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Thai Sugar-Sweetened Beverage Tax: Does It Really Help?

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Abstract

A solution recommended by the World Health Organization to prevent and control noncommunicable diseases is the Sugar-Sweetened Beverage (SSB) tax. This study aimed to evaluate the Thai SSB tax efficiency affecting the change in post-tax individual-level consumption and find causal explanations for the people's consumption behavior after the SSB tax was implemented. This study used a Productivity Model, and stratified random sampling was conducted by selecting 1,200 people. An in-depth interview was conducted to seek causal explanations for post-SSB tax consumption behavior with 15 key informants. The results revealed the SSB tax's efficiency in terms of perception and understanding at 6.75% and in terms of awareness and compliance at 2.83%. Several reasons for the failure of such a policy included no price differences for products with and without sugar, lack of coverage in regulatory enforcement, addiction to sweet tastes, insufficient food literacy, and the dangers of artificial sweeteners. Therefore, a careful and comprehensive review and revision of the tax implementation is necessary. The integration of complementary policy instruments alongside the tax is also required.

Keywords: food policy, noncommunicable diseases, policy evaluation, sugar-sweetened beverages tax

Introduction

Health policy is generally understood as a legitimate and necessary action to strengthen health systems and improve health.[1] Excise tax on sugar-sweetened beverage (SSB) is an effort to address public health problems in many countries,[2] as recommended by the World Health Organization (WHO) to prevent and control noncommunicable diseases (NCDs).[3] The primary component of the SSB tax is a specific excise tax levied based on the beverage's sugar content, meaning that it is progressive; accordingly, beverages with higher sugar concentrations are taxed at a higher rate.

In Thailand, the tax table categorizes sugar content in SSBs based on six levels: <6 g, 6–8 g, >8–10 g, >10–14 g, >14–18 g, and >18 g.[4] The SSB products containing <6 g sugar per 100 mL are exempt from the tax, while those containing ≥6 g sugar per 100 mL are taxed at a higher rate.[4] As the tax rate increases every two years, the Thai Government has imposed an SSB tax at a range of 0.10-5 Baht per liter from October 2019 to September 2021 before further lowering the threshold for higher tax and at a range of 0.30-5 Baht per liter from October 2021 to September 2023, and last, from October 2023 onwards.[4,5] The tax effectiveness depends on consumer response to price changes,[5] that the implementation of SSB tax in Thailand results in an increase in the price of taxed SSBs by 11%.[6]

The SSB tax aimed at reducing SSB consumption by making prices less affordable, encouraging consumers to switch to healthier alternatives with less or no added sugar, and prompting beverage manufacturers to reformulate their products by reducing sugar content or shifting to artificial sweeteners to maintain the desired sweetness level without the sugar and tax burden.[7,8] According to the evidence, domestic sugar consumption should be reduced. However, the domestic sugar sales volume during 2018-2023 did not show a clear downward trend, with sales volume (million tons) of 2.51, 2.48, 2.31, 2.29, 2.45, and 2.57, respectively.[9] At the same time, based on data from the Division of Non-communicable Diseases at the Thai Ministry of Public Health, the diabetes-related mortality rates of Thai people for five years (2017–2021) were 21.96, 21.87, 25.30, 25.05 and 24.55, respectively.[10]

Overall domestic sugar consumption volume and the diabetes-related mortality rate of the Thai population do not appear to be affected by SSB tax implementation since Thailand has various foods and sources of sweetness (white sugar, brown sugar, coconut sugar, palm sugar, honey).[11,12] Sugar consumption is not limited to only consuming sweet beverages.

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As a consequence, people's sweet taste preferences may not decrease, according to the objectives of policy enforcement. This poses a challenge in implementing excise on SSBs, whether it could really improve individual behavior in reducing sugar consumption and help the community have better health degrees.

