Research article

Taxing sugar-sweetened beverages: Knowledge, beliefs and where should the money go?

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A B S T R A C T

Background: The Sugar-Sweetened Beverage (SSB) industry consciously and subconsciously influences consumers to buy its products. Countering unhealthy messaging and behaviour could be tackled through the SSB levy and allocation of revenue toward healthy lifestyle programs. Given the limited information in the UAE on demographic and consumer knowledge and beliefs and allocation of SSB levy, we conducted a study to explore this further. The study objectives were to a) explore the association between demographic factors (nationality, income and education) with knowledge and beliefs for SSB and b) explore participants' views on allocating SSB levy toward healthy lifestyle programs.
Methods: A cross-sectional study of adults in the United Arab Emirates.
Results: The findings suggest knowledge was high for Sugar-Sweetened Beverages (SSB), obesity, and diabetes (1,231, 96.1%), and there was a high awareness of SSB tax (1,066, 83.2%). Knowledge and beliefs about Sugar-Sweetened Beverages were statistically significant for two demographic factors. There was support for the tax revenue to be spent on government programs and greater support for spending to be directed toward specific healthy lifestyle programs such as school health programmes (514, 39.8%), children's diet and nutrition programmes (497, 38.5%), physical activity programmes (480, 37.2%), among others.
Conclusions: The findings shed light on the influence demographic factors have on knowledge and beliefs, public health gaps and potential areas for SSB levy expenditure. Further research is needed to understand how best to implement healthy lifestyle programs within the community to optimise coverage, cost-effectiveness, and health outcomes.

1. Introduction Background

Public health has gained significant interest over the past two decades, especially in Non-Communicable Diseases (NCD) and associated risk factors [1]. Several studies have shown the association between Sugar-Sweetened Beverage (SSB) consumption and NCDs. [2–5]. The World Health Organisation recommends that children and adults limit added sugar consumption to 5–10% of total daily energy intake [6]. Many countries exceed this amount, and SSB significantly affects excess sugar intake across all socio-economic groups. Globally, patterns of SSB consumption are changing [7]. For example, in 2014, North and Latin America were among the highest

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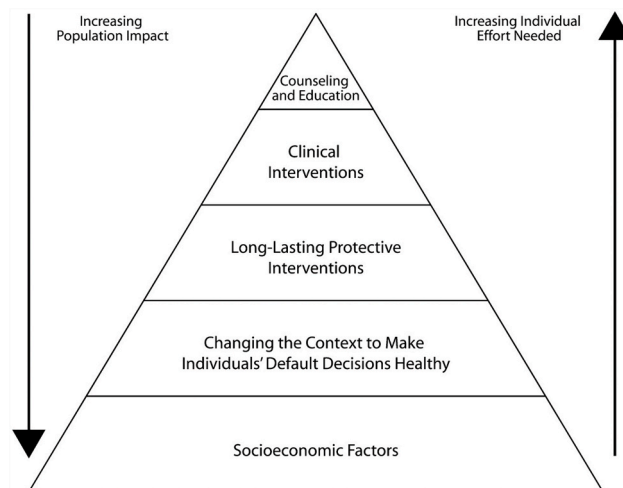*E-mail address:* khamis.alalawy@mbrsg.ac.ae (K. Al-Alawy).

Fig. 1. The Health Impact Pyramid
Frieden T. R. (2010). A framework for public health action: the health impact pyramid. *American journal of public health*, *100*(4), 590–595. https://doi.org/10.2105/AJPH.2009.185652.

