

## Article

# Public Acceptability of Policy Interventions to Reduce Sugary Drink Consumption in Urban Vietnam

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**Abstract:** This study aims to assess the public acceptability of interventions to reduce sugary drinks in Vietnam, identify the key determinants, and develop a classification of consumers. A cross-sectional survey with 263 urban consumers evaluated perceptions of four potential interventions: restricting choice, taxation, nudging, and labeling. Thereby, specific attention was devoted to perceived intrusiveness and (personal and societal) effectiveness, as well personal characteristics, including Confucius values. Results showed that “hard” interventions like taxation are less acceptable to consumers than “soft” measures such as labeling. Acceptability is generally affected by perceived intrusiveness and effectiveness (especially on other people in the society), while other factors (sugary drink behavior, trust in government’s competence, personal values, age, education) only matter for some of the interventions. Cluster analysis revealed three consumer segments, depicted as anti-taxation (28%), pro-intervention (20%) and pro-labeling (52%), which further underpins the heterogeneity of intervention acceptability.

**Keywords:** consumer survey; perceived effectiveness; food policy intervention; perceived intrusiveness; sugary drinks; Vietnam

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## 1. Introduction

Overweight and obesity are one of the major global public health concerns of the 21st century [1]. They are associated with a high risk of having a stroke attack, type-2 diabetes, and several types of cancers [2]. Although initially a phenomenon of the developed world, the obesity epidemic became more and more prevalent in developing countries [3]. Therefore, greater efforts need to be in place to achieve the sustainable development goals (SDG), especially SDG3, “health and well-being for all” [4]. In Vietnam, the prevalence of obesity and overweight among adults has increased fivefold from 2000 to 2015. The country also recorded more than 300,000 deaths per year due to non-communicable diseases. Nearly 40% of these cases were linked to cardiovascular diseases, for which unhealthy diets are a key risk factor [5]. Despite governmental efforts, Vietnam is still not projected to meet the overweight-related target of SDG3 in 2030 [6]. As a consequence, Vietnam and other similar countries want to take more action to end malnutrition in all forms, with the promotion of healthier diets as one of the recommended pathways.

A case-in-point is the consumption of sugary drinks. Sugary drinks are defined as “all non-alcoholic water-based beverages with added sugar, including sugar-sweetened soft drinks, energy drinks, fruit drinks, sport drinks, and fruit juice concentrates [7]. Following the causal link between sugary drinks and prevalence of overweight or obesity [8], governments are called to include the reduction of sugary drinks consumption in their national nutrition agenda. In June 2017, the Vietnamese government discussed the possibility of introducing a sugary tax in its first national attempt ever to curb the increasing trend of overweight and obesity [9]. Such a tax is expected to reduce the consumption of sugar by 11% and increase the consumption of healthier beverages by 2%,

both for tea and milk [10]. Nevertheless, this proposed intervention immediately intensified the debate on its legitimacy and was strongly criticized by industries that would be directly affected by this regulation [11]. However, whether consumers of sugary drinks in Vietnam would be in favor of this or similar interventions remains an unsolved question. As noted by WHO [12], “Having a good policy is not enough: to be effective, policy requires public support” (p40).

Public acceptability plays a fundamental role in determining the effectiveness of a policy measure [13]. Fiscal regulation of sugary drinks in the UK, for instance, is facing a mixed public opinion which hampered the success of its implementation [14]. Reactance theory, introduced by Brehm (1966) [15], highlights the need to consider public acceptability before launching an intervention. According to this theory, unacceptable interventions may induce strong emotions among the target group, which could provoke them to go against the desired behavior. Interventions promoting a healthier diet are particularly sensitive to the public because they deal with an innate human bias toward, for example, sugars and high caloric food [16,17]. Therefore, higher levels of public acceptability are needed to increase the likelihood of adopting the recommended behavior [18].

In research, the majority of acceptability studies have set their focus on Western or developed contexts, where expressing personal opinions are linked to a climate of public comfort [19]. As such, their contextual findings might not be applicable to developing settings where people are subject to a different set of beliefs [20].

Against this backdrop, this study aims to answer the following research questions: (1) What is the public acceptability level of interventions to reduce sugary drinks in Vietnam; (2) What are the key factors affecting the level of public acceptability of the different interventions, including personal belief factors such as Confucianism; and (3) What classification of consumers can be developed based on their perceptions of policy interventions. Thereby, the focus is on urban consumers in Vietnam, a middle-income country that is transitioning in various ways, as illustrated by its shift in the economy, nutrition status, and personal values, especially in urban areas [21]. This study helps to close the existing literature gap in public acceptability of interventions to change health-related behavior in developing contexts while providing insights to policymakers who aim to invest efforts to meet the public health targets in Vietnam.

### *1.1. Policy Options to Reduce Sugary Drink Consumption and Public Acceptability*

Among the strategies governments can take to curb sugary drinks consumption, taxation is dominating the literature [22]. Thereby, lower-income groups are shown to be the most affected, by which the benefits are expected to be the largest in this segment [23]. The WHO suggests applying a tax rate of 20% in order to achieve positive health impacts [24]. Currently, taxation policies are widely applied in Western countries, Latin America and a few South-East Asian countries [23]. Studies in developed countries found that the majority of consumers tend to support this measure, as illustrated in Australia [25], the UK [26], and the United States [27]. Support levels tend to increase over time and are higher when the collected levy is spent on other health promotion programs [28]. Nevertheless, the opposite is more often the case. A number of countries, especially in Europe and in some US States, had to withdraw this regulation due to both public and industry backlash [23].

Front-package labeling, which provides nutrition information in easy formats, has emerged as an effective policy intervention due to its high level of endorsement from consumers, both in Western and Eastern settings [29,30]. Out of all types, traffic light labeling is considered most effective in helping consumers to identify healthier products [31–33]. The label assigns color codes to sugar or caloric levels, such as red (high), yellow (medium), and green (low). Other approaches only indicate healthier choices, such as the labeling policies adopted in Australia and Denmark [34], or provide warning labels for unhealthy choices, which are implemented in, for example, Chile and Thailand [30].

