject that prevents me to drink SSB (P-value 0.009) mean - 3.91 (Agree)	I have knowledge on the subject that prevents me to drink SSB (P-value 0.019) - mean 3.91 (Agree)
4.	SSB is not available when I go out (P-value 0.008) mean - 2.67 (Neither agree or disagree)	SSB is not available at home (P-value 0.010) - mean 3.38 (Neither agree or disagree)
5.	I don't like the taste of SSB (P-value 0.037) mean - 2.89 (Neither agree or disagree)	SSB is not available when I go out (P-value <.001) - mean 2.67 (Neither agree or disagree)
6.	SSB makes me sick (P-value 0.041) mean - 3.02 (Neither agree or disagree)	My family and friends do not drink SSB (P-value <.001) - mean 2.99 (Neither agree or disagree)
7.	The label and packaging of SSB tell me it is harmful to my health (P-value <.001) mean - 2.69 (Neither agree or disagree)	I don't like the taste of SSB (P-value 0.007) - mean 2.89 (Neither agree or disagree)
8.	I always have alternatives that are cheaper or free (P-value <.001) mean - 2.89 (Neither agree or disagree)	SSB makes me sick (P-value 0.045) - mean 3.02 (Neither agree or disagree)
9.		Drinking SSB stresses me out (P-value 0.021) - mean 2.75 (Neither agree or disagree)
10.		The label and packaging of SSB tells me it is harmful to my health (P-value <.001) - mean 2.69 (Neither agree or disagree)
11.		I always have alternatives that are cheaper or free (P-value <.001) - mean 2.89 (Neither agree or disagree)

**Note:** Similar colours or arrows are used to show the observed pairs between Household Income and Nationality.

### 3.5. Nationality and SSB barriers

We received 956 to 967 (74.1%–75%) valid responses. Out of four-teen questions, we report twelve statistically significant barriers by nationality. The analysis showed statistical significance across specific points on the Likert scale (Table 3).

#### 3.5.1. Other SSB barriers

The top three barrier words reported in the 'others' category included high sugar content (n = 59), unhealthy alternative drinks (n = 42), and Non-communicable Diseases (NCD) and health complications (n = 25); refer to Fig. 3.

### 4. Discussion

The adoption of the SSB tax has undoubtedly gained interest among decision-makers over the past decade. There are over 40 countries that have adopted a fiscal policy for SSB, covering approximately two billion people (World Bank Group, 2020) [44]. Aside from the potential to reduce sales and excess sugary drink consumption, taxation can have other benefits; for example, it can generate revenue to support healthier alternatives, improve consumer awareness (signal the public to adopt healthier alternatives) and nudge non-price industry responses to lower or replace the amount of sugar in drinks (reformulation). The study findings suggest that the enablers and barriers for SSB consumption by household income and nationality varied and provided several insights. *First*, the hope of curtailing obesity through fiscal policy requires



**Fig. 3.** Word cloud for 'other' barriers.

further investigation to determine its effectiveness and sustainability (Royo-Bordonada, 2019; and Maite, 2018) [45,46]. There must be an appetite to understand the contributing factors that promote or inhibit SSB consumption for strengthening public health policy, as the evidence from a psychological or a marketing perspective suggests that price may not be the key determinant (Claudy M et al., 2020) [26,47].

*Second*, our study highlights statistically significant enablers and barriers for SSB and participant viewpoints across the Likert scale. For example, participants' neutral viewpoint on price as an enabler suggests fiscal policy would need to be strengthened along with other factors to deter consumption and sway responses to the disagree or strongly disagree. Research suggests that a 50–100% increase in price alone would shift consumption levels; however, they may be a need to go beyond the upper threshold when considering the effect of the previous levy, the base price of specific products, price elasticity, purchasing power, disposable income, or obesity prevalence (Eykelboom et al., 2019; and Wright et al., 2017) [48,49]. Participants' neutral viewpoints on labelling and packaging of SSB and harm to health suggest it does not have the desired effect to inform healthier purchases. In a meta-analysis and systematic review to assess consumer behaviours and intentions following the use of different labelling on SSB products [symbol with nutrient profile (1), the symbol with health effect (2), the text of nutrient profile (3), text of health effect (4), graphic with health effect (5), and graphic with nutrient profile (6)], researchers reported labelling and packing to be an effective measure, and use of graphic with health effect to have had the largest impact (Ruopeng et al., 2020) [50].