Although the tax has impacted reducing SSB consumption in Chile, France, Mexico, and the US,[13-15] it does not mean that it can change a sugar consumption behavior beyond the body's needs for an imperfect nutritional knowledge and self-control problems of consumers.[16] Eating behavior and liking for food tastes are accumulated behaviors becoming personality traits similar to food addiction.[17] Changing such behavior takes time and appropriate adjustment to the food environment,[18] and there are many factors associated with inappropriate changes in consumption behaviors other than the SSB tax enforcement.[19] Therefore, this study aimed to evaluate the SSB tax effectiveness in altering the population's sugar consumption patterns using Vedung's Productivity Model,[20] measuring individual behavioral outcomes and investigating underlying reasons that might influence the success or failure of SSB tax in modifying consumption behaviors.

Method

This mixed-method study was conducted from March 2020 to June 2021. For the quantitative approach, a questionnaire was applied to assess perceptions, understanding, awareness, and compliance with the SSB tax to evaluate policy effectiveness. For the qualitative approach, an in-depth interview was implemented to gather detailed insights into the Thais' perspectives and food-selecting behaviors before and after the SSB tax implementation to investigate underlying reasons that might influence the SSB tax's success or failure in modifying inappropriate consumption behaviors.

The sample group was selected using stratified random sampling from the Bangkok Metropolitan Region covering Bangkok, Nakhon Pathom, Nonthaburi, Pathum Thani, Samut Prakan, and Samut Sakhon. This region spans over 7,000 square kilometers and has a population of 10,872,100 people in 2021.[21] As the country's most prosperous economic region, it has the largest number of educational institutions and serves as the center for government administration, business, trade, and finance.[22] Given the region's access to up-to-date news, information, and public healthcare services, it was deemed an appropriate site for the study.

Yamane's sample size formula was taken to calculate the required sample size,[23] yielding 400 individuals. To enhance statistical reliability and verify the homogeneity of data, the sample was collected through three replications of the sample group.[24] Consequently, the final sample size was 1,200 participants aged 15-79 years (see supplementary content). The age range was based on the general population health survey by the Bureau of Non-communicable Diseases, Thai Ministry of Public Health.[25] Questionnaires were distributed to various public locations and communities to recruit respondents. Both printed and digital versions were collected through face-to-face communications. The digitalized questionnaire was administered where possible, using electronic communication devices in areas with a Wi-Fi signal, and the printed questionnaire was used in areas lacking a Wi-Fi signal.

In the qualitative phase, 15 key informants representing the public sector, private sector, and general public were selected using snowball sampling and participated in in-depth interviews. Inclusion criteria for public sector informants required expertise in food, health, health education, health policy, or public policy. Private sector informants were business owners or employees with at least 10 years of experience in food product development, food and beverage (F&B) product development, or food marketing. General public informants were residents aged 15-79 years living in the Bangkok Metropolitan Region for more than 10 years.

The questionnaire was developed as closed-ended questions to explore Thais' perception, understanding, awareness, and compliance concerning the SSB tax. In the first part, a yes or no question was, "Do you know and understand SSB tax policy or not?" The second part comprised two questions on the awareness and compliance of the policy with two images of beverage products before and after the SSB tax implementation: the first question featured images displaying each product's price and Guideline Daily Amounts (GDA) label, and the second question featured images displaying a GDA label and the list of ingredients percentage on each product label. Respondents then chose only one image in each question to evaluate their awareness and compliance with the SSB tax policy. These food choices were determined based on the book "From Basic Nutrition to Sweet, Fatty, and Salty Labels."[26]

For scoring, respondents should choose the correct choice, which was a product with lower total sugar, in both questions to examine the score of awareness and compliance. The questionnaire also gathered the respondents' general demographic data. The questionnaire's validity assessment used an Index of Item-Objective Congruence (IOC). Four experts reviewed and rated the questionnaire, and the appropriateness of each question to its objective was evaluated

to ensure content accuracy, understanding, and clarity of language. All questions demonstrated an IOC value of >0.75. Reliability was determined using Cronbach's alpha coefficient.[27] The questionnaire was pre-tested on at least 30 individuals, separate from the research sample, yielding a Cronbach's alpha value of 0.81.