Ironically, the nutritionally sensitive group, which are typically characterized by a low risk of obesity, appears to benefit the most from this intervention [35].

Limiting the availability of sugary drinks is another option to reduce sugary drink consumption. A review on choice restriction demonstrates its potential for improving people's diet [36], though this policy intervention is prone to criticism and rejection due to its high level of perceived intrusiveness [37]. Therefore, policymakers often find it more feasible to apply such a policy in specific settings, such as schools [38]. However, children and young adults can also demonstrate strong reactions toward such coercive measures. This is illustrated by a case study in the UK, where adolescents were creating a "black market" for sweets in response to the school's prohibition of unhealthy food [39]. Alternatively, one could also restrict the portion size of meals. This was, for instance, proposed in the state of New York, though it was eventually rejected due to substantial public criticism and industry lobbying [40].

A relatively new approach to modifying the choice architecture denoted as nudging [41] has increasingly attracted attention. Evidence points to its notable effectiveness on behavior change toward healthy food choices, with various successful nudges, such as reducing portion size [42], making (un)healthy foods more (in)visible [43], or priming [44]. Nevertheless, the level of intrusiveness of nudging as a policy intervention is often a subject of debate. Critics question the government's legitimacy to interfere with their unconscious decision-making process, making it overt coercion that distorts the choice architect and hinders the ability to self-assess a choice set [45]. However, developers of the concept, Nobel prize winners Thaler and Sunstein [41], claim that nudging does not completely eliminate choices but still enables individual freedom of choice.

Regarding the effectiveness of the aforementioned interventions, a systematic review revealed inconclusive results on dietary changes of various types of interventions [38], while another review claimed that many interventions only have limited impact [37]. This suggests that the impact of such interventions could be context-dependent. Insights into consumer perceptions of their effectiveness, however, are largely lacking.

To date, there is limited research that compares public acceptability of different interventions targeting sugary drinks consumption. Furthermore, when available, the majority of such studies were conducted in Western settings [25,46], by which restricting choice is commonly excluded due to its controversy in such study locations. In general, research has found that most interventions receive support from a large share of consumers. Thereby, labeling appears to be the most accepted intervention, followed by nudging and taxation. Regarding non-Western settings, cross-country studies on public acceptability of general health-related interventions further show that East Asian countries have a high tendency to support more coercive measures [47]. In such countries, people demonstrate to have a highly positive attitude toward nudging, regardless of the type or target objective [48].

### *1.2. Factors Affecting Public Acceptability*

In consumer research, public acceptability of healthy food interventions is mainly determined by attitudinal factors [19,49]. Evidence highlighted the role of people's perceptions of the costs and benefits associated with the intervention [47,50]. To reflect and examine perceptions on, respectively, costs and benefits, the concepts of perceived effectiveness and intrusiveness are often introduced. Perceived intrusiveness refers to the perceived level of individual freedom of choice associated with the intervention [51,52]. Support is typically higher for policies that are perceived as less intrusive [47,53]. The Nuffield intervention ladder ranks policies/interventions based on their perceived intrusiveness in the following order: providing information; guiding or enabling choice; and eliminating, restricting, or limiting choice [54]. Perceived effectiveness deals with the expected health improvement, either at a personal or societal level [53,55]. Perceived societal effectiveness reflects the individual level of altruism. It is a key value in shaping the acceptability of health behavior policies [56] and could be linked to particular groups.

For example, reluctance toward a sugary drink tax resonates with the perceived ineffectiveness of those being addicted or obese [57]. The level of acceptability is also associated with the belief about the cause of the social issue at hand. Therefore, public awareness of the evidence about the causal link between sugary drink consumption and obesity is needed to generate action. Unfortunately, many consumers reject interventions over the type of beverage since they believe that governments address the wrong cause [58].

Another crucial aspect that shapes public acceptability is the level of trust in the government [59]. When the public holds the perception that a government will not act in their best interest, the odds of being reluctant of governmental interventions increase [60]; this is particularly expected in the case of taxation policies, where concerns about government's trustworthiness tend to demotivate people to accept fiscal measures [61]. Similarly, people tend to reject a health policy intervention if they question the government's legitimacy in regulating the targeted behavior [19].

Personal values also play an important role in shaping consumers' attitudes toward policy interventions. At an individual level, one's health interest has straightforward implications on his or her views on health behavior, which then translates into a more positive attitude toward health-related policies. People who have a clear goal to maintain a healthy diet or who are aware of the importance of healthy eating may have preferential attitudes over policies on healthy food choices [62]. Besides, cross-cultural studies have shown that the cultural environment people are exposed to is also pivotal in shaping their views on health behavior policies. For example, being part of a paternal state increases the tendency to embrace policy interventions, such as nudging [56], while a conformity culture makes people more likely to support intrusive interventions, such as taxation [47,48]. This is particularly relevant in Asian countries, where people's beliefs are often historically grounded in Confucianism and its underlying values of obedience and hierarchy [63].

Confucius's values point to a higher level of conformity, which in turn may influence acceptability toward (particular) policy interventions. Here, three dimensions of Confucianism that influence the relationship between people and the state are deemed to be relevant, namely hierarchy, group orientation, and face-saving. First, hierarchy is considered an important aspect to maintain social harmony [64]. The prime meaning of hierarchy is the belief in social order. According to Confucianism, everyone in society has a fixed position and each person should behave according to his rank. The higher the rank, the more power one has in a society. As such, the belief in a hierarchical society may lead to a higher degree of acceptance of rules and orders, including (coercive) policy interventions. Second, group orientation refers to a sense of belonging to a community. Such values prioritize social harmony over individual welfare. Confucianism is linked to a natural tendency to outsource ones' well-being to other members of society. Thus, it is crucial to maintain a good relationship within the community in two ways, i.e., by respecting the norms and values of the society; and by seeking others' approval when making decisions [65]. Third, the concept of face-saving in Confucianism implies that individuals tend to avoid putting themselves and their social groups in a shameful position [66]. As a consequence, having this value motivates to follow and accept rules and social norms in order to fulfill social expectations.