*Third*, in the context of enablers by household income and nationality, participants agreed that SSB is readily available when going out and that labelling and packaging does not suggest it is harmful to health; however, several other key factors were reported as neutral such as the use of mobile platforms to easily access SSB, and lack of healthy alternatives suggesting further efforts needed to sway responses to 'disagree' or 'strongly disagree' (Lee et al., 2017) [51].

*Fourth*, there were more statistically significant barriers than enablers. Some provided insight on policy measures that inhibit SSB consumption ('I have knowledge on the subject that prevents me to drink SSB' and 'I am happy with the sugar-free alternatives') however, several responses were reported as 'neither agree' or 'disagree' ('no good deals/promotions to buy SSB', 'there are in-store promotions on healthy alternatives' and 'I always have alternatives that are cheaper or free') suggesting more work is needed to sway participants into the 'agree' or 'strongly agree' category. Considering the findings, several barriers could be strengthened or introduced. For example, SSB could be categorised into a tiered structure (1–5) based on the type or amount of added sugar with a levy surcharge for the highest tiers (4 and 5) to support prevention programs (Lee et al., 2020) [52]. Offering healthier and cheaper alternatives to align with daily calorific intake from added sugar could be explored as the evidence suggests this approach can reduce SSB consumption and promote weight loss (Deborah et al., 2012) [53]. These interventions would benefit from a social marketing approach to optimise the process of 'exchange' to healthier alternatives (Vannarath Te, Pauline Ford, and Lisa Schubert, 2019) [54]. Other measures that could be considered include restricting the number of outlets that sell SSB close to schools and offering free telehealth services for healthy lifestyles advice and support to overcome sugar addiction (Swarna, 2014) [55].

*Fifth*, the findings suggest there are some instances where the enablers and barriers may come into conflict; for example, participants report 'SSB is readily available when I go out' as an enabler but also report 'There are no good deals/promotions to buy SSB' as a barrier'. This demonstrates the complexity of understanding behaviour and would merit further investigation through a qualitative approach as there may be opportunities to strengthen the barriers or introduce others where there is an apparent conflict or inconsistency. For example, education of healthier alternatives through social media channels may sway participants to 'disagree' or 'strongly disagree' that they are no

healthier alternatives. Participants reported being satisfied with sugar-free alternatives, suggesting the ongoing need to emphasise reformulation with industry (Federici et al., 2019) [56].

*Sixth*, the study provides insight into how psychosocial frameworks such as HBM can be utilised to understand SSB behaviours. One of the most effective and opportune approaches for cues to action would be through frontline healthcare professionals, who are often the first point of contact to address a health need. They are also opportune health educators and influential in triggering behavioural change or referral to specialist services (Pell et al., 2019; Gray et al., 2007; Mozaffarian, 2012; and Greenhalgh, 2012) [57–60]. Adopting the HBM may increase the likelihood of engaging and sustaining health-promoting behaviour.

*Lastly*, household income and nationality can influence SSB enablers and barriers in different ways, and in some instances, presents a nexus; thus, we reject the Null hypothesis. Household income and nationality can form the basis for policy action and refinement following further demographic investigation to improve policy decision-making.

#### 4.1. Limitations

The survey may have excluded key groups within the population, such as non-English or Arabic speaking residents or those with no access to electronic surveys. We achieved the minimum sample size for statistical analysis; however, a larger study sample would strengthen the generalisability of the findings. Alternative explanations to our results may have been due to several factors that were not accounted for, such as recall bias, under or over estimation of behaviours, participant viewpoints of specific SSB products or general perspective, or other factors within the HBM. A qualitative approach may provide greater insights into the underlying factors associated with the study findings and the extent to which perceived seriousness, susceptibility, threat, and self-efficacy play toward SSB consumption. Further research approaches could be pursued to determine the effect of SSB taxation.

