




Public acceptability of a sugar-sweetened beverage tax and its associated factors in the Netherlands

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Abstract

Objective: To investigate the level of public acceptability of a sugar-sweetened beverage (SSB) tax and its associated factors.

Design: Participants completed an online self-administered questionnaire. Acceptability of an SSB tax was measured on a seven-point Likert scale (*strongly disagree* to *strongly agree*). Associations between acceptability and socio-demographic factors, weight status, SSB consumption and beliefs about effectiveness (e.g., ‘An SSB tax would reduce people’s SSB consumption’), appropriateness, socioeconomic and economic benefit, implementation and trust were assessed using multivariable linear regression analyses.

Setting: The Netherlands.

Participants: Dutch adults aged ≥ 18 years representative of the Dutch population for age, sex, education level and location ($n = 500$).

Results: Of the participants, 40 % supported and 43 % opposed an SSB tax in general. Moreover, 42 % supported (43 % opposed) an SSB tax as a strategy to reduce overweight, and 55 % supported (32 % opposed) an SSB tax if revenue is used for health initiatives. Participants with a low education level ($B = -0.82$, 95 % CI -1.31 , -0.32), overweight ($B = -0.49$, 95 % CI -0.89 , -0.09), moderate or high SSB consumption ($B = -0.86$, 95 % CI -1.30 , -0.43 and $B = -1.01$, 95 % CI -1.47 , -0.56 , respectively) and households with adolescents ($B = -0.57$, 95 % CI -1.09 , -0.05) reported a lower acceptability of an SSB tax than their counterparts. Beliefs about effectiveness, appropriateness, socioeconomic and economic benefit, implementation and trust were associated with acceptability ($P < 0.001$).

Conclusions: Public acceptability of an SSB tax tends to be higher if revenue is used for health initiatives. The factors associated with acceptability should be taken into consideration.

Keywords
Acceptability
Nutrition policy
Public opinion
Sugar-sweetened beverages
Taxes

The prevalence of obesity is increasing worldwide⁽¹⁾. Obesity is a significant risk factor for developing non-communicable diseases such as type 2 diabetes mellitus, CVD, musculoskeletal disorders and some types of cancer⁽¹⁾. Obesity is a complex condition that is caused by many factors⁽²⁾. Among the dietary determinants, the consumption of sugar-sweetened beverages (SSB) has been recognised as a suitable target for obesity prevention interventions^(3–5). There is compelling evidence that consumption of SSB is causally related to weight gain and that reducing SSB consumption decreases weight gain among children and adults^(3–5). Mechanisms include their high levels of added sugar, low satiety and an incomplete compensatory reduction in energy intake at subsequent

meals^(3–5). In addition, SSB provide almost no nutritional value^(3–5). Evidence supporting the association between SSB consumption and weight gain is stronger than for any other single type of food or beverage⁽⁵⁾. Various interventions have been developed to reduce the consumption of SSB⁽⁶⁾. In recent years, SSB taxation has received considerable attention as a feasible fiscal measure to implement⁽⁷⁾.

The effectiveness of SSB taxation in reducing SSB purchases and consumption is supported by growing evidence^(7–12). Furthermore, according to modelling studies, an SSB tax of 10–20 % could decrease the prevalence of overweight and obesity on a population level^(13–18). For example, one modelling study has found that the

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prevalence of obesity in the German population aged 15–79 years could decrease by approximately 4 % given a 20 % SSB tax fully passed on to consumers⁽¹⁷⁾. The Commission on Ending Childhood Obesity of the WHO states the rationale for an SSB tax is strong and supported by the available evidence and therefore recommends governments to implement an SSB tax as a component of ‘a comprehensive, integrated package of interventions that address the obesogenic environment’⁽⁷⁾. Over forty countries worldwide have enacted taxes on SSB to date, including a 10 % excise tax on SSB in Mexico and a tiered excise tax applying different rates depending on the sugar content of beverages in the UK⁽¹⁹⁾. However, other countries have not yet introduced such a policy, for example, the Netherlands.

Although evidence of the effectiveness of SSB taxation is an important consideration for governments in the decision-making process, the extent to which an SSB tax is likely to be acceptable to the public is also affecting its agenda-setting, formulation, adoption and implementation⁽²⁰⁾. Quantitative and qualitative literature on public acceptability of an SSB tax has been synthesised in a recently conducted mixed-method systematic review⁽²¹⁾. Results of the meta-analysis of this review indicated that less than half (42 %) of the public supports an SSB tax based on studies conducted in the USA, Australia, the UK and France, ranging from 27 % among registered Texan voters to 55 % among a nationally representative sample of Australian adults^(22,23). As public acceptability of an SSB tax varies across countries because of different political, economic and sociocultural contexts, there is a need for studies in a wide range of countries⁽²¹⁾.

Within countries, several factors at the individual level seem to be associated with public acceptability of an SSB tax^(23–32). For example, previous studies indicated age^(23,25–27,30,31), sex^(23,24,29,30), education level^(23–27), weight status⁽²⁶⁾ and SSB consumption⁽²⁴⁾ to be associated with public acceptability of an SSB tax. Public acceptability may also depend on public beliefs towards SSB taxation, such as beliefs about effectiveness and cost-effectiveness, appropriateness, economic and socioeconomic benefit, policy adoption and implementation, and mistrust of the industry, government and public health experts⁽²¹⁾.