Finally, consumers' characteristics are often linked to the public acceptability of food policy interventions. The level of acceptability was shown to be significantly different according to gender, age, and socioeconomic status [19,27]. Consumers' own behavior is also considered to be important as people who are less engaged in the targeted behavior appear to be more supportive of intrusive interventions [67].

### *1.3. The Case of Vietnam: The Nutrition Transition and Policy Considerations to Reduce Sugary Drink Consumption*

Following its economic transition, Vietnam is currently facing a shift in nutritional patterns, illustrated by rising consumption levels of animal-based products at the expense

of fruits and vegetables [68]. In Hanoi, for instance, an analysis of food expenditures from 1999 to 2013 has shown significantly larger increases for meat (2.5-fold) than for vegetables (1.5-fold) [69]. Added sugar intake levels also drastically increased, partially due to the exposure to Western diets and eating out-of-home habits, especially for young urban consumers [21]. As a consequence, the total sugar consumption per capita in Vietnam is nearly twice as large as the daily recommended level of WHO [70]. Given the popularity of soft drinks, illustrated by their consumption levels, which doubled between 2010 and 2015, sugary drink consumption has become a major public health concern in Vietnam [71].

This nutrition trend poses Vietnam as an emerging economy to the risk of overnutrition. For instance, the prevalence rate of obesity and overweight among adults has increased five times from 2000 to 2015, i.e., from 3.5% to nearly 15%, with rates for urban adults going up to 22% [5]. Furthermore, diabetes incidence is rising at an alarming rate, and has almost doubled, from 3.7% in 2004 to 6% in 2016 [72]. With the annual cost per patient of Type 2 Diabetes in Vietnam estimated at around US \$246, this health problem accounted for 12% of the GDP per capita [73].

Within this context, the Vietnamese government has considered several policy options to reduce the consumption of sugar in general, and sugary drinks in particular. In terms of labeling, for instance, food companies are required to provide information about the sugar content of pre-packaged food, though it is not mandatory to highlight the amount of added sugar [74]. The government also considered introducing a sugary drink tax. However, this intervention was heavily criticized through various media channels by questioning its necessity and possible negative economic consequences [11]. Such intense reactions have been widely observed in developed countries, which mostly resulted in the cancelation of such a regulation, even after its introduction [23]. Nevertheless, more recent empirical research underlined the potential of interventions, like taxation and labeling, in order to change behavioral patterns of Vietnamese consumers in a positive way [10,75].

## 2. Materials and Methods

### 2.1. Data Collection Method

A standardized survey was developed and administered in two megacities in Vietnam, namely Hanoi and Ho Chi Minh City. In each city, we collected data from two districts that varied in population density. To select the most relevant districts, we grouped all districts based on their population density and computed the median level. Next, we ranked districts above and below the median and grouped all districts with the same rank together. We then randomly selected two pairs in both cities, namely: Hai Ba Trung and Nam Tu Liem districts in Hanoi, Thu Duc, and Go Vap districts in Ho Chi Minh City. The survey was first developed in English and then translated into Vietnamese. The questionnaire did not contain any questions on personal identity or any sensitive (e.g., religious) questions. A pilot test was conducted with 60 Vietnamese respondents to revise the survey to local context and evaluate the understanding by different types of consumers. We targeted to have 65–70 respondents per district and obtained a total sample of 263 respondents based on data collection in July 2018 by local enumerators. All respondents were older than 18 years old. Instead of limiting our study to overweight or obese respondents, we opted to measure BMI status and examine its potential role. As such, this study also includes respondents that are non-obese (i.e., underweight or normal) respondents. These are also beneficiaries of nutrition interventions, given that they are also sugary drink consumers. While the role of sugary drinks on obesity prevalence is well-established [8], it is important to state that the selected policy interventions target sugary drink consumption of all people, regardless of their nutrition status. Indeed, WHO [24] encourages governments to apply measures to curb sugary drinks consumption on a general public level, rather than targeting (only) obese and overweight groups. All respondents were asked for their informed consent before continuing the study, which

indicated that they could end the interview at any time. Each interview lasted around 20 min, and respondents were not compensated for their time.

## 2.2. Survey Design

We first exposed respondents to four hypothetical policy options: banning the sale of sugary drinks in supermarkets every Tuesday (Restriction); enforcing a sugary drinks tax at 10% (Taxation); removing all sugary drinks from eye-level shelves (Nudging), and introducing a traffic light label on the sugar content of drinks (Labeling). The policy interventions were chosen based on their ranking on the Nuffield's intrusion ladder [54]. A tax level of 10% has been proposed by the Vietnamese government. Three policies (taxation, nudging, labeling) are widely described in literature on food policies related to health behavior. Restriction is normally excluded from comparative studies in developed settings due to its risk of public objection and backlash [14,38] but was added in this study. In this way, we build upon the study of Branson et al. [47], which showed that East Asian countries tend to be more relaxed with coercive measures.

In the first part of survey questions, respondents were then asked to evaluate each policy option by indicating their acceptability (on a 5-point scale, from 1 = highly unacceptable, to 5 = highly acceptable), their perception of the intrusiveness (on a 5-point scale, from 1 = not at all intrusive, to 5 = very intrusive), and the effectiveness, both on themselves and on the other people in the society at large (both on a 5-point scale, from 1 = not at all effective, to 5 = very effective).