#### 4.2. Implications for public health policy and health promotion

The study has several implications. Household income and nationality are associated with SSB enablers and barriers, and they are instances where the same variable is an enabler and a barrier, suggesting that an intersectoral approach to tackle SSB consumption is needed. Public health policy approaches that could be pursued include obtaining consumer insight to support efforts in economic modelling (modelling current levy or adopting a tiered approach that is dependent on type or amount of added sugar) and revisiting urban planning to limit the number of outlets that sell SSB per geographical area or population; for example, establish SSB free zones around schools. This may be particularly important for children and the community as there is a tendency for unhealthy behaviours to stem from an early age into adulthood. Regarding health promotion, the HBM is relevant to understand, predict and sustain health-promoting behaviours. The HBM offers a practical approach for frontline healthcare providers to tailor interventions to suit demographic profiles or the enablers and barriers. This should be considered with the viewpoint that not all constructs may be relevant to understand or predict behaviour, and no single theoretical model may fully explain behaviour, which can be complex and, at times, irrational.

## 5. Conclusions

There are several associations between household income, nationality and SSB enablers, and barriers. These associations should be considered for future public health policy and health promotion decision-making to reduce SSB consumption. In addition, further research is needed to explore how other demographic factors (modifying variables) are associated with SSB enablers and barriers.

## Ethical approval

Ethical approval was granted from the Mohammed Bin Rashid School of Government Ethics Committee (REC 80/2020).

## Declaration of competing interest

We have no conflicting or competing interests.

## Acknowledgement

We would like to acknowledge and thank Mohammed Bin Rashid School of Government, Dubai, UAE, and the Alliance for Health Policy and Systems Research at the World Health Organization for their financial Support as part of the Knowledge to Policy (K2P) Center Mentorship Program [BIRD Project].