consumers of SSBs per capita [7,8]. SSB consumption has also dramatically increased in emerging and mature markets, e.g., Southeast Asia [9–11] and the Middle East [12,13]. The SSB industry targets vulnerable markets with inadequate strategies and regulations to tackle high levels of SSB consumption. The emerging crisis of excess SSB consumption [14] has led to the adoption of fiscal measures by several countries [15,16], and there is growing interest among politicians, public health experts, economists, and the public in revenue generation and spending [8]. Fiscal measures have historically been used to influence behaviour at the point of purchase [17]; however, the desired effects of policy have been somewhat dampened [18] by small tax increases that are insufficient to sway consumers from substitution [19] and prevent the industry from adopting innovative approaches [20] toward price pass-on and reformulation. Wright et al. conducted a systematic review to investigate health taxes, including 51 studies on the United States, 34 on European countries and a few across the globe, with only 20 high-income countries and a smaller number of middle-income countries [21]. The findings suggest that at least a 20% increase in tax is needed to reduce the consumption of unhealthy products. While public opinion generally does not favour taxes, earmarking taxes for health programmes increases public support. However, using the World Bank definitions, none of the countries included in the study were from the Middle East [22]. This makes it difficult for decision-makers to build a case for the SSB levy and allocation of resources. The Health Impact Pyramid (HIP) recognises the need for a comprehensive approach to tackling NCDs and suggests tackling socio-economic factors (Fig. 1) as a key strategy to improve health because it ensures all population groups and risk factors are targeted [23,24]. The literature on SSB knowledge and beliefs provides a different perspective. Munsell et al. undertook a study with parents to understand their perception of the healthiness of SSB for their children [25]. The authors report that most parents who provide SSBs to their children believe that some SSBs are healthy and rely on the packaging claims. Rampersaud et al. explored knowledge, perceptions, and behaviours regarding added sugars in beverages [26]. The study highlighted considerable misunderstanding or confusion around the different types of SSB, and less than 40% of participants identified SSB as a concern at the point of purchase. Park et al. explored associations between health-related knowledge and SSB intake and reported higher SSB consumption (except soda) among respondents with limited knowledge of SSB [27]. Dono et al. conducted a study to identify the variables with the strongest relationship for intention to reduce SSB consumption and reported that perceived susceptibility to health risk has the strongest relationship among a suite of variables. Social and environmental variables were not associated with reduced SSB consumption [28].

In 2020, the UAE expanded its tax policy to tackle the negative effects of industry. For SSB, tax was set to 50% and 100% on energy drinks [29]. Recent obesity data suggests the UAE is ranked 26th (male) and 20th (female) among 200 countries for adults, 21st for children (males), and 24th (females) [30]. Morbidity associated with obesity, transient multi-national population coupled with limited demographic and behavioural data on SSB presents challenges for decision makers to support future public health planning and policy [31]. While taxes generate revenue, there is a need to identify healthy lifestyle programs supported by the public. Thus, this knowledge gap presents a research opportunity in the UAE.

2. Research objectives

The SSB industry consciously and subconsciously influences consumers to buy its products. Countering unhealthy messaging could be tackled through the SSB levy and allocation of revenue toward healthy lifestyle programs. The Null Hypothesis (H$_0$) was that demographic factors (nationality, education, and household income) do not influence SSB knowledge and beliefs. The study objectives were to a) explore the association between demographic factors (nationality, income and education) with knowledge and beliefs for SSB and b) explore participants' views on allocating SSB levy toward healthy lifestyle programs.

3. Methods

3.1. Study design

A cross-sectional study design was performed [32]. Cross-sectional studies are descriptive observational studies that capture current trends in prevalence, opinions, outcomes, and exposures and do not require prospective or retrospective follow-up [33]. Additionally, cross-sectional studies are cost-effective and useful for public health planning, monitoring, and evaluation or for directing further research [34].

4. Setting and development of survey

The study was conducted in the UAE, which has limited information on demographic and consumer knowledge and beliefs and allocation of SSB levy. Following a review of the UAE Healthy Survey Report [35], literature [36–38] and expert consensus, the Qualtrics survey system was utilised to develop an English and Arabic survey for adults aged 18 years and above in the United Arab Emirates to cover the objectives, including demographics, knowledge about SSB and its relation to health and ill health, such as obesity and diabetes. An under 18 years category in the survey was included to rule out any underage submissions which were highly unlikely as we were using database of institutions and their employees. In addition, no data was collected from those who selected under 18 years; if they did select this choice; it took them to the end of the survey. The survey included SSB definitions per UAE law and questions on the demographic characteristics, attitudes, and beliefs toward SSB and how tax revenue should be allocated. All questions were coded for analysis. The demographic segment covered nationality (Emiratis or Non-Emiratis), education (Primary School, Secondary School, Higher Certificate or Diploma, Bachelor, Master, Ph.D./Doctorate/Post Doc) and household income in Arab Emirate Dirhams (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). The knowledge and beliefs segment covered six key areas (the link betwes, source of awareness (newspaper, radio/tv, internet/social media, when buying a product, family or friends and other), belief about the necessity of the tax (very unnecessary, unnecessary, neutral, necessary and very necessary), the effect of the tax in tackling health conditions such as obesity, diabetes and other diseases (little/insignificant, minor, moderate, major, big effect/severe), support for tax if revenue was directed towards government spending, and support for tax if spending was directed towards healthy lifestyles programs (subsidising healthy food and drinks, school health program, diet and nutrition programs for children, diet and nutrition programs for adults, health education programs, social well-being and networking programs, mental health programs, healthy cooking skills programs, physical activity programs, and other). Two questions in the survey included an 'other' response category with free text for the source of awareness of SSB tax and programs supported. Two questions in the survey included a 5-point - Likert scale for the necessity of SSB tax (1 = very unnecessary and five very necessary) and the effect of tax on diabetes/obesity and other health diseases (1 = little/insignificant to 5 = big effect/severe).