In the second part of the survey, four types of potential determinants were questioned, i.e., health-related behavior, trust in the government, personal values (including Confucius values), and sociodemographic variables (see annex 1 for all items and their descriptors). Regarding the former, the level of sugary drink consumption was measured through a self-reported scale of the number of times per week sugary drinks were usually consumed. Besides, also the BMI (body mass index) status was measured based on weight and length.

To measure trust in the government, the scale developed by Grimmelikhuijsen and Knies [76] was applied and adapted to the local context. The Ministry of Health was used as a reference point for the questions, as it is hypothetically responsible for introducing measures of cutting sugary drink consumption. Based on a 5-point Likert scale, respondents were asked to evaluate statements on two key aspects of government trust, namely "Trust in Competence" (3 items) and "Trust in Benevolence" (2 items) [76]. In addition, respondents were asked whether they believe in the government's legitimacy in regulating individual food and beverages choice ("Trust in Legitimacy"; 1 item).

Questions about personal values dealt with respondents' health interest and cultural values. For the individual health interest, we opted for a reduced form of the Health Scale, initially developed by Roininen, Lähteenmäki, and Tuorila [77]. Using a 5-point Likert scale, four items were employed to determine participants' attitudes toward healthy eating in general (e.g., "It is important to me that my diet is low in fat"). In addition, respondents were also specifically asked about their craving for sugary drinks ("I often have cravings for sugary drinks"). With respect to cultural values, statements were borrowed from the cross-national consumer study of Monkhouse et al. [78] in order to measure three sub-dimensions, namely: Face Saving (5 items, e.g., "I pay a lot of attention to how others see me"), Group Orientation (5 items; e.g., "I recognize and respect social expectations, norms and practices"), and belief in a hierarchical society ("Hierarchy", 4 items, e.g., "I am happy if people look up to me"). All items were measured on a 5-point Likert scale to increase the response rate and response quality [79].

Finally, main sociodemographic characteristics were questioned, among which age (metric), gender, education, occupation, income (metric), and marital status.

### 2.3. Data Analysis

Data was inserted and analyzed in Stata, version 15. In the case of group orientation, reverse scaling was needed for two items (“I usually make decisions without listening to others”; “If there is a conflict between my interest and my family’s interest, I will put priority on mine”). Multi-item scales for trust in government and personal values were evaluated by exploratory factor analysis (varimax rotation) and reliability analysis (Cronbach’s alpha). This resulted in five factors, namely, general health interest, trust in government (competence, benevolence), saving face and hierarchy, with all factor loadings exceeding the 0.4 level. Respective Cronbach’s  $\alpha$  values were high and ranged from 0.75 (hierarchy) to 0.87 (general health interest). Due to the very low Cronbach’s  $\alpha$  score of group orientation (below the threshold of 0.5), we failed to confirm the internal consistency of this factor. As a consequence, we have excluded this factor in the analysis.

Paired sample t-tests were performed to compare the mean scores of acceptability, perceived intrusiveness and perceived effectiveness (on own behavior or on others) between each of the interventions.

Next, in order to identify key determinants of public acceptability, we ran five linear regression models, i.e., four models explaining each of the hypothetical interventions, and one aggregated model based on the mean acceptability. We removed all outliers and used a VIF threshold of 5 to test for multicollinearity, as suggested by Kutner, Nachtsheim, and Neter [80]. As occupation generated a multicollinearity issue in all models, we have removed this variable from the regression analyses.

Finally, hierarchical cluster analysis using Ward’s clustering method was performed to identify homogenous groups of consumers based on their level of acceptability toward the targeted policy interventions. After identifying the most suitable cluster solution, cluster membership was analyzed using the independent variables of the regression models as profiling variables. In order to detect significant cluster differences, we used the one-way ANOVA test for metric variables and Chi2-test for categorical variables.

## 3. Results

### 3.1. Sample Descriptives

The main sociodemographic characteristics of the respondents are described in Table 1. Our sample is relatively evenly distributed across gender and marital status. The majority of the respondents are below 35 years old and well educated, confirming the importance of rather young population segments in the Vietnamese study region. BMI values, using Asian cut-offs, mostly fall into the normal category, though more than 20% of the sample is considered to be overweight or obese. In terms of occupation, the sample is mainly represented by semi-skilled or unskilled manual workers, as well as students. With an average sugary drink consumption frequency between two and three times per week, our sample can be considered a group of moderate users.

**Table 1.** Characteristics of the sample (% ,  $n = 263$ , Vietnam).

Indicator	%	Indicator	%
Gender		Education Level	
Male	49.8	Secondary school or lower	8.3
Female	50.2	High/vocational school	39.1
Age groups (mean: 32.9; SD:12.86)		University/college or higher	52.6
18–24	26.2	Occupation	
25–34	41.5	Managerial	3.4
35–44	11.8	White-collar or skilled manual	9.1
45–54	7.2	Semi-skilled manual	39.5
55+	13.3	Unskilled manual	24.7
Marital status		Student	23.3
Married	47.8	Income (million VND)	
Unmarried	53.2	Mean	6.67
BMI (Asian cut-off) (mean: 20.9; SD: 3.0)		SD	3.32
Underweight (up to 18.5)	16.7	Sugary drink consumption	
Normal (18.5–22.9)	63.1	Mean	2.35
Overweight (23–27.4)	16.4	SD	1.53
Obese (higher than 27.4)	3.8		

SD, Standard Deviation, VND: Vietnamese Dong.

Regarding personal values, consumers' overall scores for face-saving are high, while hierarchy received an agreement score closer to the neutral midpoint (Table 2). Consumers' attitude toward healthy behavior is also considered to be (highly) positive. In general, consumers have a slight tendency to trust the competence and benevolence of their Vietnamese government and its legitimacy to intervene in the choice of food and drinks of people.