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhip.2021.100189>

## References

- [1] World Health Organisation, Obesity and overweight [Online], <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>, 2021, 2021a [accessed 08th April 2021].
- [2] International Diabetes Federation, IDF Diabetes Atlas, 9th Edition, 2021. <http://www.diabetesatlas.org/en/> [accessed 08th March 2021].
- [3] Cuijilin Zhang, et al., Abdominal obesity and the risk of all-cause, cardiovascular, and cancer mortality: sixteen years of follow-up in US women, *Circulation* 117 (13) (2008) 1658–1667. <https://doi.org/10.1161/CIRCULATIONAHA.107.739714>.
- [4] Haijiang Dai, et al., The global burden of disease attributable to high body mass index in 195 countries and territories, 1990–2017: An analysis of the Global Burden of Disease Study, *PLoS Med.* 17 (7) (2020), e1003198. <https://doi.org/10.1371/journal.pmed.1003198>.
- [5] McKinsey Global Institute, Overcoming obesity: An initial economic analysis. [https://www.mckinsey.com/~/media/mckinsey/business%20functions/economic%20studies%20temp/our%20insights/how%20the%20world%20could%20become%20healthier%20and%20stronger/mgi\\_overcoming\\_obesity\\_full\\_report.ashx](https://www.mckinsey.com/~/media/mckinsey/business%20functions/economic%20studies%20temp/our%20insights/how%20the%20world%20could%20become%20healthier%20and%20stronger/mgi_overcoming_obesity_full_report.ashx), 2021 [accessed 16th March 2021].
- [6] World Health Organisation, Diabetes country profiles: United Arab Emirates. [https://www.who.int/diabetes/country-profiles/are\\_en.pdf](https://www.who.int/diabetes/country-profiles/are_en.pdf), 2021, 2021b [accessed 08th April 2021].
- [7] International Diabetes Federation, United Arab Emirates Diabetes Report 2010 - 2045, ninth ed., 2021. <https://www.diabetesatlas.org/en/> [accessed 10th March 2021].
- [8] A. Fox, W. Feng, V. Asal, What is driving global obesity trends? Globalisation or “modernisation”? *Glob. Health* 15 (2019) 32. <https://doi.org/10.1186/s12992-019-0457-y>.
- [9] R.F. Kushner, S.W. Choi, Prevalence of unhealthy lifestyle patterns among overweight and obese adults, *Obesity* 18 (6) (2010) 1160–1167. <https://doi.org/10.1038/oby.2009.376>.
- [10] Ruth Mabry, et al., A systematic review of physical activity and sedentary behaviour research in the oil-producing countries of the Arabian Peninsula, *BMC Publ. Health* 16 (2016) 1003. <https://doi.org/10.1186/s12889-016-3642-4>.
- [11] Evan Blecher, et al., Global trends in the Affordability of sugar-sweetened beverages, *Prev. Chronic Dis.* 14 (2017) E37, 1990-2016, <https://doi.org/10.5888/pcd14.160406>.
- [12] Eman Sharara, et al., Physical inactivity, gender and culture in Arab countries: a systematic assessment of the literature, *BMC Publ. Health* 18 (1) (2018) 639. May 18, <https://doi.org/10.1186/s12889-018-5472-z>.
- [13] Khalil Bernard Aly, et al., Diabesity in the Arabian Gulf: Challenges and opportunities, *Oman Med. J.* 33 (4) (2018) 273–282. <https://doi.org/10.5001/omj.2018.53.jul>.
- [14] S. Pengpid, K. Peltzer, Trends in the prevalence of twenty health indicators among adolescents in United Arab Emirates: cross-sectional national school surveys from 2005, 2010 and 2016, *BMC Pediatr.* 20 (2020) 357. <https://doi.org/10.1186/s12887-020-02252-0>.
- [15] V.S. Malik, M.B. Schulze, F.B. Hu, Intake of sugar-sweetened beverages and weight gain: a systematic review, *Am. J. Clin. Nutr.* 84 (2) (2006) 274–288. Aug, <http://doi.org/10.1093/ajcn/84.1.274>.
- [16] F.B. Hu, Resolved: there is sufficient scientific evidence that decreasing sugar-sweetened beverage consumption will reduce the prevalence of obesity and obesity-related diseases, *Obes. Rev.* 14 (8) (2013) 606–619. <https://doi.org/10.1111/obr.12040>.
- [17] Statista. Sugar consumption, Total human domestic consumption of sugar in the United Arab Emirates from 2015 to 2020 (in million metric tons), <https://www.st>
- [18] A. Bray George, M. Popkin Barry, Dietary sugar and body weight: Have we reached a Crisis in the epidemic of obesity and diabetes? *Health Be damned! Pour on the sugar.* *Current Concepts of type 2 diabetes prevention*, *Diabetes Care* 37 (4) (2014) 950–956. Apr, <https://doi.org/10.2337/dc13-2085>.
- [19] Sandrine Lioret, et al., Lifestyle patterns begin in early childhood, persist and are socioeconomically patterned, Confirming the importance of early Life interventions, *Nutrients* 12 (2020) 724. <https://doi.org/10.3390/nu12030724>.
- [20] M. Simmonds, A. Llewellyn, C.G. Owen, N. Woolacott, Predicting adult obesity from childhood obesity: A systematic review and meta-analysis, *Obes. Rev.* 17 (2016) 95–107.
- [21] U.A.E. Federal, Excise Tax, 2019. <https://u.ae/en/information-and-services/finance-and-investment/taxation/excise-tax> [accessed 20th April 2021].