A semi-structured interview form was designed for the in-depth interview to discuss and solicit opinions on SSB tax, perception and understanding of the policy, food-selecting behavior before and after the SSB tax implementation, and relevant issues. The form's validity assessment used the IOC. Three experts reviewed and rated the form, including an evaluation of content accuracy, understanding, and clarity of language in each question. All the interviewed questions had an IOC value of 1.0.

This study categorized and statistically analyzed the collected data as follows: i) Descriptive statistics were employed to describe the sample's demographic characteristics; ii) Analysis of primary data from three respondent groups applied Analysis of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT) to compare all possible pairs of group means, assess multiple comparisons, and detect homogeneity subsets at a 95% confidence level.[28] This analysis aimed to determine whether the three sample groups represented the population and whether any statistically significant differences between the group means; iii) The data from the three sample groups were combined into a single dataset to evaluate the efficiency of the SSB tax policy by applying the Productivity Model (Equation 1) to analyze percentages of perception and understanding (Equation 2), as well as percentages of awareness and compliance (Equation 3).

$$Productivity = Output/Input$$

Equation 1. The Productivity Model of Vedung[20]

$$The\ percentage\ of\ perception\ and\ understanding = \frac{the\ amount\ of\ people\ who\ having\ perceived\ and\ understood\ the\ policy}{Total\ amount\ of\ sample}\ x\ 100$$

Equation 2. The Applied Equation for the Analysis of Perception and Understanding Percentage

$$The\ percentage\ of\ awareness\ and\ compliance = \frac{the\ amount\ of\ people\ who\ had\ awareness\ and\ applied\ the\ policy's\ advantages}{Total\ amount\ of\ sample}\ x\ 100$$

Equation 3. The Applied Equation for the Analysis of Awareness and Compliance Percentage

Audio recordings from the various informants were transcribed for subsequent data analysis and synthesis. The analysis focused on perceptions and understanding of the SSB tax policy, food-selecting behaviors before and after the implementation, and other pertinent issues, including additional recommendations from the key informants. For coding purposes, key informant groups were designated as public sector (G), private sector (C), and general public (P).

Results

Most respondents in the sample group were female than male, by about 7%. The samples were mostly of working age and divided into various jobs, and most had income levels between 10,001–20,000 THB (≈ 296.86–593.67 USD) per month (Table 1). ANOVA revealed no statistically significant differences (p-value >0.05) in the mean percentages of perceived policy efficiency, encompassing both perception and understanding and awareness and compliance, among groups 1, 2, and 3 (Table 2). Furthermore, DMRT indicated a homogeneity across all three groups, as evidenced by their inclusion within a single subset (Table 3). In short, these three sample groups represent the broader population studied.

Data from three sample groups were then aggregated to assess the overall effectiveness of SSB tax policy within the larger sample. Analysis revealed a mean score of perception and understanding of 6.75% and a mean score of awareness and compliance score of 2.83% (Table 4). These low percentages suggested a limited impact of the SSB tax on raising consumer awareness and stimulating behavioral change toward reduced sugar consumption. This observation required further investigation through a qualitative study to explore the underlying reasons for the policy's low effectiveness.

Table 1. Demographic Characteristics of Sample Group (N = 1,200)

