Evidence brief for policy

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Reducing the consumption of sugar-sweetened beverages and their negative health impact in Estonia

World Health Organization
REGIONAL OFFICE FOR Europe

Evidence-informed Policy Network (EVIPNet) Europe

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EVIPNet
EVIDENCE-INFORMED POLICY NETWORK

ABSTRACT

The consumption of sugar-sweetened beverages is associated with increased energy intake, weight gain, overweight and obesity more than for any other food or beverage as well as with the development of several non-communicable diseases and poor oral health. Already, more than half of all Estonians are overweight or obese, and the numbers are rising rapidly, especially among children and adolescents. The brief focuses on children, as beverage preferences and consumption patterns develop early in childhood and can persist over time.

Four policy options were selected for reducing the consumption of sugar-sweetened beverages and their negative health effects: regulation of food advertising, labelling of sugar-sweetened beverages and raising awareness about their health effects, school interventions and nutrition policies, and imposing taxes on sugar-sweetened beverages, subsidizing other food groups and/or substituting alternative beverages.

Based on the findings it was concluded that the four policy options complement each other and, if implemented in combination, would help to reach the goal of better health outcomes. Comprehensive, multicomponent interventions will reduce the consumption of sugar-sweetened beverages and their negative health effects.

Keywords

Beverages – adverse effects
Dietary Sucrose - adverse effects
Food Habits
Obesity - prevention and control
Estonia

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MAIN MESSAGES

The problem

The consumption of sugar-sweetened beverages is associated with increased energy intake, higher risks for poor oral health and weight gain and therefore also with increased risks for various noncommunicable diseases. The association between consumption of sugar-sweetened beverages and weight gain is stronger than that for any other food or beverage; 89.2% of Estonian schoolchildren drink sugar-sweetened beverages, the numbers of overweight and obese Estonians are growing rapidly and the numbers of newly diagnosed cases of diseases related to overweight and obesity have also increased, including other hyper-alimentation diseases and type 2 diabetes.

What we know from systematic reviews about the four viable options for addressing the problem

- **Option 1.** Regulation of food advertising
  - Regulating advertising of foods high in fats, sugars and salt is a policy that can be justified as a precautionary measure and one that helps the change social norms in dietary behaviour and appropriate nutrition for children.
  - Comprehensive, preferably statutory, restrictions on food advertising are recommended to reduce marketing pressure on children, with Government-led monitoring of compliance and adequate sanctions for non-compliance.

- **Option 2.** Labelling of sugar-sweetened beverages and raising awareness about their health effects
  - Front-of-package labelling as part of nutrient-specific schemes, with text, symbols and colours indicating nutrient levels, allow consumers to select healthier products more easily.
  - Long-term individual counselling, face-to-face or by telephone, is the most effective way to improve children's diets; group interventions are promising for people of low socioeconomic status.

- **Option 3**. School interventions and nutrition policies
  - Less intensive but longer duration programmes that combine educational and environmental interventions and address several unhealthy foods, are most effective in changing behaviour.
  - Direct methods such as education or workshops on healthy eating, promoting physical activity and counselling are more likely to be effective than indirect methods such as information leaflets.
  - Medium-intensity (4–10 1-h sessions delivered over periods ranging between 6 weeks to 12 months) nutrition education programmes on beverage choices delivered by peers, teachers or nutritionists could be effective in reducing the consumption of sugar-sweetened beverages by primary and secondary school-aged children.

- **Option 4**. Imposing taxes on sugar-sweetened beverages, subsidizing other food groups and/or substituting alternative beverages
  - Food taxes and subsidies can influence consumption, and increasing the price of sugar-sweetened beverages is associated with reduced demand. To maximize the effect, the taxes and subsidies should constitute a minimum of 10–15% of the price.
  - The most effective, cost-effective policy is to combine subsidies for healthy foods with taxation of unhealthy foods. This also allows consumers to switch to more healthy products without incurring additional cost.

Implementation considerations

- All four policy options would help to reduce the consumption of sugar-sweetened beverages. To reach the goal of better health outcomes, however, they should be implemented in combination.
- In order to reduce the negative health effects of sugar-sweetened beverages, policy options should be implemented as part of a wider, comprehensive healthy nutrition strategy or plan. Stand-alone activities targeting only the consumption of sugar-sweetened beverages might be less effective.

EXECUTIVE SUMMARY

The consumption of sugar-sweetened beverages is associated with increased energy intake, weight gain, overweight and obesity. The association with weight gain is stronger than for any other food or beverage; 89.2% of Estonian schoolchildren drink sugar-sweetened beverages.

Consumption is also associated with the development of obesity-related chronic metabolic diseases, such as metabolic syndrome and type 2 diabetes, and also cardiovascular disease, certain types of cancer, poor oral health in adolescence (dental erosion and caries), non-alcoholic fatty liver disease, elevated uric acid levels and gout.

Already, more than half of all Estonians are overweight or obese, and the numbers are rising rapidly, especially among children and adolescents. Consequently, the numbers of new cases of overweight- and obesity-related diseases in Estonia have also increased rapidly, including other hyper-alimentation diseases and type 2 diabetes. Cardiovascular diseases are still the main cause of death in Estonia, constituting 53% of all deaths, and the main contributor to the burden of disease, accounting for 33%.

The brief focuses on children, as beverage preferences and consumption patterns develop early in childhood and can persist over time; once the habit of consuming sugar-sweetened beverages is formed, it may be difficult to break. Intake of such beverages stimulates dopamine release, which gives a sense of reward and reinforces consumption, making a decrease in consumption even more difficult.

The challenges to decreasing consumption of sugar-sweetened beverages are:

- increased access at home and in school;
- widespread advertising and promotion;
- low price;
- permissive parenting;
- parental consumption of these beverages; and
- poor knowledge about the health effects, especially among parents.

We selected four policy options for reducing the consumption of sugar-sweetened beverages and their negative health effects.

With regard to the first option, regulation of food advertising, we found:

- Regulating advertising of foods high in fats, sugars and salt is a policy that can be justified as a precautionary measure, which helps to change social norms of dietary behaviour and appropriate nutrition for children.

Box 1. Background to the policy brief

This policy brief is based on both global and local evidence and provides four options for addressing the problem and considerations for implementation. The brief summarizes evidence mainly from systematic reviews of the literature and occasionally from single studies. A systematic review is a summary of studies addressing a clearly formulated question that is based on systematic, explicit methods for identifying, selecting and appraising studies and synthesizing data from the studies that are included. The policy brief advocates recommendations for policy.

The brief was prepared in five steps:

1. A working group was convened comprising representatives from the Ministry of Social Affairs, the National Institute for Health Development and the University of Tartu.
2. The terms of reference for the policy brief were drafted and refined, particularly framing the problem and drafting four viable options for addressing it.
3. Relevant research on the problem, options and implementation considerations were identified, selected, appraised and synthesized.
4. The policy brief was drafted in such a way as to present the evidence concisely and in accessible language.
5. The brief was finalized after input from several reviewers.