To date, no studies have been conducted in the Netherlands to investigate public acceptability of an SSB tax. In the Netherlands, 50 % of adults and 13 % of children have overweight or obesity⁽³³⁾. SSB consumption in the Netherlands is particularly high among children⁽³⁴⁾. The most recent results from the National Food Consumption Survey (2012–2016) demonstrate that children consume on average 620 ml of SSB per day⁽³⁴⁾. Although declines in consumption levels have been reported over this period, SSB continue to contribute to a significant proportion (23.6 %) of added sugar intake among both Dutch children and adults⁽³⁴⁾. Therefore, several stakeholders (e.g., consumer/health organisations, health professional associations and scientists) have previously argued for an SSB

tax. In 2016, one parliamentary party adopted an SSB tax in its draft election programme. The tax proposal was, however, withdrawn during their election congress because the majority of their party members voted against the tax. Furthermore, no SSB tax has been included in the National Prevention Agreement presented by the Dutch government in collaboration with public and private organisations⁽³⁵⁾. Currently, the Netherlands has a value-added tax rate of 9 % that applies to all food and beverages⁽³⁶⁾. In addition, consumer tax is payable on fruit and vegetable juices, soft drinks and mineral water, with no distinction made between SSB and sugar-free beverages (e.g., water or non-energetic sweetened beverages)⁽³⁷⁾.

In the current study, an online survey was conducted to investigate public acceptability of an SSB tax in the Netherlands. Specifically, we intended to: (i) determine the level of public acceptability of an SSB tax, and (ii) assess the associations between public acceptability of an SSB tax and sociodemographic factors, weight status, SSB consumption and beliefs about effectiveness, appropriateness, economic and socioeconomic benefit, policy adoption and implementation, and trust of the industry, government and public health experts.

Methods

Study design and participants

This online survey was conducted in March 2019 using a data collection agency (Panel Inzicht), which maintains an online panel of 114 540 Dutch members aged ≥ 18 years. Panel members are invited to participate in about one online survey per month, and survey participation is rewarded with various incentives (e.g., member points that can be redeemed for cash).

All panel members met the inclusion criteria of the current study (i.e., living in the Netherlands, Dutch speaking and ≥ 18 years old). A stratified sampling method was used to ensure that the sample was nationally representative for age, sex, education level and location. By applying quotas based on the distribution of those variables within the Dutch population using data from the national statistical office, Statistics Netherlands (CBS)⁽³⁸⁾, random subsamples of panel members were sent an e-mail invitation to participate with a link to the online questionnaire. For the age quotas, age was classified into the following categories: 18–24, 25–34, 35–44, 45–54, 55–64 and ≥ 65 years. Education level was based on the highest qualification attained and classified into three levels based on the standard classification from the CBS⁽³⁸⁾: low (less than secondary school or higher secondary school certificate), middle (higher secondary school certificate) and high (technical college or university degree). Location was based on province and classified into four regions (i.e., North, East, South and West) based on the standard classification from the CBS⁽³⁸⁾. The survey was run over 8 d

until the agreed number of 500 completes was achieved. A total of 7069 panel members were invited to participate in the survey. The survey response rate was 7.1%.

Measures

Data were collected on the acceptability of an SSB tax, socio-demographic factors, weight status, SSB consumption and beliefs by means of an online self-administered Dutch questionnaire (see online supplementary material, Supplemental Table S1). The questionnaire was developed in Dutch language proficiency level B1⁽³⁹⁾, which is understood by the vast majority of the population. The questionnaire was pilot-tested on a heterogeneous target population of Dutch adults aged 22–79 years (n 16) who were asked for feedback on the structure and phrasing of questions as well as the online procedure and layout using the thinking-aloud method. Based on the feedback, we clarified terms that were unclear to some participants (e.g., experts and societal health programmes). In addition, small adjustments were made to the layout of the questionnaire (e.g., we changed the colour of the progress bar from red to black, because several participants associated a red progress bar with making mistakes).

Acceptability of an SSB tax

Differences in the intended objective of the tax may affect the acceptability of an SSB tax⁽²¹⁾. Therefore, the acceptability of an SSB tax was assessed using three questionnaire items: 'I support imposing an SSB tax in the Netherlands', 'I support imposing an SSB tax in the Netherlands as a strategy to reduce overweight' and 'I support imposing an SSB tax in the Netherlands if revenue is used for health initiatives'. Items were all positively phrased in the active voice to improve readability, and responses were indicated on a seven-point Likert scale ranging from 'strongly disagree' (1), 'disagree' (2), 'slightly disagree' (3), 'not disagree, not agree' (4), 'slightly agree' (5), 'agree' (6) to 'strongly agree' (7). For the descriptive statistics, the variables were grouped into three categories: 'disagree' (response options 1–3), 'neither' (response option 4) and 'agree' (response options 5–7).

Sociodemographic factors and weight status

Data were collected on age, sex, education level, location, household composition, grocery responsibility, employment status, body height and weight. Age was categorised into '18–24 years', '25–54 years' and '≥55 years'. Household composition was categorised into 'one or more children aged 0–13 years living at home', 'one or more adolescents aged 14–18 years living at home' (including the response options 'one or more adolescents aged 14–18 years living at home' and 'both children and adolescents living at home') and 'no children or adolescents living at home' (including the response options 'no children or adolescents' and 'no children or adolescents living at home'). Grocery responsibility was categorised into 'not responsible', 'partly

responsible' and 'largely/totally responsible' (including the response options 'largely responsible' and 'totally responsible'). Employment status was categorised into 'employed' and 'unemployed' (including the response options 'unemployed', 'retired', 'student' and 'other'). Self-reported BMI was calculated as weight (kg)/height (m)².