Demographic Characteristics		n	Percentage (%)
Sex	Female	642	53.50
	Male	558	46.50
Age	15-20 years (adolescence)	111	9.25
	21-60 years (working age)	900	75.00
	61-79 years (retirement age)	189	15.75
Occupation	Student	222	18.50
	Teacher	19	1.58
	Medical staff	17	1.42
	Bureaucrat	117	9.75
	State enterprise employee	68	5.67
	Private company employee	115	9.58
	Laborer	294	24.50
	Merchant	76	6.33
	Private business owner/freelancer	39	3.25
	Farmer	13	1.08
	Househusband/housewife	213	17.75
	Artist/actor/performer	2	0.17
	Retired/unemployed	5	0.42
Income level (per month)	≤10,000 THB (≈ ≤296.83 USD)	340	28.33
	10,001–20,000 THB (≈ 296.86–593.67 USD)	515	42.92
	20,001–30,000 THB (≈ 593.78–890.50 USD)	171	14.25
	≥30,001 THB (≈ ≥890.51 USD)	174	14.50

Notes: N = the size of the population; n = the sample size; the current exchange rate as of February 5, 2025; 1 USD = 33.6803 THB.

Table 2. ANOVA for Comparison of Mean Differences of the Three Sample Groups

	Source of Variation	ANOVA Tests of REP				
		SS	df	MS	F	p-value
Perception and understanding	REP	0.020	2	0.010	0.159	0.853
	Error	75.512	1197	0.063		
	Total	81.000	1200			
Awareness and change behavior	REP	0.002	2	0.001	0.030	0.970
	Error	33.035	1197	0.028		
	Total	34.000	1200			

Notes: REP = 3 sample groups; SS = sum of squares; Residual MS = mean squared error (residual SS/residual degrees of freedom); F = overall F test for the null hypothesis

Table 3. DMRT for Comparison of Mean Differences of Three Sample Groups

	REP	N	Subset 1
Perception and understanding	1	400	0.0625
	3	400	0.0675
	2	400	0.0725
	p-value		0.6000
Awareness and change behavior	1	400	0.0275
	3	400	0.0275
	2	400	0.0300
	p-value		0.8430

Notes: REP = number of sample groups; N = the size of the population; Subset = subgroups that represent the homogeneity of means

Table 4. The Efficiency of Sugar-Sweetened Beverage Tax Policy (N = 1,200)

Policy	Efficiency Percentage Value	
	Perception and Understanding	Awareness and Compliance
SSB tax	6.75	2.83

Notes: N = the size of the population; SSB = Sugar-Sweetened Beverage

The in-depth information was gathered from 15 key informants regarding potential reasons for the perceived lack of success of the SSB tax policy in Thailand. Five issues emerged from the data are:

No Difference in Prices of Products with and without Sugar

Regarding the policy's impact on consumers, the Thai government anticipated that the price mechanism would indirectly influence consumer behavior. However, the SSB tax practically resulted in an insignificant increase in the price of sugar-sweetened beverages. *"I actually do not believe it can help. Look at liqueur and cigarettes; the tax is up, but customers still can buy… and after the tax on SSBs is applied, the cost of drinks goes up a bit—customers can pay."* (Food product standards specialist, G1). When healthy foods became a popular trend, manufacturers caught some marketing opportunities, leading to an increase in prices. This aligns with several key informants' viewpoints suggesting that the manufacturers promote the "good for health" label to boost the perceived value of their products. Product development specialist (C1) and a coffee business entrepreneur (C2) shared that: *"When it comes to price, will it be expensive if the product is good for health? This is a marketing issue. That is… those who want to take care of their health, they may have to pay a higher price for their good health."* People chose more affordable soft drinks when healthier beverages were expensive. *"Regular soft drinks cost 15 Baht per bottle, but if promotion is available, [the price is] 20 Baht for 2 bottles. It is unlike a sugar-free drink, which [costs] 25-50 Baht per single bottle. No matter how good they are, I cannot afford them. So expensive!" (Bus fare collector, P1).*