Before distribution, the research group piloted and refined the survey to ensure clarity in questions and reliability and validity of the findings. For example, the list of sources of awareness and healthy lifestyle programs was expanded to capture more response categories, such as diet and nutrition programs for children, health education programs, newspapers, and when buying a product. The final survey was distributed electronically through Qualtrics and Microsoft Outlook. An opportunistic sampling approach was adopted for survey distribution targeting only adults (18 years and above) in the UAE through an existing Mohamed Bin Rashed School of Government (MBRSG) database of institutions and employees, workforce numbers for local health authorities and social media platforms accounting for approximately 7500 participants [39]. The survey included consent to participate and the option to withdraw at any point. The survey ran for eight weeks, and two reminders were sent during the survey period. The minimum study population was 385, with a confidence level of 95% for a response distribution of 50% [40,41].

4.1. Data Collection and statistical analysis

Data was collected through Qualtrics and saved onto Microsoft Excel for data cleansing and coding. Cleansed data was then transferred to the Statistical Package for Social Sciences (SPSS) Subscription version for analysis. Descriptive and frequency analyses were performed for demographic variables and presented in tables and graphs. Pearson's Chi-square test was utilised to determine the

Table 1
Descriptive statistics of survey responses.

Variable	Numbers contacted	Number	Maximum	Minimum	Mean	Standard Deviation
Nationality	7500 (100%)	1290 (17.2%)	1	2	1.58	0.495
Education	7500 (100%)	1289 (17.18%)	1	6	4.07	0.947
Household Income	7500 (100%)	1290 (17.2%)	1	7	4.28	1.941
Link between SSB and Obesity/Diabetes	7500 (100%)	1281 (17.08%)	1	2	1.04	0.194
Awareness of SSB Tax	7500 (100%)	1281 (17.08%)	1	2	1.17	0.374
Necessity for SSB Tax	7500 (100%)	1233 (16.44%)	1	5	3.61	1.430
Effect on Tax with Obesity/Diabetes	7500 (100%)	1229 (16.38%)	1	5	3.27	1.414
Support for Government Spending	7500 (100%)	1244 (16.58%)	1	2	1.24	0.426
Support for Healthy Lifestyles Programs	7500 (100%)	1244 (16.58%)	1	2	1.11	0.310

associations between the three demographic variables, participants' knowledge and beliefs, and how tax revenue could be allocated. The free text was used for the 'other' response category for the 'source of awareness of tax' and the 'programs supported'.

A descriptive analysis was done using the mean scores for questions that included a scale (how necessary is the tax and how much effect the tax may have on health conditions such as obesity, diabetes, and other diseases) and presented in a table.

5. Results

5.1. Distribution of survey participants

We contacted 7500 (100%) participants for the study and received 1290 (17.2%) responses. Briefly, as shown in Table 1, we report the highest responses for nationality (1,290, 17.2%), education (1,289, 17.18%) and Household Income (1,290, 17.2%), respectively, and the lowest was noted in Effect on Tax with Obesity/Diabetes (1,229, 16.38%) and Necessity for SSB Tax (1,233,16.44%). Table 2 provides the distribution of responses. There were more non-Emirati responses (742, 57.5%) than Emirati responses (42.5%), which reflects the general population distribution. The highest proportion of respondents were educated to a bachelor level (661, 51.2%), and nearly one-fourth of respondents earned more than 30,000 AED (298, 23.1%). For the six key areas on knowledge and beliefs, there

Table 2
Frequency and percent of survey responses.