SSB consumption

To assess SSB consumption, participants were asked about their consumption of four SSB groups: regular soft drinks, fruit drinks and juices with added sugars, energy drinks and sport drinks with added sugars, and flavoured water with added sugars. The questionnaire included items adopted from the Dutch version of the FFQ that was designed for the HELIUS study to collect information about the frequency (e.g., 'during the past four weeks, how often did you drink regular soft drinks?') and the amount (e.g., 'how many glasses (200 ml) of regular soft drinks did you drink on these days?') of intake of these beverages⁽⁴⁰⁾. Examples of popular beverages were selected to clarify each SSB group using the most recent results from the National Food Consumption Survey for adults (2012–2016)⁽³⁴⁾. Total SSB consumption was calculated as the sum of the four SSB groups and expressed in number of glasses consumed per week. Based on the currently enacted SSB taxes⁽¹⁹⁾, SSB consumption excluded water, artificially sweetened drinks, hot tea and coffee, concentrates, 100% fruit or vegetable juice and milk-based beverages.

Beliefs

Beliefs that appeared to have implications for the acceptability of an SSB tax in previously conducted qualitative studies were assessed using questionnaire items that were developed based on themes and subthemes that derived from the thematic synthesis of a mixed-method systematic review⁽²¹⁾. Questionnaire items included beliefs about the following themes: (i) effectiveness and cost-effectiveness (e.g., 'I believe that an SSB tax would contribute to improving people's health'), (ii) appropriateness (e.g., 'I believe that SSB consumption contributes to the development of overweight'), (iii) economic and socioeconomic benefit (e.g., 'I believe that an SSB tax is not fair for those with a low income'), (iv) policy adoption and implementation (e.g., 'I believe that an SSB tax is feasible to implement in the Netherlands'), and (v) trust of the industry, government and public health experts (e.g., 'I trust that the government views an SSB tax as a strategy to improve people's health'). Themes and subthemes from the systematic review and corresponding questionnaire items can be found in online Supplemental Table S1. Items were all phrased in the active voice, and responses were indicated on a seven-point Likert scale ranging from 1 'strongly disagree' to 7 'strongly agree'. For the descriptive statistics, the variables were grouped into three categories: 'disagree' (response options 1–3), 'neither' (response option 4) and



'agree' (response options 5–7). The questionnaire items 'I believe that an SSB tax would reduce my SSB consumption' and 'I believe that an SSB tax would contribute to improving my health' also included the response option 'I do not drink SSB' because the two items were considered not applicable to people who do not drink SSB. Participants who selected this option were excluded from the analyses with these two items.

Statistical analyses

Participants reporting a body height of <100 cm and/or SSB consumption of >105 glasses per week (i.e., >3 l/d) were excluded from all analyses ($n = 12$), because these values were considered implausible. Descriptive statistics were used to characterise the sample, to determine the level of public acceptability of an SSB tax and to determine the level of agreement with beliefs about effectiveness, appropriateness, economic and socio-economic benefit, policy adoption and implementation and trust. Associations between acceptability of an SSB tax and sociodemographic factors, weight status, SSB consumption and beliefs were assessed using linear regressions. Given the non-linear relationship between acceptability of an SSB tax and BMI and SSB consumption, BMI was categorised into underweight and normal weight (<25 kg/m²), overweight (25.0–29.9 kg/m²) and obese (≥30 kg/m²), and SSB consumption was divided in tertiles. The three acceptability variables that measured the acceptability of an SSB tax were modelled as dependent variables. Multivariable linear regression models were produced with all sociodemographic factors, weight status and SSB consumption entered simultaneously as independent variables to assess which variables were independently associated with the acceptability of an SSB tax. Values of $P < 0.05$ were considered statistically significant. Moreover, linear regressions were conducted to determine the associations between acceptability of an SSB tax and each belief variable separately, adjusted for sociodemographic factors, weight status and SSB consumption. Beliefs that appeared to have negative implications for the acceptability of an SSB tax in previously conducted studies were reverse-coded in the analyses⁽²¹⁾. Because of increased type I error rate caused by multiple comparisons (the probability of false-positive findings increases as the number of statistical tests increases), a Bonferroni-corrected P -value was used to test the statistical significance of belief variables ($P < 0.002$). Statistical analyses were performed using IBM SPSS Statistics 25.0. All statistical tests were two-sided.

Results

The characteristics of participants are presented in Table 1. The distribution of sex, age, education level and location in

Table 1 Descriptive statistics of sociodemographic characteristics, weight status and sugar-sweetened beverage (SSB) consumption of participants ($n = 488$)

	<i>n</i> or mean	% or SD
Age (years), <i>n</i> and %		
18–24	54	11.1
25–54	236	48.4
≥55	198	40.6
Sex, <i>n</i> and %		
Male	242	49.6
Female	246	50.4
Education level, <i>n</i> and %		
Low	110	22.5
Moderate	198	40.6
High	180	36.9
Household composition, <i>n</i> and %		
No children/adolescents	346	70.9
One or more children (0–13 years)	66	13.5
One or more adolescents (14–18 years)*	76	15.6
Grocery responsibility, <i>n</i> and %		
Not responsible	14	2.9
Partly responsible	115	23.6
Largely/totally responsible	359	73.6
Employment status, <i>n</i> and %		
Unemployed†	234	48.0
Employed	254	52.0
BMI (kg/m ²), mean and SD	25.8	4.9
Weight status, <i>n</i> and %		
BMI < 25 kg/m ²	230	47.1
Overweight	180	36.9
Obese	78	16.0
SSB consumption (glasses per week), mean and SD	8.3	14.7
Regular soft drinks	4.1	7.1
Fruit drinks and juices with added sugars	2.2	4.7
Energy and sport drinks with added sugars	0.8	3.7
Flavoured water with added sugars	1.2	4.0

*Including one or more adolescents aged 14–18 years and children of both age categories (i.e., 0–13 and 14–18 years) living at home.