Lack of Coverage in Regulatory Enforcement

The current SSB tax in Thailand covers only certain types of drinks, such as industrially produced soft drinks, energy drinks, fruit and vegetable juices, and ready-to-drink coffee or tea, which is a concern for most key informants, given that Thailand has diverse food products, and this complexity poses challenges for effective monitoring. *"Our country has many kinds of food. There are many street foods, markets, corner stores, or café, so we can buy any drink anywhere."* (Marketing and nutrition specialist/C3, a health education specialist/G2, a public health policy specialist/G3, a local public health specialist/G4, and a food and nutrition specialist/G5). Following the SSB tax implementation, the industrial sector has carried out research and development to reformulate products and mitigate tax liabilities. The reformulation often involves substituting sugar with sweeteners while maintaining a comparable level of sweetness for consumers, as a food product standards specialist (G1) and a marketing and nutrition specialist (C3) stated: *"Besides, sugar has been substituted by another, like...sweeteners that customers can accept and the government cannot tax anymore."*

Sweet Taste Addiction

Lifestyle influences the preference for sweet tastes, as it reflects accumulated familiarity with certain foods. As a health education specialist (G2), a public health policy specialist (G3), and a 72-year-old taxi service owner (P2) gave the consistent opinion that: *"If a house always serves sweet side dishes, the children will also be addicted to sweet food because it creates a habit of taste and eating."* The key informants from the public and private sectors had a shared concern about the prevalent preference for sweet taste among Thais, aligned with statements by a bus fare collector (P1), a 72-year-old taxi service owner (P2), and a food vendor in the cafeteria (P4) telling that foods sold in their work areas tasted quite sweet. While a student in grade 12 (P3) expressed great fondness for her regular beverage: *"I am a bubble milk tea lover. I have been drinking it since it was sold in a cart in front of my school. I have been addicted to it much. Oh! It is incredible, it tastes crazy yummy. I am a big fan of bubble milk tea."* Given the prevalent preference for sweet taste among Thais, after the SSB tax was imposed, the industrial sector started using sweeteners to maintain a sweetness level of products comparable to the original formula. This means no change in the population's familiarity and habit of being a sweet taste addict, as a 23-year-old new employee (P5) said: "Between regular soda and sugar-free soda, I can honestly say that I cannot tell the difference between them."

Insufficient Food Literacy

This is another obstacle hindering the success of the SSB tax since most people do not comprehend how to choose healthy food or beverages. A marketing and nutrition specialist (C3) and a pastry company entrepreneur (C4) stated that if people do not understand, they will ignore it. Meanwhile, a food vendor in the cafeteria (P4) stated the incomprehension about food labels. *"GDA label too complicated for most shoppers to understand. I do not know about nutrition and cannot understand what 3% fat, 21% sodium is? Many people are even illiterate."* (Bus fare collector, P1).

Dangers of Artificial Sweeteners

Some key informants provided advice and warnings on the dangers of artificial sweeteners, which are increasingly used by F&B industries to avoid SSB tax. A food product standards specialist (G1), a food and nutrition specialist (G5), a marketing and nutrition specialist (C3), and an organic products entrepreneur (C5) expressed their opinions in the same direction: *"We were worried about sugar, but we might not know whether the sweetener substituting sugar could cause disease as well."* The factors obtained from in-depth interviews should be a strong reason to explain the inefficient SSB tax policy phenomenon in terms of post-SSB tax consumer behavior, whether for this reason there is no change or not.

Additional suggestions on policy proposals should be implemented in conjunction with using SSB tax policy. The issue of strengthening health literacy (HL) for people, as a health education specialist (G2) and a local public health specialist (G4) suggested the same: *"We should find ways to strengthen HL of the population. This may be through advertising and public relations through various media platforms."* A public health policy specialist (G3) raised the issue of promoting health knowledge through social media: *"The government should support and supervise the role of new-generation media whose role includes being social influencers to help advocate accurate information and knowledge on NCDs and HL."*