- [22] Conner Mark, Norman Paul, *Predicting Health Behaviour: Research and Practice with Social Cognition Models*, Open University Press, 1996.
- [23] Rutter Derek, Quine Lyn, *Changing Health Behaviour. Intervention and Research with Social Cognition Models*, Open University Press, 2002.
- [24] M. Rosenstock Irwin, Historical origins of the health belief model, *Health Educ. Behav.* 2 (4) (1974) 328–335.
- [25] M. Rosenstock Irwin, The health belief model and preventive health behavior, *Health Educ. Monogr.* 2 (4) (1974) 354–386. <https://doi.org/10.1177/109019817400200405>.
- [26] M. Rosenstock Irwin, et al., Social learning theory and the health belief model, *Health Educ. Behav.* 15 (2) (1988) 175–183. <https://doi.org/10.1177/109019818801500203>.
- [27] Laurenhan, The Health Belief Model, Wiki Media Commons, 2013. [https://commons.wikimedia.org/wiki/File:The\\_Health\\_Belief\\_Model.pdf](https://commons.wikimedia.org/wiki/File:The_Health_Belief_Model.pdf) [accessed 25th March 2021].
- [28] T. Austin Latoya, et al., Breast and Cervical cancer screening in hispanic women: a literature review using the health belief model, *Wom. Health Issues* 12 (3) (2002) 122–128.
- [29] H.M. Becker, et al., The Health Belief Model and prediction of dietary compliance: a field experiment, *J. Health Soc. Behav.* 18 (4) (1997) 348–366.
- [30] Tanya Benitez, et al., Investigation of the Cultural context of sugars consumption behavior in low-income Mexican-American women, *J. Health Disparities Res. Pract.* 10 (2017) 6.
- [31] K.J. Newens, J. Walton, A review of sugar consumption from nationally representative dietary surveys across the world, *J. Hum. Nutr. Diet.* 29 (2) (2016) 225–240. <https://doi.org/10.1111/jhn.12338>.
- [32] L. Cash-Gibson, et al., Inequalities in global health inequalities research: A 50-year bibliometric analysis (1966-2015), *PLoS One* 13 (1) (2018), e0191901. <https://doi.org/10.1371/journal.pone.0191901>.
- [33] M.A. Bruce, et al., Sex, race, food security, and sugar consumption change efficacy Among low-income parents in an urban primary Care setting, *Suppl, Food Insecurity and Obesity (Suppl 2) Food Insecurity and Obesity*, *Fam. Community Health* 41 (Suppl 2) (2018). S25–S32, <https://doi.org/10.1097/FCH.0000000000000184>.
- [34] X. Wang, Z. Cheng, Cross-sectional studies: strengths, weaknesses, and recommendations, *Chest* 158 (1S) (2020) S65–S71. <https://doi.org/10.1016/j.chest.2020.03.012>.
- [35] M.D. Carlson, R.S. Morrison, Study design, precision, and validity in observational studies, *J. Palliat. Med.* 12 (1) (2009) 77–82. <https://doi.org/10.1089/jpm.2008.9690>.
- [36] Rivard Cheryl, et al., Taxing sugar-sweetened beverages: a survey of knowledge, attitudes and behaviors, *Publ. Health Nutr.* 15 (8) (2021) 1355–1361. <https://doi.org/10.1017/S1368980011002898>.
- [37] L. Miller Caroline, et al., Are Australians ready for warning labels, marketing bans and sugary drink taxes? Two cross-sectional surveys measuring Support for policy responses to sugar-sweetened beverages, *BMJ Open* 9 (6) (2019), e027962. Jun 27, <https://doi.org/10.1136/bmjopen-2018-027962>.
- [38] Cullerton Kathrine, et al., Playing the policy game: a review of the barriers to and enablers of nutrition policy change, *Publ. Health Nutr.* 19 (14) (2016) 2643–2653. <https://doi.org/10.1017/S1368980016000677>.
- [39] Virginia Wilson, Research methods: sampling. Evidence-based library and information practice, *DOAJ* 9 (2) (2014) 45–47. <https://doaj.org/toc/1715-720X/9/2>.
- [40] A. Bell Bethany, et al., How low can you go? An investigation of the influence of sample size and model complexity on point and interval estimates in two-level linear models, *Methodology: European J. Res. Method. Behav. So.l Sci.* 10 (1) (2014) 1–11. <https://doi.org/10.1027/1614-2241/a000062>.
- [41] Raosoft, Sample size Calculator. <http://www.raosoft.com/>, 2021 [accessed 28th March 2021].
- [42] Jonald L. Pimentel, A note on the usage of Likert Scaling for research data analysis, *US Respir. Dis.* 18 (2) (2010) 109–112 (2010). ISSN 0302-7937.
- [43] Gail M. Sullivan, Analyzing and interpreting data from likert-type scales, *J. Graduate Med. Educat.* (2013). December, <http://doi.org/10.4300/JGME-5-4-18>.
- [44] World Bank Group, *Taxes on sugar-sweetened beverages: International evidence and experiences*, Health, Nutrition, And Population (2020). September.
- [45] M.Á. Royo-Bordonada, et al., Impact of an excise tax on the consumption of sugar-sweetened beverages in young people living in poorer neighbourhoods of Catalonia, Spain: a difference in differences study, *BMC Publ. Health* 19 (2019) 1553, 2019, <https://doi.org/10.1186/s12889-019-7908-5>.