†Including unemployed, retired, student, other.

the study sample was reflective of the distribution of those variables within the Dutch population based on data from the CBS⁽³⁸⁾. Of the participants, 37% reported to be overweight and 16% reported to be obese, which is comparable with the overweight and obesity rates in the Netherlands (35 and 15%, respectively)⁽³³⁾. In addition, the mean consumption of SSB in our sample is comparable with that in the Dutch population (8.3 and 9.4 glasses per week, respectively)⁽³⁴⁾.

An SSB tax in general and an SSB tax as a strategy to reduce overweight were supported by less than half of the participants (40 and 42%, respectively) (Table 2). More than half (55%) of the participants supported an SSB tax if revenue is used for health initiatives. The majority of participants believed that overweight is a problem in the Netherlands (70%), that SSB consumption contributes to the development of overweight (81%), and that overweight is the responsibility of people themselves (90%) and/or SSB producers (58%). Less than half of participants believed that an SSB tax would reduce people's SSB consumption (43%). Of the participants who indicated

Table 2 Descriptive statistics of acceptability of a sugar-sweetened beverage (SSB) tax and beliefs (*n* 488)

	Mean	SD	Disagree		Neither		Agree	
			<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Acceptability of an SSB tax								
I support imposing an SSB tax	3.7	2.0	212	43.4	82	16.8	194	39.8
I support imposing an SSB tax as a strategy to reduce overweight	3.8	2.0	209	42.8	74	15.2	205	42.0
I support imposing an SSB tax if revenue is used for health initiatives	4.4	2.0	155	31.8	67	13.7	266	54.5
Beliefs about effectiveness and cost-effectiveness								
An SSB tax will be paid by consumers	5.1	1.4	49	10.0	110	22.5	329	67.4
An SSB tax will encourage producers to reduce sugar in beverages	4.8	1.5	80	16.4	100	20.5	308	63.1
SSB are more detrimental for health than artificially sweetened beverages	4.6	1.6	94	19.3	137	28.1	257	52.7
An SSB tax will save healthcare costs in the future	4.5	1.6	106	21.7	125	25.6	257	52.7
An SSB tax would contribute to improving people's health	4.4	1.5	112	23.0	128	26.2	248	50.8
An SSB tax would contribute to improving my health*	4.0	1.9	144	32.9	114	26.0	180	41.1
An SSB tax would reduce people's SSB consumption	4.0	1.6	161	33.0	119	24.4	208	42.6
An SSB tax would reduce my SSB consumption†	3.9	1.9	156	36.7	108	25.4	161	37.9
An SSB tax will be paid by producers	3.5	1.7	231	47.3	124	25.4	133	27.3
Beliefs about appropriateness								
Overweight is the responsibility of people themselves	6.0	1.1	15	3.1	33	6.8	440	90.2
SSB consumption contributes to the development of overweight	5.4	1.3	32	6.6	63	12.9	393	80.5
Overweight is a problem in the Netherlands	5.0	1.4	55	11.3	92	18.9	341	69.9
Overweight is the responsibility of SSB producers	4.6	1.6	96	19.7	109	22.3	283	58.0
SSB should be more expensive than beverages without sugar	4.5	1.9	137	28.1	91	18.6	260	53.3
An SSB tax limits individual freedom	4.4	1.7	129	26.4	113	23.2	246	50.4
Overweight is the responsibility of the government	3.3	1.6	258	52.9	106	21.7	124	25.4
Beliefs about economic and socioeconomic benefit								
Raised revenue should be used for health care	5.3	1.4	48	9.8	78	16.0	362	74.2
Raised revenue should be used for societal health programmes	4.9	1.5	69	14.1	103	21.1	316	64.8
An SSB tax is not fair for low-income people	4.3	1.8	140	28.7	118	24.2	230	47.1
An SSB tax has a negative economic impact	3.6	1.5	207	42.4	165	33.8	116	23.8
Raised revenue should be used for the general budget	2.8	1.7	294	60.2	109	22.3	85	17.4
Beliefs about policy adoption and implementation								
An SSB tax is feasible to implement in the Netherlands	4.3	1.7	136	27.9	123	25.2	229	46.9
Trust								
Public health experts give reliable information about the health risks of SSB	4.7	1.4	74	15.2	143	29.3	271	55.5
The government views an SSB tax as a strategy to improve people's health	4.0	1.6	153	31.4	131	26.8	204	41.8
SSB producers care about people's health	3.4	1.7	241	49.4	126	25.8	121	24.8

**n* 438, not including sixty-two participants who responded 'I do not drink SSB'.

†*n* 425, not including seventy-five participants who responded 'I do not drink SSB'.

consuming SSB, 38% believed that an SSB tax would reduce their own SSB consumption. Participants believed that an SSB tax will be paid by consumers (67%), and felt that the raised revenue should be used for healthcare (74%) and/or societal health programmes (65%). Approximately half of participants believed that an SSB tax is not fair for those with a low income (47%) and that an SSB tax limits individual freedom (50%). Less than half of participants trusted that the government views an SSB tax as a strategy to improve people's health (42%).