| Variable	Frequency	Percent	Valid Percent	Cumulative percent
Emirati	548	42.5	42.5	42.5
Non Emirati	742	57.5	57.5	100.0
Primary School	9	0.7	0.7	0.7
Secondary School	81	6.3	6.3	7.0
High Certificate Diploma	165	12.8	12.8	19.8
Bachelor	661	51.2	51.3	71.1
Masters	300	23.3	23.3	94.3
PhD/Doctorate/Post Doc	73	5.7	5.7	100.0
Less than 5000	60	4.7	4.7	4.7
5001 to 10,000	230	17.8	17.8	22.5
10,001 to 15,000	245	19.0	19.0	41.5
15,001 to 20,000	206	16.0	16.0	57.4
20,001 to 25,000	144	11.2	11.2	68.6
25,001 to 30,000	107	8.3	8.3	76.9
More than 30,000	298	23.1	23.1	100.0
Link for SSB and Obesity/Diabetes (Yes)	1231	95.4	96.1	96.1
Link for SSB and Obesity/Diabetes (No)	50	3.9	3.9	100.0
Awareness of SSB Tax (Yes)	1066	82.6	83.2	83.2
Awareness of SSB Tax (No)	215	16.7	16.8	100.0
Source of awareness - Newspaper	224	17.4	21.6	21.6
Source of awareness - Radio/TV	99	7.7	9.5	31.1
Source of awareness - Internet/Social Media	454	35.2	43.8	74.9
Source of awareness - When buying a product	131	10.2	12.6	87.6
Source of awareness - Family or Friends	95	7.4	9.2	96.7
Source of awareness - Other	34	2.6	3.3	100.0
Necessity of SSB Tax – Very Unnecessary	163	12.6	13.2	13.2
Necessity of SSB Tax – Unnecessary	123	9.5	10.0	23.2
Necessity of SSB Tax – Neutral	250	19.4	20.3	43.5
Necessity of SSB Tax – Necessary	197	15.3	16.0	59.4
Necessity of SSB Tax – Very Necessary	500	38.8	40.6	100.0
Effect on Tax with Obesity/Diabetes/Other Diseases – Little (insignificant)	202	15.7	16.4	16.4
Effect on Tax with Obesity/Diabetes/Other Diseases - Minor	166	12.9	13.5	29.9
Effect on Tax with Obesity/Diabetes/Other Diseases - Moderate	301	23.3	24.5	54.4
Effect on Tax with Obesity/Diabetes/Other Diseases - Major	224	17.4	18.2	72.7
Effect on Tax with Obesity/Diabetes/Other Diseases – Big effect (severe)	336	26.0	27.3	100.0
Support for Government Spending (Yes)	948	73.5	76.2	76.2
Support for Government Spending (No)	296	22.9	23.8	100.0
Support for Healthy Lifestyles Programme (Yes)	1110	86.0	89.2	89.2
Support for Healthy Lifestyles Programme (No)	134	10.4	10.8	100.0
Support Programme - Subsidising healthy food and drink	441	34.2	100.0	100.0
Support Programme - School Health	514	39.8	100.0	100.0
Support Programme – Diet and Nutrition (Children)	497	38.5	100.0	100.0
Support Programme - Diet and Nutrition (Adult)	421	32.6	100.0	100.0
Support Programme – Health Education	440	34.1	100.0	100.0
Support Programme – Social Well-being and Networking	181	14	100.0	100.0
Support Programme – Mental Health	264	20.5	100.0	100.0
Support Programme – Healthy Cooking Skills	235	18.2	100.0	100.0
Support Programme – Physical Activity	480	37.2	100.0	100.0
Support Programme – Other	0	0	0	0
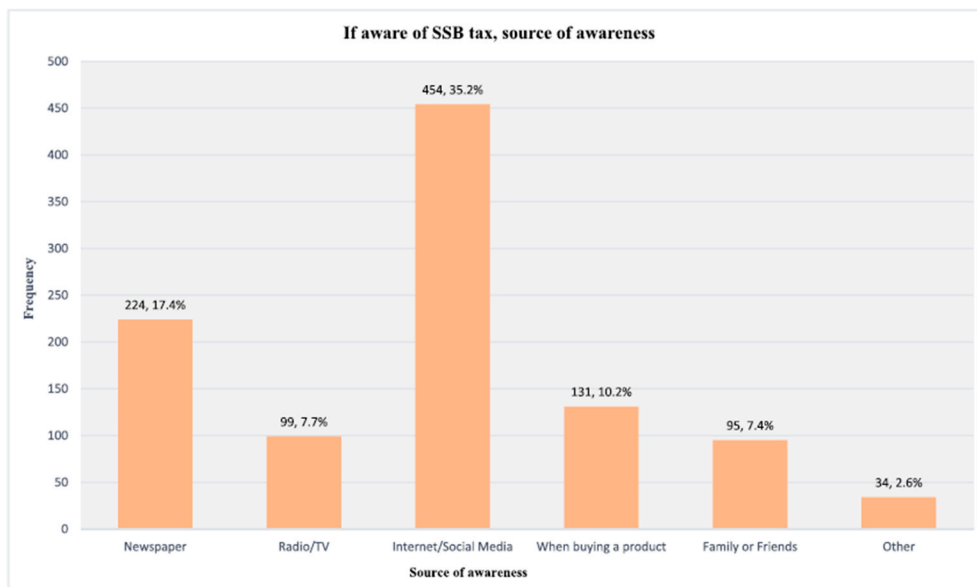
Fig. 2. Source of SSB tax awareness.