- [46] Maite Redondo, et al., The Impact of the tax on sweetened beverages: a systematic review, *Am. J. Clin. Nutr.* 108 (3) (2018) 548–563. <https://doi.org/10.1093/ajcn/nqy135>.
- [47] M. Claudy, G. Doyle, L. Marriott, N. Campbell, G. O'Malley, Are sugar-sweetened beverage taxes effective? Reviewing the evidence through a marketing systems lens, *J. Publ. Pol. Market.* (2020). <https://doi:10.1177/0743915620965153>.
- [48] M. Eykelenboom, et al., Political and public acceptability of a sugar-sweetened beverages tax: a mixed-method systematic review and meta-analysis, *Int. J. Behav. Nutr. Phys. Activ.* 16 (2019) 78. <https://doi.org/10.1186/s12966-019-0843-0>.
- [49] A. Wright, et al., Policy lessons from health taxes: a systematic review of empirical studies, *BMC Publ. Health* 17 (2017) 583. <https://doi.org/10.1186/s12889-017-4497-z>.
- [50] R. An, J. Liu, R. Liu, A.R. Barker, R.B. Figueroa, T.D. McBride, Impact of sugar-sweetened beverage warning labels on consumer behaviors: A systematic review and meta-Analysis, *Am. J. Prev. Med.* 60 (1) (2021) 115–126. <https://doi:10.1016/j.amepre.2020.07.003>.
- [51] B.Y. Lee, et al., A systems approach to obesity, *Nutr. Rev.* 75 (suppl 1) (2017) 94–106. Jan., <https://doi:10.1093/nutrit/nuw049>.
- [52] Y. Lee, et al., Health impact and Cost-effectiveness of Volume, tiered, and Absolute sugar content sugar-sweetened beverage tax policies in the United States: A Microsimulation study, *Circulation* 11 (6) (2020) 523–534, 142, <https://doi:10.1161/circulationaha.119.042956>.
- [53] D.F. Tate, et al., Replacing caloric beverages with water or diet beverages for weight loss in adults: main results of the Choose Healthy Options Consciously Everyday (CHOICE) randomised clinical trial, *Am. J. Clin. Nutr.* 95 (3) (2012) 555–563. <https://doi.org/10.3945/ajcn.111.026278>.
- [54] Vannarath Te, Pauline Ford, Lisa Schubert, Exploring social media campaigns against sugar-sweetened beverage consumption: A systematic search, *Cogent Medicine* 6 (1) (2019), 1607432. <https://doi.org/10.1080/2331205X.2019.1607432>.
- [55] Y. Swarna Nantha, Addiction to sugar and its link to health Morbidity: A primer for newer primary Care and public health Initiatives in Malaysia, *J. Primary Care Community Health* (2014) 263–270. <https://doi:10.1177/2150131914536988>.
- [56] C. Federici, et al., The Impact of food reformulation on nutrient intakes and health, a systematic review of modelling studies, *BMC Nutr* 5 (2019) 2. <https://doi.org/10.1186/s40795-018-0263-6>.
- [57] David Pell, et al., Support for, and perceived effectiveness of, the UK soft drinks industry levy among UK adults: cross-sectional analysis of the International Food Policy Study, *BMJ Open* 9 (2019), e026698. <https://doi:10.1136/bmjopen-2018-026698>.
- [58] Jackie Gray, et al., Developing the public health role of a frontline clinical service: integrating stop smoking advice into routine podiatry services, *J. Public Health* 29 (2) (2007) 118–122. <https://doi.org/10.1093/pubmed/fdm011>.
- [59] D. Mozaffarian, et al., American heart Association Council on epidemiology and prevention, Council on nutrition, physical Activity and Metabolism, Council on clinical Cardiology, Council on cardiovascular disease in the young, Council on the kidney in Cardiovasc. Population approaches to improve diet, physical activity, and smoking habits: a scientific statement from the American heart Association, *Circulation* 18 (12) (2012) 1514–1563, 126, <https://doi:10.1161/CIR.0b013e318260a20b>.
- [60] Trisha Greenhalgh, Global health and primary Care: building Capacity, *InnovAIT* 5 (8) (2012) 456–461. <https://doi:10.1093/innovait/ins021>.