Participants with a high education level reported 0.82 point higher on the seven-point Likert scale for supporting an SSB tax in general, 0.71 point higher on supporting an SSB tax as a strategy to reduce overweight, and 0.70 point higher on supporting an SSB tax if revenue is used for health initiatives compared with participants with a low education level ($P < 0.05$) (Table 3). Participants with a moderate education level were only more supportive of an SSB tax if revenue is used for health initiatives than those with a low education level ($P < 0.05$). Participants living at home with one or more adolescents were less supportive of an SSB tax as a strategy to reduce overweight or to use

the revenue for health initiatives compared with those living at home without children or adolescents ($P < 0.05$). Participants with one or more children living at home did not have statistically significant different levels of support than those living at home without children or adolescents. Participants with overweight were less supportive of an SSB tax in general and as a strategy to reduce overweight compared with those with a BMI $< 25 \text{ kg/m}^2$ ($P < 0.05$). Participants with obesity did not have statistically significant different levels of support than those with a BMI $< 25 \text{ kg/m}^2$. Participants with moderate or high SSB consumption were less supportive of SSB taxes, irrespective of the objective, than those with low SSB consumption ($P < 0.05$).

The majority of beliefs about effectiveness, appropriateness, socioeconomic and economic benefit, policy adoption and implementation and trust were statistically significant associated with the acceptability of an SSB tax (Table 4). For example, every point increase on the belief that an SSB tax reduces people's SSB consumption was associated with a 0.64 point increase on support for an SSB tax in general, adjusted for sociodemographic factors,

**Table 3** Associations between acceptability of a sugar-sweetened beverage (SSB) tax and sociodemographic factors, weight status and SSB consumption (*n* 488)

	Support for an SSB tax†			Support for an SSB tax as a strategy to reduce overweight†			Support for an SSB tax if revenue is used for health initiatives†		
	<i>B</i>	95 % CI	<i>P</i>	<i>B</i>	95 % CI	<i>P</i>	<i>B</i>	95 % CI	<i>P</i>
Age (years)									
18–24		Ref.			Ref.			Ref.	
25–54	0.03	–0.64, 0.70	0.929	–0.15	–0.83, 0.52	0.659	–0.24	–0.93, 0.45	0.495
≥55	0.12	–0.58, 0.82	0.737	–0.13	–0.83, 0.57	0.716	–0.25	–0.97, 0.46	0.486
Sex									
Male		Ref.			Ref.			Ref.	
Female	–0.22	–0.62, 0.18	0.276	–0.14	–0.54, 0.27	0.505	–0.37	–0.78, 0.04	0.078
Education level									
Low		Ref.			Ref.			Ref.	
Moderate	0.40	–0.07, 0.87	0.096	0.33	–0.14, 0.80	0.166	0.52	0.03, 1.00	0.036*
High	0.82	0.32, 1.31	0.001*	0.71	0.21, 1.20	0.005*	0.70	0.19, 1.20	0.007*
Household composition									
No children/adolescents		Ref.			Ref.			Ref.	
Children (0–13 years)	–0.02	–0.59, 0.54	0.936	0.05	–0.52, 0.61	0.873	–0.09	–0.67, 0.49	0.767
Adolescents (14–18 years)	–0.49	–1.00, 0.03	0.067	–0.57	–1.09, –0.05	0.033*	–0.56	–1.09, –0.02	0.040*
Grocery responsibility									
Not responsible		Ref.			Ref.			Ref.	
Partly responsible	–0.58	–1.67, 0.51	0.296	–0.20	–1.30, 0.90	0.724	–0.02	–1.14, 1.11	0.973
Largely/totally responsible	–0.60	–1.68, 0.47	0.273	–0.32	–1.40, 0.77	0.567	–0.04	–1.15, 1.06	0.939
Employment status									
Unemployed		Ref.			Ref.			Ref.	
Employed	–0.05	–0.46, 0.37	0.832	–0.09	–0.51, 0.34	0.692	–0.25	–0.68, 0.18	0.261
Weight status									
BMI < 25 kg/m ²		Ref.			Ref.			Ref.	
Overweight	–0.49	–0.89, –0.09	0.017*	–0.52	–0.92, –0.12	0.012*	–0.36	–0.78, 0.05	0.086
Obese	–0.35	–0.87, 0.17	0.189	–0.44	–0.96, 0.09	0.102	–0.32	–0.86, 0.22	0.240
SSB consumption									
Low		Ref.			Ref.			Ref.	
Moderate	–0.86	–1.30, –0.43	<0.001*	–0.83	–1.27, –0.39	<0.001*	–0.60	–1.05, –0.15	0.009*
High	–1.01	–1.47, –0.56	<0.001*	–0.84	–1.29, –0.38	<0.001*	–0.91	–1.38, –0.45	<0.001*

B, regression coefficient.

Multivariable analysis with all independent variables entered simultaneously. **P* < 0.05.

†Measured on a seven-point Likert scale ranging from 1 'strongly disagree' to 7 'strongly agree'.

weight status and SSB consumption. The beliefs 'an SSB tax will be paid by consumers', 'overweight is the responsibility of people themselves' and 'SSB producers care about people's health' were not statistically significantly associated with the acceptability of an SSB tax (Table 4).