**Table 2.** Mean and standard deviation of personal values, trust in government and behavior indicators.

Indicators	Mean (SD)	Indicators	Mean (SD)
Personal values		Trust in government	
Face saving	4.0 (0.8)	Competence	3.3 (1.0)
Hierarchy	3.1 (0.9)	Benevolence	3.5 (1.1)
Health interest	3.9 (1.0)	Legitimacy	3.5 (1.4)
Behavior			
Craving for sugar	2.2 (1.1)		
Sugary drink consumption	2.3 (1.5)		

SD, standard deviation; Note: Personal values and indicators of trust in government are based on the average score of the respective items (see annex 1). Indicators, except for sugary drink consumption (average weekly consumption frequency), were measured based on a 5-point Likert scale.

### 3.2. Acceptability of Policy Interventions to Reduce Sugary Drink Consumption

Table 3 shows the variation in acceptability, perceived intrusiveness, and perceived effectiveness (on oneself and on others) of all four interventions. With respect to acceptability, consumers are most positive toward labeling, followed by restriction, nudging, and taxation. Penalizing consumption through taxation is significantly less preferred than banning products through targeted restriction. Sugary drink taxation is also perceived as the most intrusive among the four interventions. Furthermore, people do not believe that nudging would be a highly effective intervention to change either their own behavior or



the behavior of other people in society. On the contrary, they consider labeling to be most effective intervention, both for themselves as well as for others, followed by taxation.

**Table 3.** Comparison of public acceptability, intrusiveness, and effectiveness (self/others) between four policy interventions, mean and standard deviation per intervention, and significant differences by paired sample t-tests.

	Restriction		Taxation		Nudging		Labeling	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Acceptability	3.38 <sup>b</sup>	1.21	2.62 <sup>c</sup>	1.15	3.27 <sup>b</sup>	1.00	3.95 <sup>a</sup>	1.11
Intrusiveness	2.71 <sup>c</sup>	1.20	3.08 <sup>a</sup>	1.11	2.73 <sup>c</sup>	0.96	2.95 <sup>c</sup>	1.21
Effectiveness (self)	3.10 <sup>b,c</sup>	1.17	3.23 <sup>b</sup>	1.06	3.03 <sup>c</sup>	1.00	3.54 <sup>a</sup>	0.98
Effectiveness (others)	3.47 <sup>c</sup>	0.98	3.57 <sup>b</sup>	0.93	3.38 <sup>c</sup>	0.98	3.71 <sup>a</sup>	0.98

SD, standard deviation. Note: The alphabetical order of the letters denotes significant differences between interventions. Statistical significance was reported at 1%, except for perceived effectiveness on other people in the society in case of taxation and labeling, which were reported at 5% level.

### 3.3. Determinants of Acceptability of Policy Interventions to Reduce Sugary Drink Consumption

The results of the different regression analyses related to the individual intervention models and the aggregated intervention model are summarized in Table 4. As expected, intrusiveness had a significant, negative effect on intervention acceptability, except for the less intrusive, labeling intervention. Regarding the perceived effectiveness, findings generally point to a positive effect, though differences are observed depending on the frame of reference. The effect of societal effectiveness perceptions was significant across all interventions, while perceived individual effectiveness was only significant for taxation and nudging. Somewhat surprising, Confucius values did not play an important role, except for an association between hierarchy and acceptability of taxation, which was perceived as the most intrusive intervention.

Regarding trust in the government, only trust in competence is significant, with a positive effect on acceptability of less known interventions like choice restriction and nudging. The frequency of sugary drink consumption is also a significant predictor, negatively influencing acceptability of taxation and nudging, but not restricting choice and labeling.

We did not find any significant effect of sociodemographic characteristics, except for age and education. While the negative effect of age on the acceptability of taxation is rather small, the positive education effect on labeling acceptability is much more pronounced. Having a high education level, either through high school or university, increases the likelihood of accepting labeling as a policy.

**Table 4.** Determinants of acceptability of policy interventions to reduce sugary drink consumption.

	Restriction	Taxation	Nudging	Labeling	All Interventions
Intrusiveness	−0.27 ***	−0.38 ***	−0.32 ***	−0.32	−0.30 ***
Perceived effectiveness (self)	0.06	0.20 ***	0.16 **	0.16	0.21 ***
Perceived effectiveness (others)	0.32 ***	0.15 *	0.16 **	0.16 **	0.18 **
Behavior					
Craving for sugary drink	−0.09	0.06	−0.06	−0.11	−0.01
Sugary drink consumption	−0.07	−0.13 **	−0.12 ***	−0.08	−0.42 ***
Trust in government					
Trust in competence	0.05 *	−0.01	0.04 *	0.04	−0.35
Trust in benevolence	−0.00	0.00	−0.02	−0.02	−0.10
Trust in the legitimacy	−0.05	−0.03	−0.00	−0.22	−0.06
Personal values					
Face saving	0.03	−0.02	0.01	0.01	0.12

Hierarchy	−0.01	0.03 *	0.01	0.02	0.19
Health interest	0.01	0.00	−0.03	0.01	−0.07
Age	0.00	−0.01 *	0.00	0.00	0.00
BMI	−0.03	0.00	−0.02	−0.02	−0.08
Education					
High school/vocational school	0.32	−0.40	−0.00	0.46 *	0.40
University/college or higher	0.44	−0.34	0.08	0.58 **	0.90
Income	0.02	−0.02	−0.03 *	−0.03	0.00
Gender (female)	−0.04	0.17	−0.12	−0.12	0.03
Adjusted R <sup>2</sup>	0.26	0.20	0.20	0.06	0.30

Note: Statistical significant level reported: (\*)  $p$ -value < 0.1; (\*\*)  $p$ -value < 0.05; (\*\*\*)  $p$ -value < 0.01.

### 3.4. Consumer Segmentation

The findings of the hierarchical cluster analysis in Table 5 revealed three segments of consumers according to their acceptability level: “anti-taxation” (29% of the sample), “pro-intervention” (20% of the sample); and “pro-labeling” (51% of the sample). This demonstrates that, aside from a very positively oriented group, there is a group in favor of one (labeling) or three interventions (restriction-nudging-labeling).