The four options for addressing the problem are not mutually exclusive. They could be pursued simultaneously, or elements could be drawn from each to create a new, fifth option.

The aim of the brief is to inform policy dialogue, in which evidence is one of many considerations. Participants' views and experience and the tacit knowledge they bring to the issues at hand are other important inputs. One goal of the policy dialogue is to spark insights that can be expressed only when all those who will be involved in or affected by future decisions about the issue work on it together. A second goal of the policy dialogue is to stimulate action by participants and by reviewers of the dialogue.

- Comprehensive, preferably statutory, restrictions on food advertising are recommended to reduce marketing pressure on children.
- Government-led monitoring of compliance and adequate sanctions for non-compliance are recommended.
- There is limited scientific evidence for the efficacy of media educational measures among parents and children, and there is still little evidence that counter-advertising would be successful against advertising for foods high in fats, sugars and salt.
- The Government should define the media that would be covered by the restrictions, the products that would be controlled and the population groups that would be protected by the restrictions.

With regard to the second policy option, labelling of sugar-sweetened beverages and raising awareness about their health effects, we found:

- Parents have strong responsibility and control over their children's dietary habits in the home environment. Therefore, if diet-changing interventions are conducted only at school, they will have limited success, particularly in the long term.
- Individual, face-to-face or telephone counselling is the most effective way to involve parents in improving their children`s diet, and group interventions are promising for people of low socioeconomic status.
- Long-term parental counselling is the only means that has proven to be effective in changing the dietary habits of their children in the long term.
- Front-of-package labelling as part of nutrient-specific schemes, with text, symbols and colours indicating nutrient levels, allow consumers to select healthier products more easily.

With regard to the third option, school interventions and nutrition policies, we found:

- Interventions with only an educational component and no environmental strategy appear to have little effect in obesity prevention; multicomponent programmes give more favourable results.
- Less intensive, multicomponent interventions repeated for longer are more likely to result in behavioural change, resulting in better anthropometric outcomes.
- Focusing on only one aspect of the food environment, such as vending machines, is likely to be less effective than interventions on multiple aspects of the food environment, such as canteen menus, snack bars and vending machines.
- Interventions that limit the possibility of compensatory behaviour, such as ensuring that the same products are not still available elsewhere, should be a priority.
- Regulation of a single unhealthy food is likely to be less successful than regulation of the whole diet.
- A multidisciplinary approach in schools, in which children's families are involved, may be the best, most sustainable approach for managing childhood obesity.
- Direct methods such as education or workshops on healthy eating, promoting physical activity, counselling and parent involvement, are more likely to be effective than indirect methods such as information leaflets.
- Medium-intensity (4–10 x 1-h sessions delivered over periods ranging from 6 weeks to 12 months) education programmes on beverage choices, delivered by peers, teachers or nutritionists could be effective in reducing consumption of sugar-sweetened beverages by both primary and secondary school-aged children.

With regard to the fourth option, imposing taxes on sugar-sweetened beverages, subsidizing other food groups and/or substituting alternative beverages, we found:

- Food taxes and subsidies can influence consumption.
- Raising the price of sugar-sweetened beverages is associated with lower demand.
- Imposing substantial taxes on energy-dense foods might improve outcomes such as body weight and chronic disease risk.
- The most effective and cost-effective intervention is combining subsidies on healthy foods with taxation of unhealthy foods.
- To maximize the effect, taxes and subsidies should constitute a minimum of 10–15% of the price.

- Combining food taxes with subsidies could alleviate potential regressive effects by enabling consumers to switch to more healthy products without incurring additional costs.
- A tax on sugar-sweetened beverages and other policy changes should be combined with population education about suitable alternative beverages.

In conclusion, we found that the four policy options complement each other and, if implemented in combination, would help to reach the goal of better health outcomes. Comprehensive, multicomponent interventions will reduce the consumption of sugar-sweetened beverages and their negative health effects. Thus, taxes should be accompanied by subsidies for healthy alternatives, educational programmes and labelling. Parents and obese and overweight people should be the targets of these programmes. Education on sugar-sweetened beverages and their effects on health should target risk groups such as overweight people and those of low socioeconomic status.

Box 2. Definitions of sugar-sweetened beverages and preferences

Sugar-sweetened beverages: all non-alcoholic drinks, including sweetened milks or milk alternatives, tea and coffee drinks, energy drinks, sports drinks, sweetened water and juices, non-diet sodas, that contain added sugars, typically high fructose, corn syrup or sucrose, or sugar substitutes (*1*). A sugar-sweetened beverage is identified from its list of ingredients as one that contains corn syrup, high fructose corn syrup, sucrose, brown sugar, glucose, dextrose, honey, invert sugar, molasses, cane sugar or fruit juice concentrates.

Preferences: Beverage preferences and consumption patterns develop in early childhood and can persist (*2*, *3*). Intake of sugar-sweetened beverages stimulates dopamine release, which gives a sense of reward and reinforces consumption (*4*). Once the habit of consuming sugar-sweetened beverages is formed, it may be difficult to break (cited in *5*).

With regard to **barriers to and opportunities for implementation**, we found that, to decrease the negative health impact of sugar-sweetened beverages, policy options should be implemented as part of a wider healthy nutrition strategy or plan. This is an opportune moment in Estonia, at the time of issuance of the Estonian nutrition and physical activity green paper, which is soon to be published.

Another opportunity is the Estonian Government's 2015–2019 programme (*6*), in which the Minister for Health and Labour is requested to conduct an analysis of the effects of potential restrictions on energy drinks for children under 18 years. The Ministry of Finance is leading a working group on sustainable health care financing, which is considering imposing food taxes to increase revenue, especially on sugar-sweetened beverages.

The food industry in Estonia is not ready for restrictions, additional taxes or labelling and is lobbying against the Government's goals. The Government should therefore have a good communication strategy to balance understanding of the problem, policy options and their impact. Advertising restrictions could be imposed step by step in order to make them more acceptable to the industry.

There is currently no nutrient profiling model in Estonia. This will be necessary to restrict advertising of sugar-sweetened beverages or change the labelling. International models, such as the WHO nutrient profile model, could be used or adapted to the Estonian context.

Adding extra functions to primary care practice, such as counselling, would require additional human and financial resources. As Estonia is renewing its primary care centres and increasing the number of personnel, their work-load may decrease, and extra functions could be added.

THE PROBLEM OF SUGAR-SWEETENED BEVERAGES

How the problem came to our attention

The problem came to our attention with the request in the Government 2015–2019 programme to "assess hazardous energy drink sale restrictions for under 18 year olds in schools and kindergartens" (*6*). Accordingly, the Ministry of Health and Labour was asked to study the effect of restricting the availability of energy drinks to children under the age of 18 years.

A meeting of specialists from the ministries of Social Affairs, Finance and Rural Affairs, the Consumer Protection Inspectorate and the Young Social Democrats was held to discuss restrictions on energy drinks on 9 July 2015. The participants agreed that the topic should be widened from energy drinks to sugar-sweetened beverages, because the main reason for including the task in the Government programme was the increasing prevalence of overweight in the Estonian population, especially among children.