Discussion

The current study aimed to determine the level of public acceptability of an SSB tax and assess its associated factors. We demonstrated that 40 % of participants supported (*v.* 43 % who opposed) an SSB tax in general, 42 % supported (*v.* 43 % who opposed) an SSB tax as a strategy to reduce overweight and 55 % supported (*v.* 32 % who opposed) an SSB tax if revenue is used for health initiatives. Participants with a high education level were more supportive of the tax than those with a low education level. Participants with overweight, moderate or high SSB consumption and those with adolescents living at home were less supportive of the tax than those with a BMI < 25 kg/m², low SSB

consumption and no children or adolescents living at home. Moreover, participants were more supportive of an SSB tax when they more strongly believed that an SSB tax is effective, is appropriate, has socioeconomic and economic benefit and is feasible to implement; and when they had more trust in the government and public health experts.

The finding that the level of public acceptability of an SSB tax tends to depend on the intended objective of the tax is in line with the findings of a systematic review and meta-analysis about public acceptability of an SSB tax⁽²¹⁾. In this meta-analysis based on studies conducted in the USA, Australia, the UK and France, pooled proportions indicated that 42 % of the public supports an SSB tax in general, 39 % of the public supports an SSB tax as a strategy to reduce overweight and obesity and 66 % of the public supports an SSB tax if revenue is used for health initiatives⁽²¹⁾. These findings suggest that higher public acceptability for an SSB tax if revenue is used for health initiatives can be observed regardless of the study population (*i.e.*, is not country-specific).

Table 4 Associations between acceptability of a sugar-sweetened beverage (SSB) tax and beliefs (n 488)

	Support for an SSB tax†			Support for an SSB tax as a strategy to reduce overweight‡			Support for an SSB tax if revenue is used for health initiatives‡		
	B	95 % CI	P	B	95 % CI	P	B	95 % CI	P
Beliefs about effectiveness and cost-effectiveness									
An SSB tax would contribute to improving people's health	0.72	0.62, 0.81	<0.001*	0.77	0.70, 0.86	<0.001*	0.76	0.66, 0.85	<0.001*
An SSB tax would reduce people's SSB consumption	0.64	0.55, 0.74	<0.001*	0.70	0.61, 0.79	<0.001*	0.64	0.54, 0.73	<0.001*
An SSB tax will save healthcare costs in the future	0.61	0.51, 0.71	<0.001*	0.63	0.53, 0.73	<0.001*	0.66	0.56, 0.76	<0.001*
An SSB tax will encourage producers to reduce sugar in beverages	0.61	0.50, 0.71	<0.001*	0.59	0.48, 0.70	<0.001*	0.61	0.50, 0.72	<0.001*
SSB are more detrimental for health than artificially sweetened beverages	0.47	0.37, 0.58	<0.001*	0.49	0.39, 0.60	<0.001*	0.41	0.30, 0.52	<0.001*
An SSB tax would contribute to improving my health‡	0.46	0.38, 0.55	<0.001*	0.48	0.39, 0.57	<0.001*	0.47	0.38, 0.56	<0.001*
An SSB tax would reduce my SSB consumption§	0.39	0.30, 0.48	<0.001*	0.42	0.33, 0.51	<0.001*	0.44	0.34, 0.53	<0.001*
An SSB tax will be paid by producers	0.21	0.11, 0.31	<0.001*	0.22	0.12, 0.32	<0.001*	0.16	0.05, 0.26	0.003
An SSB tax will be paid by consumers	0.06	-0.06, 0.19	0.323	0.02	-0.10, 0.15	0.708	0.09	-0.04, 0.22	0.176
Beliefs about appropriateness									
SSB should be more expensive than beverages without sugar	0.72	0.65, 0.80	<0.001*	0.73	0.65, 0.80	<0.001*	0.70	0.62, 0.78	<0.001*
SSB consumption contributes to the development of overweight	0.65	0.52, 0.77	<0.001*	0.65	0.52, 0.78	<0.001*	0.68	0.55, 0.82	<0.001*
Overweight is a problem in the Netherlands	0.61	0.50, 0.73	<0.001*	0.61	0.49, 0.73	<0.001*	0.60	0.48, 0.72	<0.001*
Overweight is the responsibility of SSB producers	0.53	0.43, 0.63	<0.001*	0.52	0.42, 0.62	<0.001*	0.49	0.38, 0.59	<0.001*
An SSB tax limits individual freedom	0.48	0.39, 0.58	<0.001*	0.50	0.40, 0.59	<0.001*	0.49	0.39, 0.58	<0.001*
Overweight is the responsibility of the government	0.43	0.32, 0.53	<0.001*	0.45	0.34, 0.56	<0.001*	0.37	0.26, 0.49	<0.001*
Overweight is the responsibility of people themselves	-0.07	-0.24, 0.09	0.384	-0.07	-0.24, 0.10	0.408	-0.23	-0.40, -0.06	0.010
Beliefs about economic and socioeconomic benefit									
Raised revenue should be used for societal health programmes	0.48	0.37, 0.60	<0.001*	0.52	0.41, 0.63	<0.001*	0.57	0.46, 0.68	<0.001*
Raised revenue should be used for healthcare	0.41	0.29, 0.53	<0.001*	0.43	0.31, 0.55	<0.001*	0.57	0.45, 0.69	<0.001*
An SSB tax is not fair for those with a low income	0.41	0.32, 0.51	<0.001*	0.40	0.30, 0.49	<0.001*	0.41	0.31, 0.51	<0.001*
Raised revenue should be used for the general budget	0.27	0.17, 0.38	<0.001*	0.29	0.19, 0.40	<0.001*	0.17	0.06, 0.28	0.002*
An SSB tax has a negative economic impact	0.15	0.03, 0.27,	0.012	0.18	0.06, 0.30	0.004	0.22	0.10, 0.35	<0.001*
Beliefs about policy adoption and implementation									
An SSB tax is feasible to implement in the Netherlands	0.67	0.58, 0.76	<0.001*	0.68	0.59, 0.76	<0.001*	0.68	0.58, 0.77	<0.001*
Trust									
Public health experts give reliable information about the health risks of SSB	0.52	0.40, 0.63	<0.001*	0.55	0.44, 0.67	<0.001*	0.62	0.51, 0.74	<0.001*
The government views an SSB tax as a strategy to improve people's health	0.47	0.36, 0.57	<0.001*	0.49	0.39, 0.59	<0.001*	0.45	0.34, 0.55	<0.001*
SSB producers care about people's health	-0.07	-0.17, 0.04	0.220	-0.03	-0.13, 0.08	0.612	-0.03	-0.14, 0.08	0.592