were a high number of responses for the association between SSB and health conditions such as obesity or diabetes (1,231, 96.1%) and awareness of the SSB tax (1,066, 83.2%). Internet and social media appear to be the highest source of information (454, 35.2%), and nearly two-thirds felt the tax was necessary or very necessary (197, 15.3% and 500, 38.8%). Two-thirds of respondents believed SSB tax has a moderate, major and big effect (severe) on diabetes, obesity and other conditions (861, 66.7%). There was high support for the levy to be allocated for government spending (948, 73.5%) and greater support for healthy lifestyle programs (1,110, 86%). Fig. 2 presents the sources of SSB tax awareness for 'yes' respondents. The 34 (2.6%) 'other sources of awareness' were placed into two themes (while studying at university and at work). As shown in Fig. 3, the top five responses for where the money should go were for school health programmes (514, 39.8%), children's diet and nutrition programmes (497, 38.5%), physical activity programmes (480, 37.2%), subsidising healthy food and drink programmes (441, 34.2%) and health education programmes (440, 34.1%). Further information on the allocation of spending by nationality, household income, and education is available in the supplementary files section. For 'other' source of awareness of tax, we grouped the responses into seven categories (all of the above, college, work, price change, social media, decree, family member) for statistical analysis; however, the numbers within each category and total number of responses (26 responses) were too low relative to the total number of responses received from the survey to provide meaningful insights. For 'other' programs supported, the total numbers were also too low (8 responses) and varied (all of them, awareness program, ban sweeteners, community sports, discounts on use of public parks, pools for residents, increase salary, promote plant-based diet and providing up to date diabetes medications and devices) for analysis.

5.2. Demographic variables vs SSB knowledge and beliefs

We report statistical significance for the three demographic variables, i.e., nationality, education and household income (Table 3). For nationality, significance was observed by the source of awareness of tax, the necessity for SSB and supporting spending on healthy lifestyle programs (P-value = <0.001, 0.002, and <0.001, respectively). Statistical significance by education was observed for the source of awareness only (P-value = <0.001). Statistical significance by household income was not observed in any of the categories.