Other opinions on promoting HL came from a food product standards specialist (G1), a health education specialist (G2), a public health policy specialist (G3), a marketing and nutrition specialist (C3), and a pastry company entrepreneur (C4) recommending, *"We should reform the national curricula to include scientific knowledge and HL."* The front-of-package labels (FoPL) were another issue raised by almost all key informants. The Thai FoPL format is complicated to understand, so they chose to ignore reading labels before deciding to buy. *"The Health Star Rating System label is a pattern of FoPL that is easy to understand because it has pictures, even illiterate people can understand."* (Public Health Policy Specialist/G3 and Marketing and Nutrition Specialist/C3). Besides, the issue of creating incentives via financial policy instruments was raised by a product development specialist (C1), a pastry company entrepreneur (C4), and a 23-year-old new employee (P5), suggesting an alternative financial policy instrument that might receive better response from manufacturers and consumers: *"The government should consider implementing the Goods and Service Tax reduction policy on healthy food and beverage, because this positive policy may yield better results of modifying consumer behaviors than a negative policy."*

Discussion

The SSB tax can improve the food environment[29] by affecting people's sugar consumption behavior and reducing the prevalence of NCDs.[7] The briefly analyzed causes of NCDs can be divided into two dimensions: NCDs result from consumer choice and the environment.[30] The tax appears to be the right choice to address the price incentives problem and create an environment limiting food choices. A study evaluating Chile's SSB tax demonstrated a significant decrease of 21.6% in the volume of purchases of the higher-taxed sugary soft drinks each month.[13] A study on the impacts of the French soda tax on prices, purchases, and tastes found a reduction in regular soft drink purchases.[14] In the US, the odds of daily regular soda consumption decreased by 40% within the first two months of tax implementation.[15] A study in Thailand also revealed a significantly greater decrease in the consumption of taxable SSB products compared to non-taxable SSBs.[4]

However, the SSB tax measure still needs further study for any gaps: the tax policy might have been partially effective,[4,13] the tax's impact on prices exhibited uneven pass-through across different beverage categories,[14] and the tax effectiveness in reducing the NCD prevalence remained speculative.[6] This study revealed the efficiency of the Thai SSB tax with a quite low percentage of perception and understanding at 6.75% and awareness and compliance at 2.83%. This is a consequence of the SSB tax being unable to change the food environment, thus giving rise to many paradoxes in practice where the Thai food environment is characterized by diversity and various distribution channels.[12] Moreover, the SSB tax only applies to industrially produced soft drink products, energy drinks, powdered mineral salts, fruit and vegetable juices, and ready-to-drink coffee or tea.[31] It means that other beverages sold by small merchants on the roadside, Sunday markets, floating markets, or cafés, such as bubble milk tea, fruit juice, milkshakes, and coffee, are excluded from the tax. Also, the Thais have insufficient food literacy in selecting which food or beverages will not adversely affect their health.[32] Therefore, consumers can still access and consume high-sugar beverages at levels comparable to pre-tax implementation, indicating no substantial change in the food environment.

The persistent preference for sweet tastes was evident in the post-tax implementation, in which there was a massive growth of the bubble milk tea market[33] and continued growth of the market for sweetened condensed milk (SCM), a main ingredient in beverages excluded in the tax.[34] WHO's new guideline on non-sugar sweeteners (NSS), released on May 15, 2023, recommends against using NSS to control body weight or reduce NCD risks.[35] This recommendation contradicts the apparent trend where the industrial sector increasingly relies on artificial sweeteners in response to the SSB tax policy.

This shift is reflected in the growth of the global sugar substitutes market, estimated at USD 7.01 billion in 2023 and projected to expand at a compound annual growth rate (CAGR) of 5.8% from 2024 to 2030.[36] For these reasons, while the Thai SSB tax policy may demonstrate some effectiveness in reducing SSB product consumption, it might not be a sufficient mechanism for sustainably reducing the NCD prevalence. This is reflected in the persistent rate of diabetes-related mortality among the Thai population.[11]

Given the diverse and dynamic context of the country, the government should carefully and comprehensively review and revise the tax implementation. Further research on the tax implementation process is necessary to ascertain whether its aims and actual outcomes are aligned.[37] Otherwise, the SSB tax may fail to improve public health effectively. It could instead increase household expenditure due to the tax burden while simultaneously creating market opportunities for products labeled as "good for health."