B, regression coefficient.

All analyses were adjusted for age, sex, education level, weight status, SSB consumption, household composition, grocery responsibility and employment status.

*P < 0.002.

†Measured on a seven-point Likert scale ranging from 1 'strongly disagree' to 7 'strongly agree'.

‡n 438, not including participants who responded 'I do not drink SSB'.

§n 425, not including participants who responded 'I do not drink SSB'.

||Reverse-coded items.



Consistent with previously conducted studies in the USA, Australia and France^(23–27), we found that adults with a high education level are more supportive of an SSB tax than those with a low education level. However, our finding that adults with adolescents living at home are less supportive of an SSB tax is not consistent with the results reported by Julia *et al.*⁽²⁵⁾. Julia *et al.*⁽²⁵⁾ observed no statistically significant association between household composition and public acceptability of an SSB tax among French adults. A potential reason for this discrepancy could be the higher consumption of SSB among Dutch adolescents than among French adolescents^(34,41). Participants in our study with adolescents living at home may be less supportive of the tax because of an expected increase in grocery spending. Although we assessed the participants' own SSB consumption, we have no information on the consumption of household members or purchases. Therefore, we were unable to test our hypothesis.

The finding that adults with overweight and obesity are less supportive of an SSB tax than those with a BMI < 25 kg/m², although the negative association between obesity and acceptability of an SSB tax was not statistically significant, is not in line with previously conducted studies in the USA, Australia and the UK that observed no statistically significant associations between weight status and public acceptability of an SSB tax^(23,27,28). Rivard *et al.*⁽²⁶⁾ demonstrated that the likelihood of support for an SSB tax is statistically significantly lower among US adults with obesity than among those with a BMI < 25 kg/m². A potential reason for the non-significant association between obesity and acceptability in our study could be due to a lack of statistical power. Comparable with the distribution of obesity within the Dutch population⁽³³⁾, 16 % of participants (*n* 78) in our sample reported to be obese, while corresponding with the higher obesity rates in the USA, more participants reported to be obese (29 %, *n* 161) in the study by Rivard *et al.*⁽²⁶⁾. The finding that adults with moderate or high SSB consumption are less supportive of an SSB tax than those with low SSB consumption is consistent with the results reported by Donaldson *et al.*⁽²⁴⁾. Donaldson *et al.*⁽²⁴⁾ demonstrated that the likelihood of support for an SSB tax is lower among adults from a mid-Atlantic US state who consume SSB daily. In contrast to our results, SSB consumption was not associated with the acceptability of an SSB tax among French adults⁽²⁵⁾. Julia *et al.*⁽²⁵⁾ indicated that sociodemographic factors have been associated with SSB consumption and that these sociodemographic factors rather than SSB consumption itself were associated with the acceptability of an SSB tax. Although we have adjusted our models for sociodemographic factors, SSB consumption was independently associated with the acceptability of an SSB tax in our study.

We found no statistically significant associations for age, sex, grocery responsibility and employment status. Inconsistent results have been reported in the existing literature regarding age and sex. A potential reason for this

inconsistency could be that these associations may vary across countries. With regard to age, younger participants were more likely to support the tax than older participants in studies conducted among US^(26,27,30,31) and Australian adults⁽²³⁾. In contrast, older participants were more supportive of the tax than younger participants in the French sample⁽²⁵⁾. In line with our findings, other studies conducted in the USA and the UK report no statistically significant association between age and acceptability of an SSB tax^(24,28). With regard to sex, females were more supportive of the tax than males in studies conducted among US^(24,30) and Australian adults^(23,29). In line with our findings, sex was not statistically significantly associated with the public acceptability of an SSB tax in other studies conducted in the USA^(26–28,31), France⁽²⁵⁾ and the UK⁽²⁸⁾. No previous evidence is reported regarding the associations between acceptability of an SSB tax and grocery responsibility and employment status.