**Table 5.** Segmentation analysis of consumers’ perceptions of policy options to reduce sugary drinks consumption, significant cluster differences by one-way anova and  $\chi^2$ -test.

Variables	Cluster 1 Anti-Taxation ( $n = 75$ )		Cluster 2 Pro-Intervention ( $n = 53$ )		Cluster 3 Pro-Labeling ( $n = 135$ )	
	Mean	Sd	Mean	Sd	Mean	Sd
<b>Segmentation variables</b>						
Restriction	4.28 <sup>a</sup>	0.58	4.25 <sup>a</sup>	0.55	2.53 <sup>b</sup>	1.05
Taxation	2.08 <sup>c</sup>	0.93	4.04 <sup>a</sup>	0.68	2.36 <sup>b</sup>	0.96
Nudging	3.31 <sup>b</sup>	1.09	4.19 <sup>a</sup>	0.39	2.90 <sup>c</sup>	0.87
Labeling	4.51 <sup>a</sup>	0.50	4.43 <sup>a</sup>	0.67	3.44 <sup>b</sup>	1.26
<b>Profiling variables</b>						
<b>Intrusiveness</b>						
Restriction	2.43 <sup>b</sup>	1.09	2.25 <sup>b</sup>	1.07	3.05 <sup>a</sup>	1.22
Taxation	3.09 <sup>b</sup>	1.07	2.42 <sup>c</sup>	1.08	3.35 <sup>a</sup>	1.04
Nudging	2.73 <sup>a</sup>	0.96	2.40 <sup>b</sup>	1.03	2.85 <sup>a</sup>	0.89
Labeling	2.96 <sup>a,b</sup>	1.21	2.68 <sup>b</sup>	1.33	3.04 <sup>a</sup>	1.16
<b>Perceived effectiveness on themselves</b>						
Restriction	3.25 <sup>a</sup>	1.13	3.30 <sup>a</sup>	1.22	2.93 <sup>b</sup>	1.16
Taxation	3.41 <sup>a</sup>	1.00	3.38 <sup>a</sup>	1.06	3.07 <sup>b</sup>	1.07
Nudging	3.16 <sup>a</sup>	1.05	3.30 <sup>a</sup>	1.01	2.85 <sup>b</sup>	0.93
Labeling	3.72 <sup>a</sup>	0.94	3.57 <sup>a</sup>	1.08	3.44 <sup>b</sup>	0.94
<b>Perceived effectiveness on others</b>						
Restriction	3.83 <sup>a</sup>	0.79	3.62 <sup>a</sup>	0.92	3.21 <sup>b</sup>	1.02
Taxation	3.72 <sup>a</sup>	0.97	3.81 <sup>a</sup>	0.86	3.39 <sup>b</sup>	0.91
Nudging	3.47 <sup>a,b</sup>	1.00	3.64 <sup>a</sup>	0.94	3.24 <sup>a</sup>	0.96
Labeling	3.99 <sup>a</sup>	0.81	3.87 <sup>a</sup>	1.09	3.49 <sup>b</sup>	0.97
Consumption of sugary drink	2.00 <sup>a</sup>	1.4	1.72 <sup>b</sup>	0.79	2.79 <sup>a</sup>	1.64
Trust in government						
Trust in benevolence	3.71 <sup>a</sup>	1.17	3.69 <sup>a</sup>	0.94	3.34 <sup>b</sup>	1.12
Trust in competence	3.48 <sup>a</sup>	1.02	3.55 <sup>a</sup>	0.90	3.12 <sup>b</sup>	0.90
Personal values						

Face saving	4.10 <sup>a</sup>	0.73	4.10 <sup>a</sup>	0.87	3.86 <sup>b</sup>	0.85
Hierarchy	2.93 <sup>b</sup>	0.85	3.42 <sup>a</sup>	3.15	3.08 <sup>a</sup>	1.00
General health interest	4.19 <sup>a</sup>	0.87	4.21 <sup>a</sup>	0.78	3.64 <sup>b</sup>	0.98
Age	35.80 <sup>a</sup>	13.7	35.06 <sup>a</sup>	13.08	30.44 <sup>b</sup>	11.85
Income	7.60 <sup>a</sup>	3.6	6.87 <sup>a,b</sup>	3.19	6.19 <sup>b</sup>	3.02
BMI	20.71	0.38	20.69	0.37	21.17	0.24
	N	%	N	%	N	%
Education (dummies)						
Secondary school or lower	4	5.3 <sup>a,b</sup>	7	13.2 <sup>b</sup>	10	7.4 <sup>a</sup>
High school or vocational training school	31	41.3 <sup>a,b</sup>	13	24.5 <sup>b</sup>	59	43.7 <sup>a</sup>
University/college or higher	40	53.4 <sup>a,b</sup>	33	62.3 <sup>a</sup>	66	48.9 <sup>b</sup>
Occupation (dummies)						
Managerial	4	5.3 <sup>a</sup>	2	3.8 <sup>a,b</sup>	3	2.2 <sup>b</sup>
White-collar and skilled manual	6	8.0 <sup>b</sup>	6	11.3 <sup>a,b</sup>	12	8.9 <sup>a</sup>
Semi-skilled manual	27	36.0 <sup>b</sup>	27	51.0 <sup>a,b</sup>	50	37.0 <sup>a</sup>
Unskilled manual	26	34.7 <sup>a</sup>	12	22.6 <sup>a,b</sup>	27	20.0 <sup>b</sup>
Student	12	16.0 <sup>b</sup>	6	11.3 <sup>a,b</sup>	43	31.9 <sup>a</sup>
Marital status (married dummy)						
Married	45	60.0 <sup>a</sup>	27	50.9 <sup>a,b</sup>	51	37.8 <sup>b</sup>
Unmarried	30	40.0 <sup>b</sup>	26	49.1 <sup>a,b</sup>	84	62.2 <sup>a</sup>

SD, standard deviation. Note: the alphabetical order of the letters denotes significant differences in mean (one-way ANOVA) or distribution (chi<sup>2</sup> test), using a significance level of 5%. Only variables generating significant cluster differences were included.