This study was subject to certain limitations, and generalizations based on its findings should be made cautiously. Due to its cross-sectional design, the SSB tax effectiveness in altering the population's sugar consumption patterns was analyzed at a single point. A sampling bias constituted the first limitation, as data were collected solely from urban areas due to time constraints and the COVID-19 pandemic. In quantitative studies, increasing the sample size, often through replication, is a common method employed to mitigate such bias and enhance statistical reliability.[24] A snowball sampling method was employed in the qualitative part of the study. In the context of snowball sampling, saturation is reached when the inclusion of additional participants yields no new information or insights relevant to the research question. At this point, further data collection is deemed redundant, as it is unlikely to alter the findings significantly.[38]

Information bias constituted the second limitation. In the quantitative component, questionnaire validity was assessed using IOC, while reliability was evaluated using Cronbach's alpha coefficient.[25] For the qualitative component, the validity of the semi-structured interview guide was assessed via IOC. Furthermore, information was analyzed through data triangulation, drawing from three distinct key informant groups. Moreover, the purpose and method of analysis were explained to both quantitative respondents and qualitative informants, with assurances given that results

would be presented anonymously from an overall perspective rather than individually. This ensured that individual responses and opinions remain confidential. Consequently, both respondents and informants could be confident that truthful answers would not result in any negative repercussions.

Further analysis utilizing more comprehensive samples from both urban and rural areas is undeniably crucial. Future studies addressing these shortcomings will undoubtedly enhance the precision and validity of findings. Further quantitative studies on influential factors to the success and failure of SSB tax policy, along with qualitative studies exploring complementary policy proposals, are needed to ensure the sustainable effectiveness of such policy in reducing NCD prevalence. These efforts will support the present study's findings and facilitate their practical implementation.

Conclusion

Viewed from the lens of the study findings, the anticipated health benefits of the SSB tax, particularly in reducing NCDs, may be illusory due to the complexities of Thailand's diverse food environment, which hinders effective management and monitoring of post-tax community behavior. Complementary measures are crucial for improving the food environment. First, the government should prioritize food and health literacy by promoting accurate information about NCDs and healthy consumption through various media, including educating and supporting social influencers and reforming national curricula to integrate relevant scientific knowledge. Second, price interventions, such as GST reductions on healthy food and beverages, can incentivize both production and consumer purchasing decisions. Third, the government should reassess the health risks associated with artificial sweeteners compared to sugar. Finally, developing user-friendly FoPL will empower consumers to make informed choices, all of which will support the effectiveness of the SSB tax in reducing NCD prevalence.

Abbreviations

SSBs: Sugar-Sweetened Beverages; WHO: World Health Organization; NCDs: Noncommunicable Diseases; F&B: food and beverages; GDA: Guideline Daily Amounts; IOC: Index of Item-Objective Congruence; ANOVA: Analysis of Variance; DMRT: Duncan's Multiple Range Test; HL: Health Literacy; FoPL: Front-of-Package Labels; SCM: Sweetened Condensed Milk; NSS: Non-Sugar Sweeteners.

Ethics Approval and Consent to Participate

This study was approved by the Committee for Research Ethics (Social Science), Mahidol University, under the project "The proactive policies for tackling risk factor of noncommunicable diseases (NCDs) problems in the dimension of unhealthy diet" code No. MU-SSIRB: 2018/189.1408 approved on August 14, 2018. Informed consent was obtained from all participants included in the study.

Competing Interest

The authors declare no competing financial or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Please contact the corresponding author for any inquiries about the data supporting the findings. Due to data privacy/ethical restrictions, the research team cannot share the data publicly.

Authors' Contribution

Study conception and design: SS and BT; data collection: SS; analysis and interpretation of results: SS and BT; draft manuscript preparation: SS. All authors reviewed the results and approved the final version of the manuscript.

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