6. Discussion

6.1. SSB knowledge and beliefs

Our study explores the association between nationality, income and education with SSB knowledge and beliefs and sheds light on how demographic factors influence participant responses. We also explored views on allocating SSB levy for health improvement programmes. Our study findings suggest that participants were generally knowledgeable about SSB health and taxation, and internet/ social media was the primary source of information. Participants felt that the SSB tax was generally 'necessary' or 'very necessary' and perceived to have a moderate, major and big effect (severe) on diabetes/obesity and other health diseases, which aligns with the literature [42,43]. There was support to spend revenue from SSB tax on government programmes and greater support for healthy lifestyle programs. We observed a variation in responses by nationality, education, and income. For example, responses in the non-Emirati group were generally higher, and bachelor graduates appeared to be more knowledgeable on SSB and support health
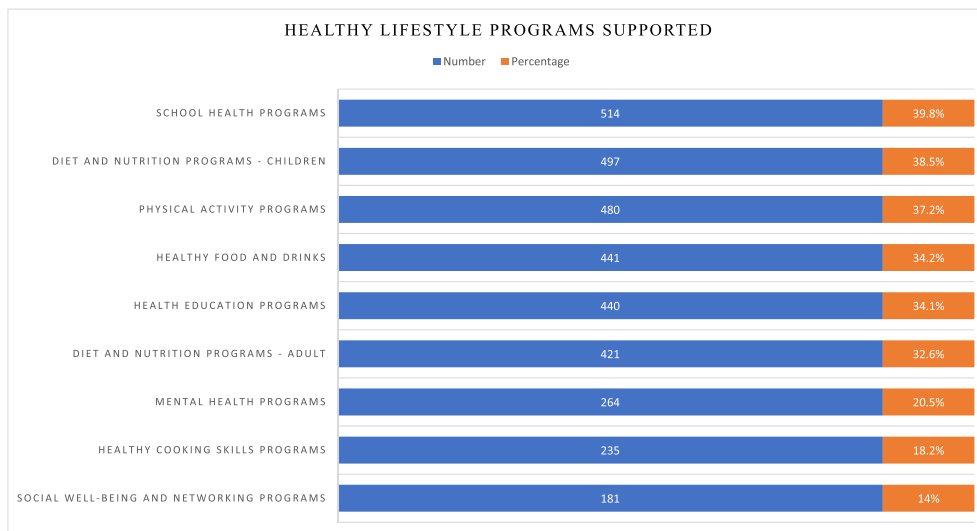
Fig. 3. Healthy lifestyles programs supported by participants.

improvement programmes versus those educated to a primary school level. Income appears to influence positive responses. For example, participants who earned more than 30,000 AED appear more aware of SSB and are more likely to agree with their responses. This might be because low-income and education groups face greater challenges accessing health information [44,45], have different consumption characteristics [46], are affected more by price changes, and thus are less supportive of SSB taxation. Views from lower education and income groups could be addressed through health education programs and subsidies toward healthier alternatives and programs [47–50]. Statistical significance was varied across the different demographic categories and questions and only observed for nationality and education. Our study highlights the influence demographic factors may have on SSB knowledge and beliefs; thus, we reject the Null hypothesis based on our findings for nationality and education.

6.2. Implications for decision-makers: where should the money go?

There is limited evidence on how SSB revenue could be spent on healthy lifestyle programs. The responses from our study suggest five key areas of interest: School health programmes, children's diet and nutrition programmes, physical activity programmes, subsidising healthy food and drinks, and health education programmes. The findings from the study are relevant for decision-makers seeking to benefit from public consultation in several ways. *First,* while government priorities and spending may vary and be politically driven, the annual allocation of budgets to national programs and local authorities could be better informed through public engagement in health issues such as SSB. *Second,* the findings shed light on current gaps and potential areas where the government can benefit from public engagement and consensus to demonstrate public accountability to maximise the efficiency and effectiveness of the SSB levy spending. This does not necessarily mean decision-makers should avoid spending on other healthy lifestyle programs, but public consultation may inform the proportion of expenditure directed toward areas of greatest perceived need to tackle obesity. *Third,* spending on public needs is likely to benefit the local prioritisation and integration of programs, increase program uptake, evaluation and realisation of cost benefits. *Fourth,* our study suggests an SSB knowledge gap by education and household income. Miller et al. suggest a lack of in-depth knowledge of SSB and Artificially Sweetened Beverages (ASB) [51]. This knowledge gap could be improved through public consultation and awareness of the health issues related to SSB and ASB to optimise support for levy and spending. *Fifth,* engagement with the public may support further increments to SSB levy or policy measures such as plain packaging and labelling, which would be the natural pathway toward reducing SSB uptake [52,53]. *Sixth,* understanding health needs through public consultation would help planners and strategists map the need against disease burden, services, infrastructure and environment. This includes but is not limited to maximising green spaces, increasing access to outdoor gyms, enabling safe cycling and walking, upgrading school facilities and other community venues for broader community use, restricting the number of outlets where SSB is easily accessible and improving access to healthier foods [54–56]. Healthy infrastructure should not be underestimated and is critical in creating a healthy and sustainable lifestyle. An environment that defaults towards healthy lifestyles makes it easier for the public to transition into sustainable healthy living. *Lastly,* SSB insight on knowledge and belief and allocation of the levy is needed for strategic public health planning to reduce associated disease prevalence. There may be a need to target demographic groups to improve knowledge and application of knowledge, e.g., increased activity, tracking daily sugar intake and substituting toward healthier alternatives to reduce calorific intake for the whole family [57,58]. This is important because lack of or inconsistent knowledge and beliefs may lead to unhealthy lifestyles for generations.