Strengths and limitations

The main strength of the current study is that it is, to our knowledge, the first that investigated public acceptability of an SSB tax in relation to a wide range of factors, including the majority of beliefs that appeared to have implications for the acceptability of an SSB tax in previously conducted qualitative studies. Furthermore, we used a nationally representative sample of the Dutch population for age, sex, education level and location. The current study also has several limitations. Firstly, data were self-reported and may, therefore, be prone to social desirability bias. Additionally, BMI could have been underreported because of self-reporting⁽⁴²⁾. However, in our sample, 40 % of participants reported to be overweight and 16 % obese, which is comparable with the overweight and obesity rates in the Netherlands (35 and 15 %, respectively)⁽³³⁾. Secondly, it is unknown whether non-respondents would have provided different answers to our survey questionnaire than those included in the sample. However, the acceptability of an SSB tax is comparable with previously conducted studies, which increases confidence in our findings. Thirdly, although previously conducted studies showed education level to be associated with the acceptability of an SSB tax rather than income^(23–26,28,30), one study found lower support for an SSB tax among those with a higher income⁽²⁷⁾. We have no data on income in the current study to investigate this in the Netherlands. Lastly, there is controversy surrounding how data derived from Likert scales should be analysed. However, Likert scale items with at least five categories may generally be treated as continuous data⁽⁴³⁾.

Implications for future research

Different SSB tax definitions, questions, response options and data collection methods have been used in the literature to assess public acceptability of an SSB tax, which all may have influenced responses. Multi-country surveys are

needed to enable high-quality cross-country comparisons. Since the literature on public acceptability of an SSB tax in low- and middle-income countries is scarce⁽²¹⁾, low- and middle-income countries should be included in these surveys. Furthermore, future longitudinal and experimental studies should explore how to change public acceptability of an SSB tax and its associated beliefs. Our data were cross-sectional, and therefore causality was not determined in the current study. In addition, the stage of implementation of an SSB tax itself may be an important determinant of public acceptability of an SSB tax. Public acceptability of government interventions to change health-related behaviours generally becomes more acceptable once they have been introduced⁽²⁰⁾. We were not able to investigate this relation because no SSB tax was implemented in the Netherlands during our study period. If an SSB tax will be implemented in the Netherlands in the future, we encourage replication of our study to generate insights into the relationship between implementation and public acceptability of an SSB tax. Another potential direction for future research lies in investigating public acceptability of other environmental interventions on the consumption of SSB (e.g., limits to the availability of SSB in schools and multicomponent community campaigns focusing on SSB)⁽⁶⁾ and of other health-related food tax options (e.g., taxes on junk food).

Implications for practice

The current study provides insights into the current public acceptability of an SSB tax that could have implications on policymaking in the Netherlands. For example, our finding that the majority of the Dutch public supports an SSB tax if revenue is used for health initiatives may affect agenda-setting of the policy⁽²⁰⁾. Although an SSB tax has been (and is currently being) discussed in the Netherlands, the level of public acceptability of an SSB tax has received little attention in the political debate. However, it is important to note that public acceptability is only one factor in the dynamic and complex system in which the policymaking process takes place⁽⁴⁴⁾. Other important factors, such as changes in government, industry opposition and administrative load for the tax authority⁽⁴⁵⁾, may affect the policymaking process as well.

We demonstrated that support for an SSB tax if revenue is used for health initiatives is higher than support for an SSB tax in general, which suggests, in line with the review by Eykelenboom *et al.*⁽²¹⁾, that raising the revenue for health initiatives could elicit increased public acceptability. Currently, some countries invest the revenue raised by SSB taxation in health initiatives. For example, the revenue collected from the Soft Drinks Industry Levy in the UK is invested in programmes to encourage children's physical activity⁽⁴⁶⁾. Because of increased public acceptability across countries if tax revenue is used for health initiatives, it should be considered to recommend the use of SSB tax revenue for health initiatives in global guidelines for SSB taxes. When explicit earmarking of revenues is not acceptable or

feasible due to the political context of a country, other methods could be considered. For example, in the Netherlands, explicit earmarking of revenues may not be acceptable because of national budget rules⁽⁴⁷⁾. However, a budget allocation specifically for health initiatives could be announced simultaneously with an SSB tax without explicitly linking SSB tax revenues⁽⁴⁸⁾.

Targeting population subgroups with low levels of support for an SSB tax might be an effective strategy for campaigns⁽⁴⁹⁾. In the Netherlands, we demonstrated that adults with a low education level, overweight, moderate or high SSB consumption and those with adolescents living at home may have low levels of support. Understanding the interests and characteristics of those groups allows customisation of messages⁽⁴⁹⁾. For example, when targeting those with a low education level, messages could be adjusted according to their level of health literacy by providing messages at a low reading level and using pictures to facilitate understanding of information⁽⁵⁰⁾. Our findings suggest that dissemination of messages around the following themes might be helpful: (i) effectiveness and cost-effectiveness (e.g., communicating about the potential effectiveness of an SSB tax in improving health, product reformulation and the potential cost-effectiveness of the tax in saving future healthcare costs), (ii) appropriateness (e.g., communicating about the relationship between obesity and SSB, the problem of overweight and the responsibility of entities external to individuals), (iii) economic and socioeconomic benefit (e.g., communicating about the potential of an SSB tax to raise revenue for societal health programmes and to limit socioeconomic inequalities in health), (iv) policy adoption and implementation (e.g., communicating about the feasibility of the introduction of an SSB tax) and (v) trust (e.g., communicating about the purpose of an SSB tax to improve population health).

Conclusions

In the Netherlands, an SSB tax in general is supported by less than half of the public. More than half of the public supports an SSB tax if revenue is used for health initiatives. Sociodemographic factors, weight status, SSB consumption and several beliefs about effectiveness, appropriateness, socioeconomic and economic benefit, policy adoption and implementation and trust are associated with public acceptability of an SSB tax and should therefore be taken into consideration in the introduction of such a policy.

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Supplementary material

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