The increase in overweight and obesity in Estonia also came to our attention in the National Health Plan performance report (2013–2014) (*7*). Therefore, in 2014, the Ministry of Social Affairs began to prepare a national nutrition and physical activity green paper on possible policy options for tackling the problem.

Extent of the problem

Systematic assessments of beverage intake among adults conducted in 187 countries show that the global intake of sugar-sweetened beverages in 2010 was 0.58 8-oz (230-mL) servings per day and that consumption was highest among young adults (*8*).

According to the 2013–2014 Health Behaviour in School-aged Children study among 11-, 13- and 15-year-old children (*9*), 89.2% of those in Estonia drank sugary soft drinks (not including energy drinks), and 34% drank energy drinks; 56.9% drank sugary soft drinks at least once a week and 13.6% at least five times a week. The daily consumption of sugary soft drinks was 8.1% and that of energy drinks was 1.6%.

In 2013, the Estonian National Institute for Health Development surveyed energy drink consumption among children and young people in grades 1–12 (aged 7–19 years) (*10*). They found that 43% of children in grades 1–6 (aged 7–13 years) had drunk energy drinks at least once, and 2.2% consumed these drinks regularly more than three times a week. In a study conducted by the European Food Safety Authority (*11*), 18% of 3–10-year-old pupils and 68% of adolescents (10–18 years old) in the European Union drank energy drinks. The proportion of children who have not drunk energy drinks in Estonia decreases with age, while consumption at least once a month increases (except among university students). The average quantity drunk by young people who consumed energy drinks at least once a week was 324 mL for 7–13-year-olds, 429 mL for children aged 13–19 years, 536 mL among vocational school students and 413 mL among university students. The main reasons given for consuming energy drinks were the taste of the drink (50.8%), curiosity (10.6%), brand (7.2%) and the caffeine content (6.6%) (*10*).

By comparison, in Poland, 44% of 12–20-year-old students drank one portion (250 mL) per day, 12% drank two portions (500 mL), and 2–3% drank three or four portions daily (*12*).

Provisional data from a population-based food intake survey (*13*) indicate that 10.5% of boys and 6.3% of girls aged 6–9 years and 4.5% of boys and 3% of girls aged 10–17 years drank sugar-sweetened beverages in the past 2 days, with average quantities consumed of 491 g for boys and 352 g for girls. The average daily energy consumption of schoolchildren aged 10–17 years who consumed sugar-sweetened-beverages was 365 kcal and carbohydrates 60 g higher than among children who did not consume them. If the average sugar content of the beverages is 7.6 g per 100 g, boys consumed 37 g and girls consumed 27 g of sugar per day from sugar-sweetened beverages.

The WHO guideline for sugar intake by adults and children strongly recommends that the intake of added sugars should represent < 10% of total energy intake or even < 5% to have a positive impact on health (*14*). The daily maximum amount of sugars is recommended to be two to four portions, which would represent 15–35 g of sugar (*10*, cited in *13*).

The consumption of sugar-sweetened beverages has risen across the globe, accompanied by an increase in the prevalence of overweight and obesity (*15*, *16*). It has been estimated that sugar-sweetened beverages are the single greatest contributor to dietary energy intake (*17*, *18*). The mean intake of added sugar in the USA accounts for 15.8% of total energy, and the main source of added sugar is non-diet soft drinks, which account for 47% of added sugars in the diet (*19*). In a study in eight countries in Europe, adolescents consumed an average of 221 kcal/day from sugar-sweetened beverages (*16*). Another study of European adolescents indicated that sugar-sweetened beverages provide more daily energy than any other beverage (*20*). Among British children aged 4–18 years, energy drinks accounted for 14% of energy intake, sugary drinks accounting for the bulk of that energy; sugar-sweetened beverage intake was particularly high among adolescents (*21*, cited in *22*).

Consequences of the problem

Malik et al. (*23*) concluded from a systematic review of epidemiological and experimental evidence that a greater consumption of sugar-sweetened beverages is associated with weight gain and obesity in children and adolescents. A meta-analysis of cohort studies of children published in 2013 showed that a higher intake of sugar-sweetened beverages was associated with a 55% higher risk of being overweight or obese (*24*, cited in *22*).

A systematic review and meta-analysis in 2013 of studies of the consumption of sugar-sweetened beverages (*25*) showed that it is associated with increased bodyweight in children and adults. One daily serving increment of sugar-sweetened beverages was associated with a 0.05–0.06-unit increase in body mass index (BMI) among children and 0.12–0.22 kg weight gain among adults during 1 year.

One mechanism by which sugar-sweetened beverages lead to weight gain is low satiety with consumption of liquid carbohydrates and the resulting incomplete compensation of energy at subsequent meals (*23*). The association between consumption of these beverages and weight gain is stronger than for any other food or beverage (*26*).

Morenga et al. (*24*) commented that the extent to which population-based advice to reduce sugar intake reduces the risk for obesity cannot be extrapolated from the available evidence. In view of the rapid weight gain that occurs after increased intake of sugars, however, they concluded that advice on sugar intake is a relevant component of a strategy to reduce the risks for overweight and obesity in most countries. Furthermore, the increased consumption of high fructose corn syrup, the sweetener used to flavour sugar-sweetened beverages, has been found to mirror the growth of the obesity epidemic (*27*, *28*). Systematic reviews of the experimental evidence also show that reducing young children's consumption of sugar-sweetened beverages is successful in reducing obesity (*25*, *29*).

Regular consumption of sugar-sweetened beverages is also associated with the development of obesity-related chronic metabolic diseases such as metabolic syndrome and type 2 diabetes (*30–34*). Overweight and obesity are risk factors for several noncommunicable diseases, including cardiovascular disease, type 2 diabetes and certain types of cancer (*35*) and also for sleep apnoea, asthma, breathing problems, complications of pregnancy, menstrual irregularity, hirsutism, stress incontinence and depression (*36*). Consumption of sugar-sweetened beverages and other sugars is also associated with an elevated risk for poor oral health in adolescence, particularly dental erosion and caries, and the relations was found to be cumulative (*37–39*). Consumption is also associated with higher risks for elevated triglycerides (*40*, *41*), cardiovascular disease (*42*), non-alcoholic fatty liver disease (*43*), elevated uric acid (*44*) and gout (*45*).

Studies specifically on sugar-sweetened beverages show that regular intake of energy drinks can lead to loss of bone mass, insomnia, hypertension and, in older age, osteoporosis and cardiovascular disease (*46*). The American Academy of Pediatrics concluded that energy drinks may overstimulate the nervous system and should not be consumed by adolescents (*47*). Consumption of energy drinks by young people has also resulted in cases of seizure, myocardial arrhythmia and even death (*48*, *49*).