Table 3

Demographic factors vs SSB knowledge and beliefs.

Nationality			
1. SSB Link with Obesity/Diabetes	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	2.873[a]	1	.090
Likelihood Ratio	2.832	1	.121
Linear by Linear Association	2.870	1	.092
No. of Valid cases	1281	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 21.19. b. Computed only for a 2x2 table	
2. Awareness of SSB Tax	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	.080[a]	1	.778
Likelihood Ratio	.079	1	.778
Linear by Linear Association	.079	1	.778
No. of Valid cases	1281	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 91.14.	
3. Source of Awareness	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	27.715[a]	5	**<.001**
Likelihood Ratio	28.133	5	<.001
Linear by Linear Association	18.647	1	<.001
No. of Valid cases	1037	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 14.39.	
4. Necessity for SSB Tax	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	17.338[a]	4	**.002**
Likelihood Ratio	17.443	4	.002
Linear by Linear Association	4.032	1	.045
No. of Valid cases	1233	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 51.67.	
5. Effect of SSB Tax on Obesity/Diabetes and Other Diseases	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	12.037[a]	4	.017
Likelihood Ratio	12.067	4	.017
Linear by Linear Association	1.853	1	.173
No. of Valid cases	1229	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 70.10.	
6. Support for Government Spending	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	7.381[a]	1	.007
Likelihood Ratio	7.475	1	.006
Linear by Linear Association	7.375	1	.007
No. of Valid cases	1244	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 125.16. b. Computed only for a 2x2 table	
7. Support for Healthy Lifestyle Programs	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	12.820[a]	1	**<.001**
Likelihood Ratio	12.643	1	<.001
Linear by Linear Association	12.809	1	<.001
No. of Valid cases	1244	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 56.66. b. Computed only for a 2x2 table	

Education			
1. SSB Link with Obesity/Diabetes	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	11.196[a]	5	.048
Likelihood Ratio	11.985	5	.035
Linear by Linear Association	5.011	1	.025
No. of Valid cases	1281	a. 3 cells (25.0%) have an expected count of less than 5. The minimum expected count is .35.	
2. Awareness of SSB Tax	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	2.145[a]	5	.829
Likelihood Ratio	1.831	5	.872
Linear by Linear Association	.220	1	.639
No. of Valid cases	1281	a. 1 cell (8.3%) has an expected count of less than 5. The minimum expected count is 1.51.	
3. Source of Awareness	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	54.457[a]	25	**<.001**
Likelihood Ratio	54.389	25	<.001
Linear by Linear Association	3.935	1	.047
No. of Valid cases	1037	a. 9 cells (25%) have an expected count of less than 5. The minimum expected count is 20.	
4. Necessity for SSB Tax	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	24.251[a]	20	.232
Likelihood Ratio	24.976	20	.202
Linear by Linear Association	9.330	1	.002
No. of Valid cases	1233	a. 5 cells (16.7%) have an expected count of less than 5. The minimum expected count is 90.	
5. Effect of SSB Tax on Obesity/Diabetes and Other Diseases	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	32.931[a]	20	.034
Likelihood Ratio	33.396	20	.031
Linear by Linear Association	14.588	1	<.001
No. of Valid cases	1229	a. 5 cells (16.7%) have an expected count of less than 5. The minimum expected count is 1.22.	
6. Support for Government Spending	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	13.643[a]	5	.018
Likelihood Ratio	13.535	5	.019
Linear by Linear Association	8.347	1	.004
No. of Valid cases	1244	a. 1 cell (8.3%) has an expected count of less than 5. The minimum expected count is 2.14.	
7. Support for Healthy Lifestyle Programs	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	8.117[a]	5	.150
Likelihood Ratio	7.134	5	.211
Linear by Linear Association	3.201	1	.074
No. of Valid cases	1244	a. 1 cell (8.3%) has an expected count of less than 5. The minimum expected count is .97.	