The first cluster, i.e., “anti-taxation”, is the one holding the strongest aversion toward taxation interventions. Members of this cluster are highly in favor of restriction and labeling and generally hold a neutral opinion about nudging. The second cluster, i.e., “pro-intervention”, tends to have a rather positive attitude toward all interventions but is the smallest among the three segments. The third group, i.e., “pro-labeling”, is the largest group and appears to be critical toward all interventions to reduce sugary drinks, except for labeling, which has a significantly higher level of acceptability.

All clusters were further profiled based on perceived intrusiveness, perceived effectiveness, health behavior, trust, personal values, and key sociodemographic characteristics. In general, members of the “anti-taxation” and “pro-intervention” clusters have a relatively similar profile, as compared to the “pro-labeling” cluster. Typical members of both clusters are more likely to believe that the proposed interventions are not intrusive and also tend to be more positive about the personal/societal effectiveness of the proposed interventions. In addition, they have a significantly higher trust level toward the government, both on its competence and benevolence. Both groups are more represented by older and married people with a higher income, who care more about their health and saving face than the other group. Apart from these similarities, the “Anti-taxation” cluster has its unique traits. As expected, people in this cluster emphasize the intrusiveness of taxation more than the “pro-intervention” group, though still less than the “pro-labeling” cluster, which is typically reluctant toward all non-labeling interventions. Furthermore, the anti-taxation cluster tends to believe less in a hierarchical society than the other two clusters. The “pro-intervention” cluster also differs from the other two groups in its profiling. It tends to be more represented by higher educated people, and has the lowest consumption frequency of sugary drinks among three clusters.

#### 4. Discussion

This study aimed to estimate the public acceptability level of interventions to reduce sugary drinks in Vietnam, determine the key factors influencing these acceptability levels,

and develop a classification of respondents based on their perceptions of policy interventions. The differences in public acceptability of the urban Vietnamese consumers in our sample confirm previous studies on policy interventions to reduce sugary drink consumption [46,81], with labeling as the most accepted intervention. As expected, enforcing taxation would generate most opposition [23,82]. Although this contradicts with a recent meta-analysis that targeted consumers in Western countries, showing positive attitudes toward a sugary drink tax [83], our findings do not necessarily imply that there is a major lack of support for this intervention. However, acceptability for taxation is significantly lower than for other interventions, indicating that policymakers should take consumers' sensitivity regarding tax-raising into account. On top of the potential public opposition, also industry rejection, anti-taxation lobbying and media driven backlash are often considered more important challenges [58], as illustrated in countries where such legislation eventually failed, such as in Slovenia or Denmark [23].

Interestingly, taxation is also perceived to be the most intrusive measure, which is not in line with the Nuffield intervention ladder, where choice restriction and banning ranked first in terms of intrusiveness [54]. The relatively positive figures on acceptability and perceived intrusiveness of choice restriction in our hypothetical supermarket scenario do lend support for this type of intervention, even beyond the traditionally targeted work or school settings.

With respect to perceived effectiveness, taxation scored relatively high, with only the well-accepted labeling intervention having a higher rating. However, evidence on actual effectiveness is often inconclusive and context-dependent. For example, labeling did not generate an impact in Ecuador and the UK [84,85], while the opposite was true for Canada [86]. Furthermore, our study revealed substantially higher scores for perceived effectiveness when a social viewpoint is taken. Depersonalizing the measurement of consumers' attitude toward the effect of the hypothesized interventions appears to lead to similar but significantly more positive reactions, which further underpins the market potential of policy interventions that aim to create impacts at a societal level. Overall, most consumers perceive each of the interventions to be effective to some extent. This is important for policymaking, as a combination of interventions is generally required to obtain effects in the long run. One example is a recent RCT study in the United States, where traffic-light labeling and taxation together doubled the effect size [87].

Our study also confirms the important role of perceived effectiveness, either on oneself or on other people, and perceived intrusiveness in shaping public acceptability [88]. Not surprisingly, only for labeling, the perceived intrusiveness was not a significant determinant. Furthermore, believing an intervention is effective for your own behavior appears to matter more for the most intrusive (taxation) and most accepted intervention (nudging), while perceived societal effectiveness was significant across all interventions. This supports communication of evidence on intervention effectiveness to the wider public as a means to improve perceptions and, hence, public acceptability.

We also found that people with a higher consumption frequency of sugary drinks were more likely to be against sugary drink taxation and nudging. Their reluctance is unfortunately not surprising, as such intrusive interventions will directly affect their own behavior, most likely more than they believe choice restriction or labeling will affect them. This corresponds with previous studies on public acceptability of sweetened beverage reduction in developed country settings, especially through taxation [89,90].

Although Confucius values were shown to be less influential than one might expect, there was still a link between hierarchy values and acceptability of taxation, which might be due to the fact that it was considered the most intrusive government intervention. While this confirms the importance of the cultural context when assessing public acceptability [91], the limited role of such values in our study may highlight the fact that consumers are increasingly challenged by Western values, such as competition, individualism, and self-expression [20].

Furthermore, the level of trust that is put in the government's competence has shown to be a potentially important driver of public acceptability, but not consistently for all interventions. While public trust indeed has shown its value for policy implementation [92], its lack of effect on the acceptability of taxation in our study does not correspond with most literature. Especially in Western contexts, consumers tend to question the introduction of taxation for health much more, even though it depends on whether the raised revenues would be used for a meaningful purpose, such as reinvesting in other public health programs [28,81]. In the context of our study, however, it is choice restriction and nudging that are more likely to be accepted if consumers believe that the government is competent. As such, trust appears to be more important in consumers' attitude formation for the interventions consumers are less familiar with. For nudging, for instance, a common trust issue to overcome refers to consumers' belief that the government covertly manipulates food choice behavior [93]. However, as nudging is a broad concept covering many types, one could address these trust levels through careful design and communication actions. Overt nudges, for example, are more likely to be accepted than covert nudges [94].