Consequences of the problem in Estonia

In Estonia, 52% of people aged 16–64 years and 13.6% of those aged 11, 13 or 15 years were overweight or obese in 2014 (*9, 50*). The numbers are rapidly increasing: in 1992, the number of overweight adults was 42% (*50*). Provisional data from an unpublished population-based food intake survey are even more alarming: 32% of boys and 30% of girls aged 6–9 years, 34% of boys and 35% of girls aged 10–13 years and 21% of boys and 22% of girls aged 14–17 years are overweight or obese.

Estonia has one of the highest prevalence rates of obesity among the European Union member states. According to the European Health Interview Survey in 2008 (*51*), the prevalence was higher only in Hungary and Malta.

The prevalence of overweight has grown even more rapidly among schoolchildren than among adults. According to school health reports collected by the Estonian Health Insurance Fund, 6.5% of schoolchildren were overweight in 2004 and 11.7% in 2015 (*52*).

Most of the diseases associated with drinking sugar-sweetened beverages have rapidly become more prevalent in Estonia:

- Cardiovascular diseases are the main cause of death in Estonia and the main contributors to the burden of disease, accounting for 53% of all deaths in 2014 and 33% of the total burden of disease (*53*). The death rate from cardiovascular diseases has decreased over the years but is still higher than in other European Union member states (*51*, *53*).
- Newly diagnosed cases of obesity and other hyper-alimentation diseases (International Classification of Diseases, revision 10 codes E65–E68) have increased since 2002 in all age groups; in 2014, 535.8 new cases were diagnosed per 100 000 inhabitants, whereas in 2002, the rate was 61.2 (*53*).
- The number of new cases of type 2 diabetes in Estonia has increased rapidly, from 247 cases per 100 000 in 2004 to 414 cases per 100 000 in 2014 (5443 newly diagnosed cases) (*53*).
- According to the study of Health Behaviour among the Estonian Adult Population (*52*), 72.5% of Estonians have at least one missing tooth, and 26% have at least six or more missing teeth. The situation has improved slightly over time, as the proportion of the population with at least six missing teeth was 31.9% in 2000–2002 (*50*).
- The dental health of children in Estonia is not promising. In 1998, the number of decayed, missing and/or filled permanent teeth among 12-year-olds was 2.7, while it was 0.7 in Finland in 2009, 0.6 in Denmark in 2012 and 0.8 in Sweden in 2011 (*54*). In 2014, according to unpublished data from the Estonian Health Insurance Fund, 20.5% of children who went for preventive dental checks had caries (19% in 2013 and 20% in 2012), and the numbers of decayed, missing and/or filled permanent teeth were one in 19%, two in 19%, three in 11% and four or more in 31%.

Factors that influence consumption

Several social and environmental factors are linked to the purchase and consumption of sugar-sweetened beverages. These include advertising and promotion (*55*), television (*56*), increased access in the home and at school (*57–60*), price (*61*), permissive parenting (*62*), consumption by parents (*60*, *63*) and poor knowledge about the health effects of sugar-sweetened beverages, especially among parents (*60*). The main factors that influence consumption by school-aged children are taste, the consumption habits of parents and friends, availability in the home and school and television viewing (*59*).

Marketing

Food marketing to children has been recognized as contributing to the obesity-promoting environment and is considered to be an important area for the prevention of obesity (*64*). Systematic reviews have found that marketing generates positive beliefs about advertised food and influences children's food preferences, purchase requests and consumption (*65*). Psychological research indicates that children, particularly those younger than 8 years, are not fully aware of the persuasive intent of food marketing and tend to accept advertising as truthful, accurate and unbiased (*66*). Older children, although they may understand that advertising is intended to sell a product, may not be able to interpret the messages critically and are still vulnerable to the persuasive intent of the marketing (*66*). Analyses of persuasive marketing techniques indicated that use of promotional characters and premiums in television advertising are concentrated in advertisements for unhealthy food products and during the broadcast periods most used by children (*67*).

A study in the Americas, Asia, Australia and Europe showed that food is the topic of 11–29% of all advertisements (*67*). Thus, if children watch television only 2 h/day (a conservative estimate) and watch during the most popular broadcast periods for children, they are exposed to 56–126 food advertisements per week (median, 70). In various countries, unhealthy food advertisements are found to dominate television advertising to children (*67*). Research in the United Kingdom found that the products most frequently advertised on television were sugary breakfast cereals, confectionery and sugar-sweetened beverages (*68*). As a result, children who watch television more often more frequently consume sugar-sweetened beverages (*60*). Adolescents who watch more than 2 h of television per day also have higher intakes of sugar-sweetened beverages, which they drink while watching television (*69*). A higher intake of sugar-sweetened beverages is also associated with more television viewing among 3-year-olds (*56*).

Food environment and parental influence

Children are more likely to consume sugar-sweetened beverages every day if they are available at school and if there are no school rules about their consumption (*70*).

Children's eating behaviour is also strongly influenced by the family food environment. Factors that have been found to be important are parents' food preferences and beliefs about the healthiness of foods, children's exposure to food and role modelling. It is widely agreed that there is an element of control in parent–child interactions with regard to food, such as restrictions on "unhealthy" food and use of food rewards to encourage non-nutrition-related behaviour (*71*). Children tend to eat the foods their parents eat, as they are expected to and the foods are available in their homes.

A study of environmental influences on obesity-related dietary behaviour in children and adolescents aged 3–18 years found consistent associations between parental influences (such as parental food intake and education) and obesity in the children and adolescents (*72*). Parents' knowledge about health can also affect children (*73*, *74*); thus, poor food habits can be ingrained in young children because their parents do not understand their children's food needs (cited in *5*).

Box 3. Collecting evidence for options to address the problem

Evidence for options to address the problem was sought primarily from five databases: PDQ-Evidence, Health Systems Evidence, Health Evidence, the Cochrane Library and PubMed. Articles were identified by searching each database for systematic reviews with topic-related keywords in the title and abstract. The keywords included "sugar-sweetened beverages", "sugary drinks", "obesity", "overweight", "food", "nutrition", "children", "labelling", "schools", "tax", "subsidy", "advertisement", "marketing", "regulation", "banning", "counselling" and "education". Although some of the reviews did not specifically address sugar-sweetened beverages (but rather a reduction in salt consumption, for example), they were not initially excluded.

Price of sugar-sweetened beverages

Consumption of sugar-sweetened beverages is associated with price; thus, higher prices result in less demand, and the greater the price increase, the greater the reduction in consumption (*61*).

Currently, financial incentives favour the consumption of highly processed, energy-dense foods, which are considerably cheaper, in terms of energy content for the

price, than less energy-dense and often more nutrient-rich foods (*75*, *76*, cited in *77*).

The price of sugar-sweetened beverages remains important to the majority of consumers in Estonia (*78*). In Poland also, adolescents give the main reason for consuming energy drinks as the price rather than taste or effect (*12*). The price effect would be anticipated to be greater among the young because they are less likely to have developed lasting preferences and may be more price sensitive (*79, 80, 81*). Evidence from real world taxes implemented on tobacco supports this by showing that price increases are likely to have a larger effect on young people and the primary influence of tobacco taxation is on smoking initiation, as well as affecting escalation and cessation among young people (*82*).Equity-related observations

Sugar-sweetened beverages tend to be consumed by younger children and by adults in lower-income households (*83*, *84*). Thus, according to the 2013–2014 Health Behaviour in School-aged Children study (*9*), the proportion of overweight and obese schoolchildren was higher among those with a low socioeconomic background (17%) than a high economic background (11%).