Household Income			
1. SSB Link with Obesity/Diabetes	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	8.854[a]	6	.182
Likelihood Ratio	7.108	6	.311
Linear by Linear Association	1.349	1	.245
No. of Valid cases	1281	a. 2 cells (14.3%) have an expected count of less than 5. The minimum expected count is 2.30.	
2. Awareness of SSB Tax	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	2.195[a]	6	.901
Likelihood Ratio	2.139	6	.907
Linear by Linear Association	.211	1	.646
No. of Valid cases	1281	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 9.90.	
3. Source of Awareness	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	52.044[a]	30	.008
Likelihood Ratio	51.886	30	.008
Linear by Linear Association	1.096	1	.295
No. of Valid cases	1037	a. 5 cells (11.9%) have an expected count of less than 5. The minimum expected count is 1.38.	
4. Necessity for SSB Tax	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	45.047[a]	24	.006
Likelihood Ratio	45.370	24	.005
Linear by Linear Association	12.063	1	<.001
No. of Valid cases	1233	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 5.39.	
5. Effect of SSB Tax on Obesity/Diabetes and Other Diseases	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	43.946[a]	24	.008
Likelihood Ratio	44.783	24	.006
Linear by Linear Association	15.628	1	<.001
No. of Valid cases	1229	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 7.29.	
6. Support for Government Spending	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	9.705[a]	61	.138
Likelihood Ratio	9.461	6	.149
Linear by Linear Association	2.407	1	.121
No. of Valid cases	1244	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 13.09.	
7. Support for Healthy Lifestyle Programs	**Value**	**df**	**Asymptotic Significance (2-sided)**
Pearsons Chi-Square	5.154[a]	6	.524
Likelihood Ratio	5.409	6	.492
Linear by Linear Association	.920	1	.337
No. of Valid cases	1244	a. 0 cells (.0%) have an expected count of less than 5. The minimum expected count is 5.491.	

6.3. Implications for public health and theory

The study has several implications for public health and theory. Public health should consider demographic factors when commissioning healthy lifestyle services to optimise health improvement programmes. Understanding the varying population needs may require different public health planning and measurement approaches. For example, commissioning should consider measuring the extent of healthy substitution and calorific intake by household income and acknowledge that different thresholds may need to be addressed for those earning less than 5000 AED or more than 30,000 AED. Public health practitioners should consider opportunistic encounters to enhance community knowledge or messaging through face-to-face and social media channels. These measures should form part and parcel of future commissioning work to counter the daily unhealthy messaging individuals and families face. The HIP

offers a theoretical approach for the government to divert public health attention into different tiers for public health action. While it suggests socio-economic factors have the most significant population benefit, it also demonstrates the need to work comprehensively. A one-size approach may be applicable in some instances; however, our study suggests the need to tailor interventions within each tier to optimise effectiveness, efficiency, and uptake. For example, the population should be educated to understand the benefits of combining nutrition, physical activity, and mental health well-being and be offered accessible services to support healthy living.

The study has limitations. Although the study achieved the minimum sample size (385), the survey adopts purposeful sampling using existing databases, social media platforms and government institutions. The online study may have excluded key groups within the population with no access to electronic surveys or who speak languages other than Arabic and English. Several factors may have provided alternative explanations to our findings, for example, participants' interpretation of questions and personal bias towards specific healthy lifestyle programs spread between Emiratis and Non-Emiratis', levels of education, and household income. Although age group was captured in the survey, it was only used to verify participant age. Future studies may consider how age might influence decision of healthy lifestyles program. A larger sample size would strengthen the generalisability of the study findings. A quantitative approach and choice of questions could limit the responses for SSB. Therefore, efforts to improve response rates should be considered in addition to adopting a qualitative approach to improve generalisability and offer greater insight into how healthy lifestyle programs could be promoted and implemented across different demographic groups.

7. Conclusions

The findings shed light on the influence demographic factors have on knowledge and beliefs, public health gaps and potential areas for SSB levy expenditure. Further research is needed to understand how best to implement healthy lifestyle programs within the community to optimise coverage, cost-effectiveness, and health outcomes.

Data availability statement

Data is available upon request. The data that support the findings of this study are available on request from immanuel.moonesar@ mbrsg.ac.ae. The data are not publicly available due to privacy or ethical restrictions.

CRediT authorship contribution statement

Immanuel Azaad Moonesar: Writing – review & editing, Writing – original draft, Resources, Methodology, Formal analysis, Conceptualization. **Khamis Al-Alawy:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis, Conceptualization. **Reem Gaafar:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e28226.

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