Interestingly, we did not find any association between BMI and acceptability. This demonstrates that other factors are much more at stake and lend support for a population-wide intervention, as recommended by WHO [24]. Nevertheless, our sample had a substantial share of overweight and obese people, which further underlines the need for well-accepted health interventions in Vietnam [95]. This is reinforced by the fact that the majority (63% of respondents) did not consider sugary drink consumption as a potential cause of obesity. This finding corresponds with a previous study in Vietnam, which reported misperceptions and a lack of awareness about obesity and overweight [96]. In this perspective, the significant association between education and acceptability of labeling in this study, which corresponds with previous research [97], further lends support for investments in nutrition education and information provision [98]. In our models, we did not find any significant income effect. This might be due to the fact that, except for taxation, the selected policy interventions, when introduced, would not have direct monetary consequences for the respondent. Nevertheless, our segmentation analysis has shown that the anti-taxation cluster has a (significantly) higher income level. Stated differently, the ones who would benefit most from taxation [23] are less represented in the anti-taxation cluster.

Based on the comparison of the public acceptability of interventions and the identified consumer segments, labeling would still be the most recommended intervention for the Vietnamese government to reduce sugary drink consumption across all segments (Table 6). Choice restriction was also positively perceived in two of the three consumer segments, although the logistic and economic feasibility of this hypothetical intervention has to be further examined in scientific and field settings.

**Table 6.** Policy options for different consumer segments.

Policy Measure	Anti-Taxation (29%)	Pro-Intervention (20%)	Pro-Labeling (51%)
Restriction (banning sugary drinks in supermarkets at least one day a week)	✓	✓	✗
Taxation (10%)	✗	✓	✗
Nudging (removing sugary-drinks from eye-level in supermarkets)	○	✓	✗
Labeling (traffic-light label for sugar content)	✓	✓	✓

✓: recommended; ✗: not recommended; ○: recommended with caution.

## 5. Conclusions

This study examined the public acceptability of four potential policy interventions to curb sugary drink consumption in the context of Vietnam, and contributed in different ways. First, it extends the body of empirical research on public acceptability by closing the gap of studies in non-Western settings. Moreover, it focuses specifically on the role of scientifically underpinned determinants of acceptability, such as the perceived intrusiveness or effectiveness of interventions. Given the context of this study, emphasis is also placed on the potential role of cultural values, as suggested by Sekhon, Cartwright, and Francis [99]. Finally, using a clustering approach, this study evaluates the market potential of these interventions through classifying and profiling consumers according to, respectively, intervention acceptability and its determinants.

The findings showed that the different policy measures to reduce sugary drinks consumption were well embraced in urban Vietnam. Nevertheless, “hard” interventions like taxation are less acceptable to consumers than “soft” measures such as labeling. Taxation is also perceived as the most intrusive intervention, which is different from the intrusiveness scale as applied in a Western context, by which restriction is ranked first. In terms of determinants, intervention acceptability is generally affected by perceived intrusiveness and effectiveness, though for labeling, only the perceived effectiveness on other people in the society appears to matter. Other factors (sugary drink behavior, trust in government’s competency, personal values, age, education) only played a role in the acceptance of some of the interventions. The association between hierarchy values and acceptability of taxation as the most intrusive intervention, for instance, was the only significant driver related to Confucius values. The consumption level of sugary drinks is also an important factor that should be taken into account in policy design, especially for taxation and nudging. When it comes to future targeting strategies, our cluster analysis revealed three public segments, depicted as anti-taxation (28%), pro-intervention (20%), and pro-labeling (52%), which further underpins the heterogeneity of intervention acceptability.

Several limitations have to be acknowledged. This study is based on a relatively small sample size and is targeted toward two main urban areas in Vietnam. Hence, these findings should be interpreted with caution as only a specific part of the Vietnamese population has been targeted. While our sample is in line with the sociodemographic heterogeneity of the target population, it would be important to further validate our findings through larger, more representative samples and compare this with research in rural Vietnam, where consumers differ in terms of nutrition status and food behavior [100]. Furthermore, this study was conducted in a specific South-East Asian context, where aside from cultural values; also the policy (e.g., nutrition policy interventions) and societal context (e.g., the burden of malnutrition, food environment) are expected to be different from other settings. As a consequence, public acceptability of these interventions in, for instance, the Western context are likely to differ [47,48]. However, as Confucianism, for example, did not play a crucial role in our Vietnamese setting, one might think that public acceptance might also be converging to some extent. But future research needs to provide evidence for these potential similarities (and differences). This study also builds upon face-to-face survey data, which might be prone to certain biases in the context of our study, i.e., measuring acceptance of policy interventions. Self-reported weight and height may be susceptible to social desirability bias [101], which might partly explain that the overweight and obesity of our female respondents is much lower than what was recorded in another study in 2009 using the same cut-off (6.0 vs. 31.3%) [102]. Questions on policy interventions to reduce sugary drinks consumption could have also been perceived as sensitive. To avoid biases toward acceptability, future research could consider indirect framing when measuring this construct, for example, through a third-person technique (“a typical neighbor”). Besides, this measurement of acceptability also relied on hypothetical intervention scenarios as currently no interventions on reducing sugary drink consumption have been in place in Vietnam. Ex-post analyses would allow for capturing the dynamic nature of consumers’ attitude formation, given that public perceptions on policy

interventions are known to alter throughout the phases of implementation. Nevertheless, as public acceptability is typically higher after enforcement [19], the ex-ante findings in our study could be considered as an indicator of post-implementation acceptability.

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