Other studies have also found that individuals with lower incomes consume more sugar-sweetened beverages. When they consume less of these beverages, they may progressively become healthier and narrow any inequality (*5*).

The key findings were extracted from each identified review, and each review was also assessed for quality (Health Evidence score or AMSTAR rating), local applicability (proportion of studies conducted in Europe), equity (proportion of studies explicitly on prioritized groups) and the degree of focus on the issue. The overall evidence for the options was then summarized and relevant caveats introduced on the basis of the assessments of quality, local applicability, equity and issue.

We considered 53 systematic reviews. After analysing the content, 33 reviews were selected. After exclusion of 12 classified as "weak" in Health Evidence or with an AMSTAR score ≤ 4 and three classified as unacceptable, 18 systematic reviews were included.

An additional search was done for systematic reviews on the option "Food advertising restrictions and measures to raise advertising literacy". Of two reviews identified, one was included.

FOUR OPTIONS FOR ADDRESSING THE PROBLEM

Many measures could be selected to address the problem. To promote discussion about potentially viable options, four were selected for more detailed review: (i) regulation of food advertising; (ii) labelling of sugar-sweetened beverages and raising awareness about their health effects; (iii) school interventions and nutrition policies and (iv) imposing taxes on sugar-sweetened beverages, subsidizing other food groups and/or substituting alternative beverages. These policy options were selected because they address a number of factors that influence the consumption of sugar-sweetened beverages.

This section describes what is known about these options. The next section addresses the barriers to adopting and implementing these options and possible opportunities for overcoming the barriers.

Option 1. Regulation of food advertising

Overview and context

This option consists of restricting advertising of food and beverages through statutory regulations, industry self-regulation and industry self-regulation with Government oversight to influence eating habits and to reduce the intake of sugary products, especially among children. Food promotion includes activities beyond traditional advertising, such as event sponsorship, product placement, viral marketing and use of social media. There is growing evidence of a relation between food advertising and increased intake of calorie-dense products by adult populations (*85*). We also included studies on educational approaches to advertising.

Children are exposed to advertising in a variety of media and settings, including television, radio, the Internet, SMS messaging, billboards and in schools and shops. Targeting advertising to young children is a controversial practice, because they do not have the maturity to recognize the purpose of advertising or to assess advertising claims (66, 86, cited in 87). The necessary cognitive skills for evaluating advertising more critically start to develop around the age of 12 years, however there have been less studies looking at the effects of food marketing on this age group (*88*, cited in *87*).

A high prevalence of dental caries and increases in overweight have sharpened the focus at national and supranational levels on the relation with advertising of sugar-sweetened beverages. Extensive literature reviews have revealed an association between exposure to advertising of foods high in fats, sugars and salt, a poor diet and obesity (*66*, *89*, *90*, cited in *87*).

Results of the literature review

We found four systematic reviews, of which we included two. An additional search resulted in the addition of a further systematic review. None of the reviews focused on sugar-sweetened beverages.

Statutory regulation

A number of regions and countries have banned advertising to children under 12 or 13 years by statutory regulation (i.e. Quebec, Norway and Sweden). Advertising of foods high in fats, sugars and salt during children's television programming is prohibited in the United Kingdom (*91*, *92*) and Ireland, and the USA limits advertising to children more generally, mainly with regard to the length of advertisements and misleading claims, rather than content. Most regulations are enacted in high-income countries (*91*). Seven of the nine studies included by Chambers et al. (*87*) supported use of statutory action, although the authors reached no conclusion on use of statutory actions. Statutory regulation is found to be effective in terms of reducing marketing according to the scope and criteria of the policy (i.e. the UK restrictions effectively limited advertising of HFSS foods during TV broadcasts "aimed at" children, according to their policy definition). However, they could be more effective if the scope were expanded to cover programming that has high proportions of children in the audience, even if the programmes do not target children specifically (*93*).

Self-regulation

The food industry and industry bodies have responded to criticism about their advertising practices by preparing guidelines for reducing the volume of and limiting children's exposure to advertising for foods high in fats, sugars and salt. The Framework for Responsible Food and Beverage Communications of the International Chamber of Commerce includes recommendations on the promotion of healthy diets and lifestyles, makes clear delineations between advertising and programming, and prohibits manipulation of children's naivety (*91*). The Confederation of the Food and Drink Industries of the European Union has made similar recommendations (*91*). The International Food and Beverage Alliance has made a commitment to advertise only healthier products to children under 12 years, stop advertising unhealthy foods to children under the age of 12 years completely and limit advertising in schools (*94*). In Europe, companies that have signed the "EU Pledge" have made similar commitments (*95*, cited in *87*).

We found one systematic review of studies in 21 countries or regions in which survey data obtained shortly before introduction of the self-regulatory pledges were compared with data obtained afterwards (*93*). Exposure to advertising appeared to be similar before and after regulation, indicating that the "pledges" have had only a small or no impact in these countries. Galbraith-Emami and Lobstein found that this was due to their weaker criteria and narrow scope when compared with statutory restrictions.

Unless pledges for self-regulation are subject to stronger government oversight, they are unlikely to be sufficiently comprehensive to have the desired effect (*93*). When studies of the results of self-regulatory action were evaluated according to whether they were conducted by the food industry or by academics, government or advocacy organizations, the industry-sponsored studies were found to claim very strong evidence of reduced exposure, even in countries or regions in which other reports or surveys found that this was not the case (*93*). Potential causes of the discrepancy between industry-sponsored reports and others may lie in differences in the definitions of audience and nutrient profiling.

Educational approaches

Bergsma et al. (*96*) found that media interventions to improve literacy can improve health outcomes, particularly in relation to alcohol use and eating disorders. Less is known about the impact of advertising literacy on healthier diets. The American Psychological Association argued cautiously that the curriculum in grades 3–12 (8–18 years) should include advertising literacy, although they emphasized that there is limited evidence that media literacy reduces the negative impact of advertising to children (*86*, cited in *87*).

The main findings of the systematic reviews relevant to option 1 are presented in Table 1. Fuller descriptions of the systematic reviews (including citations) are provided in Annex 2.

Table 1. Main findings of the systematic reviews relevant to option 1, regulation of food advertising

Category	Main findings
Benefits	• Statutory regulations could reduce the volume of and children's exposure to advertising (*87*, *93*) and the purchase of foods high in fats, sugars and salt; seven of nine studies supported the use of statutory regulations (*87*). • The benefits of regulations might become apparent later than was observed in the studies. Modelling studies indicated that results would be seen after 40–50 years (*87*).
Potential harm	• None of the systematic reviews provided information about the potential harm of regulating food advertising.
Resource use, costs and/or cost-effectiveness	• None of the systematic reviews provided information about resource use, costs and/or cost-effectiveness.

Category	Main findings
Uncertainty about benefits and potential harm (Monitoring and evaluation might be warranted if the option were pursued.)	• No clear message from studies included in the systematic reviews about: o the effects of food advertising on food-related behaviour, attitudes and beliefs in adult populations (*85*) or o the effect of self-regulation, as the results are controversial (*87*).
Key elements of the policy option if it were tested elsewhere	• The option and its outcomes should be monitored and evaluated. Useful standardized outcomes could include consumption behaviour, health outcomes, exposure to advertising, expenditure on advertising and valid nutrient criteria (*87*). • Comprehensive, preferably statutory measures are recommended, with adequate monitoring of compliance and adequate sanctions for non-compliance, based on government-approved definitions of the media to be covered, the products to be controlled and the audience to be protected (*93*). • Statutory regulations might reduce children's exposure significantly but are currently insufficient to cover the full range of marketing to children (*93*). • The emergence of new media channels with direct access to children raises further concern about the nature of the regulations that would be required to control the exposure of children to unhealthy food marketing. It is recognized that company-owned websites should be included in pledges, but there is less recognition of the use of social networking and media sites, smart-phone apps, downloadable advert-games, cross-branding of healthier food and beverage products with non-food products identified with unhealthy food-related brands, or marketing in schools and other child-friendly settings (*93*).
Stakeholders' views and experiences	• The results of studies funded by industry and those funded by national research organizations, government and advocacy groups differed widely. The studies funded by industry found that the initiatives were successful (*87*).

Suggestions

On the basis of the systematic reviews, the main recommendations for implementation of option 1 are:

- Introduce comprehensive, preferably statutory, measures to restrict advertising to children at least under the age of 12 years and even up to the age of 16 years.
- Ensure Government monitoring of compliance and sanctions for non-compliance with advertising restrictions.
- The Government should identify the media that will be targeted by advertising restrictions, the products that will be controlled and the audience to be protected by the restrictions.

Option 2. Labelling of sugar-sweetened beverages and raising awareness about their health effects

Overview and context

This policy option should be implemented in combination with measures (such as educational programmes) to raise awareness about front-of-package labelling and policies to support changes to the food environment.

Results of the literature review

We found no systematic reviews of counselling and educational programmes specifically to decrease the consumption of sugar-sweetened beverages. We found four reviews on changing children's dietary habits with their parents' help, in which decreasing the consumption of sugar-sweetened beverages and sugar was part of the change. Only two of these were used, because the other two (*97*, *98*) were considered unreliable on the basis of their AMSTAR rating or were not locally applicable.

We found no systematic reviews specifically on labelling of sugar-sweetened beverages, although two (*99*, *100*) addressed the benefits of labelling food and beverages. We included only one of these two systematic reviews in this evidence brief for policy, as the other was considered unreliable on the basis of its AMSTAR rating.

Counselling and educational programmes

Efforts to prevent childhood obesity have tended to concentrate on schools and have had limited success, particularly in the long-term (*101*). Although research on the prevention of childhood obesity has shown that the home is important, it also found that parents are difficult to engage (*102*).

Interventions targeting the parents of preschool-aged children are more effective than those for parents of older children, and individual counselling (face-to-face or by telephone) is the most effective way to involve parents in improving their children's diet; sending health information newsletters to parents at home is the least effective (*103*). Group interventions are promising for people of low socioeconomic status; however, parents in low–income settings may experience logistical barriers, such as unstable schedules, lack of transport and lack of child-care, and personal barriers, such as mistrust of providers and fear of stigmatization (*103*).

Prevention should include behaviour change techniques to enhance initial effectiveness and ensure long-term sustainability. Most interventions include behavioural or ecological (environmental) models of behaviour change; use of change theory in a child development framework is a promising development (*104*).

Few studies reported follow-up longer than 6 months. Only one Finnish study (*105*) assessed the effect of counselling beyond 6 months, and the authors concluded that long-term parental counselling is the only practice that has proven to be effective in changing dietary habits in the long term. Individualized counselling was used, every 1–3 months until the child reached 2 years of age, twice a year until the child reached 7 years of age and once a year thereafter until the child reached 20 years of age. The objective was to reduce the intake of total fat, saturated fat and cholesterol and to encourage intake of vegetables, fruits, berries and whole-grain products. Sugar-sweetened beverages and sugar intake were not the focus of the study (cited in *103*).

Labelling

A systematic review of studies on the impact of front-of-package labelling on consumption (*99*) suggested that consumers identify healthier foods more easily from nutrient-specific schemes such as nutrient-specific daily guideline amount labelling combined with traffic light than from summary systems in which an algorithm provides an overall nutritional score, such as the Choices Programme (www.choicesprogramme.org) logo, the Keyhole symbol (www.livsmedelsverket.se/en/food-and-content/labelling/nyckelhalet) and the Guiding Stars system (guidingstars.com). Particular features of front-of-package labels, such as text and colour that indicate nutrient levels, allow consumers to select healthier products more easily. Consumers find it more difficult to understand labels that display only numerical information such as "guideline daily amounts" in percentages or grams. For the largest public health impact, education about front-of-package labelling should target consumers of low socioeconomic status and with high BMIs rather than consumers who are aware of nutrition. The conclusion of the review was that more studies should be conducted of consumers in actual shopping situations to characterize more accurately how front-of-package labelling systems affect consumer purchase decisions and dietary intake, but that interpretative, easy-to-use labelling systems are likely to be most effective.

The main findings of the systematic reviews relevant to option 2 are presented in Table 2. Fuller descriptions of the systematic reviews (including citations) are provided in Annex 3.

Table 2. Main findings of systematic reviews relevant to option 2, labelling of sugar-sweetened beverages and raising awareness about their health effects

Category	Main findings
Benefits	• Educational programmes and counselling: o Home visits to 100 households by health counsellors decreased consumption of sugar-sweetened beverages from < 0.3 to < 0.1 servings/day ($P = 0.02$) and increased consumption of water from < 0.1 to 0.3 servings/day ($P < 0.04$) (*106*, cited in *99*). • Labelling of sugar-sweetened beverages: o Front-of-package nutrient-specific schemes with text and colours indicating "high", "medium" and "low" levels of nutrients, allow consumers to select healthier products more easily (*99*).
Potential harm	• Front-of-package labelling: o Few studies provide evidence of the likelihood or existence of effects of substitution, i.e. whether and how many consumers over-consume products with health symbols on the packaging because they perceive them as healthy.
Resource use, costs and/or cost-effectiveness	• Educational programmes and counselling: o The cost and cost-effectiveness of counselling and educational programmes are difficult to estimate, as there are many forms, including counselling in clinics, during home visits and by telephone. • Labelling of sugar-sweetened beverages: o Costs and cost-effectiveness have not been described. o More people with higher education than low education are willing to pay more for lower levels of negative nutrients, as indicated by a colour-coded "traffic light" system, usually displaying the ranking (e.g. high, medium or low) of nutrients (*107*, cited in *99*).
Uncertainty about benefits and potential harm (Monitoring and evaluation might be warranted if the option were pursued.)	• Educational programmes and counselling: o We found no systematic reviews specifically on decreasing consumption of sugar-sweetened beverages. We therefore used reviews of initiatives to change dietary habits, including consumption of sugar-sweetened beverages and/or sugar. • Labelling of sugar-sweetened beverages: o More research is required on the influence of front-of-package labelling on the actual purchasing and dietary habits of consumers. Many of the studies in the review were based on hypothetical purchasing patterns. Regulations, purchasing culture and the frequency of consumer educational campaigns are likely to differ in the countries and regions in which the studies were conducted (*99*).

Category	Main findings
Key elements of the policy option if it were tested elsewhere	• Educational programmes and counselling: o *England*: Home visits were made for 8 weeks to discuss healthy feeding habits. A booklet was provided on the concept of parental habit formation, which is a novel approach to modifying parents' feeding habits, based on "context-dependent repetition" to promote automatic responses and to reduce decision conflict. The consumption of sugar-sweetened beverages decreased (*108*). o *Canada*: Health counsellors made regular home visits to families to set dietary and physical activity goals. Interventions were based on social cognitive theory (the unique way in which individuals acquire and maintain behaviour in the context of their social environment and their previous experience, which influences reinforcement, expectation and expectancies). The consumption of sugar-sweetened beverages decreased, and water consumption increased (*106*). o *France*: Monthly telephone counselling (8 × 30 min) and Internet monitoring of whether consumption of dietary fat, sugar and increasingly complex carbohydrates was reduced, without behavioural theory, resulted in a decreased intake of sugar (*109*). • Front-of-package labelling: o Labels that are large and positioned in a consistent location on food packages capture attention more quickly than smaller ones positioned elsewhere (*110*, cited in *99*). o A study in Greece (*111*) found that consumers generally more often chose products on which the label displayed grams only or a "traffic light" system (colour coded, usually displaying ranking of nutrients) and text rather than labels that displayed percentages or grams of a "guideline daily amount" (cited in *99*). o In a study in United Kingdom, people asked to choose one of three hypothetical baskets of goods that differed in terms of price and nutrient content as indicated by labels that displayed a "traffic light" system for salt, sugar, fat and saturated fat strongly preferred avoiding the basket with a label that displayed more "red lights" (*107* cited in *99*).
Stakeholders' views and experiences	• Labelling of sugar-sweetened beverages: o The United Kingdom Food Standard Agency made recommendation for a colour labelling scheme and urged food manufacturers and retailers to use it voluntarily; however, a consortium of food companies disagreed with the Agency's recommendation and continued using "guideline daily amounts" or other front-of-package labels (*112* cited in *99*). o Some groups of consumers are less likely to consult front-of-package labels than others, including people who are less nutrition conscious, those of low socioeconomic status, those with a higher BMI and those who have children living in the household (*113*, *114*, cited in *99*).

Suggestions

On the basis of the systematic reviews, the main recommendations for implementation of option 2 are:

- Apply front-of-package, nutrient-specific schemes with text and colour.
- Provide education and specific communication about fronts of packages.
- Link behaviour change techniques with behaviour change theory to maximize the effectiveness of interventions.
- Use behaviour change theory within the child development framework.
- Target parental support interventions to parents of preschool-aged children.
- Provide individual counselling (face-to-face or by telephone).
- Use group approaches for people of low socioeconomic status.
- Provide long-term individual counselling (as in the Finnish study (*105*)).

Option 3. School interventions and nutrition policies

Overview and context

This option focuses on the school environment as the ideal setting for preventive obesity interventions by influencing nutrition and physical activity behaviour. The aim of interventions at school can be to influence knowledge and attitudes, to address the availability of food and beverages during meals and on the school premises or to improve facilities and ensure qualified staff and teachers.

Results of the literature review

We found 15 systematic reviews but included only 8, as the others were considered unreliable on the basis of their AMSTAR or Health Evidence rating, or they were not applicable to Estonia.

Multicomponent policies

The main finding of a systematic review of studies in Europe was that multicomponent programmes – promoting both physical activity and healthy eating – have more favourable results than purely educational interventions (115). This finding was supported by two other systematic reviews (116, 117), which showed that a multidimensional intervention is the most effective in schools. Verstraeten et al. (117) noted that multidimensional interventions achieve the best results when parents are actively involved and concluded that direct methods (e.g. education or workshops on healthy eating) that involve parents are more likely to be effective than indirect methods such as information leaflets. Kelishadi et al. (116) reported that the effect of any intervention is maintained for several years.

Nutrition education

A systematic review of studies of the effectiveness of nutrition education interventions in school concluded that they are effective in reducing the BMI of children and adolescents, especially if they last longer than one school year (*118*). Another review confirmed the effectiveness of school nutrition pricing policies in improving children's diets and reducing obesity, but did not confirm the usefulness of regulating the availability of food and beverages (*119*). The review also described the complexity of designing and evaluating school nutrition policies for reducing obesity and improving diets and concluded that interventions should be long, intense and sustainable to provide constant opportunities for long-term evaluation. It remains unclear whether specific interventions or those that include many aspects of diet and physical activity are the most successful. In order to inform policies and translate research into action more effectively, school interventions should be broader and include process evaluations before and after studies. Longer follow-up is required for impact evaluation; in most studies, follow-up was short.

Another systematic review found that school education programmes for reducing the consumption of sugar-sweetened beverages can be effective if they are sustainable (*22*).

School environment changes

A systematic review of studies on the effects of isolated interventions in the food environment indicated that modifying the school food environment, including high-level policy changes at state or national level, can alter eating behaviour, even without simultaneous education or promotion. Environmental interventions are often relatively simple to implement (*120*).

A systematic review of studies of the use of school nutrition policies and price interventions to reduce the consumption of sugar-sweetened beverages among young people concluded that they are associated with a reduced energy intake, which can reduce BMI (*121*).

The main findings of the systematic reviews relevant to option 3 are presented in Table 3. Fuller descriptions of the systematic reviews (including citations) are provided in Annex 4.

Table 3. Main findings of systematic reviews relevant to option 3, school interventions and nutrition policies

Category	Main findings
Benefits	○ Policies to limit the availability of sugar-sweetened beverages and offer healthier food in schools have generally been associated with reduced consumption of these beverages. Policies to restrict access in school can reduce the percentage of students who consume the beverages by 25% (*122*) and the energy consumed by the students by 30% (*123*). Restricting the availability of sugar-sweetened beverages in vending machines and snack bars appears to be particularly effective. Whereas an experimental study found a stronger effect among young people with a high BMI, no such difference was seen in cross-sectional studies (*124*, cited in *121*). ○ Cullen et al. (*125*) reported the effects of a policy to remove chips, sweets, sweetened beverages and desserts from snack bars. According to self-reported food frequency questionnaires, less soft drinks and more milk were consumed at school, and consumption of chips and sweets in the national school lunch programme decreased (cited in *120*). ○ Cullen et al. (*126*, cited in *121*) showed that a policy to limit the portion size (≤ 350 mL) and the accessibility of vending machines decreased overall consumption of sugar-sweetened beverages, although it had little effect on consumption at home. ○ A nutrition education programme of medium intensity (4–10 1-h sessions over a period ranging from 6 weeks to 12 months) on beverage choices, delivered by peers, teachers or nutritionists could be effective in reducing the consumption of sugary drinks of primary and secondary school-aged children (*22*). ○ Computer or web nutrition education at school and at home may be effective for reducing children's consumption of sugar-sweetened beverages (*22*). ○ For the prevention and control of childhood obesity, experts recommend specific counselling on eating and physical activity. Researchers have studied clinic-based interventions and family, community, school and after-school programmes (*116*). ○ Interventions at school are considered feasible and effective because children spend a considerable part of their time at school, and teachers and peers can be engaged in such programmes. The programmes address a large target group, and pupils may adopt some aspects of their lifestyle from structured programmes on nutrition, changed dietary habits and increased physical activity. Studies that have not included an effect of interventions on anthropometric measures still show positive effects on eating and activity (*116*). ○ de Ruyter et al. (*127*) conducted a high-quality randomized clinical trial, in which they masked sugar-sweetened beverages and replaced them with non-energy drinks in a primary school for 18 months. They found strong evidence that the reduced consumption of sugar-sweetened beverages decreases weight gain and obesity among children (cited in *22*). • Multicomponent interventions ○ Studies by Haerens et al. (*128–131*) and Singh et al. (132, *133*) provide moderate evidence that multicomponent interventions to improve diets and physical activity, combining an educational and an environmental component, had a positive effect on obesity measures in adolescent girls in Europe. An online programme was used to give individual feedback on activity and nutrition. The environmental component included changes in the school canteens, reduced price and increased availability of water and fruit and increased price and reduced availability of soft drinks and sweet desserts (cited in *115*).

Category	Main findings
	• Gender difference: o Interventions had greater effects on BMI and other obesity measures in girls than in boys (*115*). • Dietary intervention only: o Gaglianone et al. (*134*) and Sichieri et al. (*135*) reported positive effects on preferences for healthy food after 22 h of nutrition education given in 30-min sessions three times a week for 6 weeks. A decrease in daily consumption of sweetened carbonated drinks was found after research assistants led 10 1-h sessions on water intake, with classroom quizzes, games and song and drawing competitions; water bottles and banners promoting water consumption were distributed (cited in *117*). • Influence of teachers and families: o Hingle et al. (*136*, cited in 117) reported that direct methods such as education and workshops on healthy eating that involve parents are more likely to be effective than indirect methods such as information leaflets. o The effects of a policy may change over time. Christakis et al. (*137*, cited in *121*) reported that the likelihood of being overweight depends not only on parents but also on peers, suggesting that the effects of a policy may be amplified as its effects spread through social networks.
Potential harm	o School interventions on dietary habits or anthropometric measures can result in discrimination and stigmatization, which may either lead children to adopt a healthier lifestyle or have the opposite effect (*116*). o In the three schools studied by Cullen et al. (*125*, cited in *119*), the policy to remove chips, sweets, sweetened beverages and desserts from snack bars had the unintended negative consequence that pupils compensated for the lack of the "banned" foods by buying more ice cream. o Quann et al. (*138*, cited in *120*) showed that a state policy to reduce the availability of flavoured milk reduced consumption; however, the benefits of reducing added sugars was offset by a reduction in important nutrients such as calcium, potassium and vitamin D. o The school programme studied by Sichieri et al. (*135*), encouraging consumption of water rather than sugar-sweetened beverages, resulted in a significant 23% decrease in the mean daily intake of carbonated drinks; however, the consumption of fruit juices increased. The authors concluded that efforts to reduce energy consumption from liquids should comprise all sugar-sweetened beverages including juices (cited in *22*).
Resource use, costs and/or cost-effectiveness	o A multicomponent study by Rito et al. (*139*, cited in *22*) combined activities in health centres, families and schools for overweight and obese primary school children of low socioeconomic status. The cost was estimated to be €373 per child. • School educational programmes combined with environmental change: o The cost associated with the environmental changes in the intervention by Muckelbauer et al. (*140*, cited in *22*) among primary school-aged children in socially deprived areas of two German cities was estimated to be €2500 per water fountain, and the annual cost per child was €13. There was no added cost for the educational component, as the intervention was delivered by teachers. • School food environment: o Wordell et al. (*141*) reported that intervention schools in a comprehensive food environment intervention spent 49% more on produce per student than control schools and lost on average US$ 16 500 (€14 600) a year due to reduced sales of competitive school meals and vending machine purchases. French et al. (*142*, cited in *120*), however, found that increasing the availability of healthy foods in vending machines, and even discounting their price, was both effective and cost-effective, with no impact on overall sales per machine.

Category	Main findings
Uncertainty about benefits and potential harm (Monitoring and evaluation might be warranted if the option were pursued.)	• No studies were identified o No studies were found that directly addressed school price policies for sugar-sweetened beverages; however, reducing the price of lower-fat snacks, fruit and vegetables in school resulted in increased sales (*143*), suggesting that students might also be sensitive to price differentials for sugar-sweetened beverages (cited in *121*). o No studies were identified in which the price of unhealthy foods sold in vending machines or other school locations was increased as a nutrition policy. Most studies addressed subsidizing healthy foods, and there is a lack of published research about taxation of unhealthy foods or interventions to increase the price of unhealthy foods in schools (*119*). o The effects of policies may depend on previous exposure. For example, the effects of a middle-school programme may depend on whether the child has been exposed to similar programmes in elementary school, which might have already affected their consumption habits and knowledge about nutrition (*121*). • No clear message from studies o Evidence for the effectiveness of regulating the availability of food and beverages was limited, as few studies met the inclusion criteria. Two studies (*125*, *144*) suggested a significant but limited decrease in the sales of foods of minimal nutritional value after implementation of a policy limiting access to vending machines and control of the portion size of sweetened drinks in school (cited in *119*).
Key elements of the policy option if it were tested elsewhere	o The duration of nutrition education is more relevant than the intervention itself in achieving an effect (*145*), and a less intensive multicomponent intervention repeated for longer is more likely to result in behavioural changes and thus better anthropometric outcomes (cited in *118*). o Concentrating on only one aspect of the food environment, such as vending machines, was less likely to be effective than interventions on multiple aspects of the food environment (e.g. canteen menus, snack bars, vending machines) (*119*). o Most reports did not include the results of a process evaluation, e.g. implementation fidelity, which might allow more accurate interpretation of results. Process evaluation can more broadly conceptualize "evidence of effectiveness" for evaluation of health promotion programmes (*115*). o Any intervention to reduce energy consumption from liquids should address all sugar-sweetened beverages, including juices with added sugar (cited in *22*).
Stakeholders' views and experiences	• No reviews provided information about stakeholders' views or experiences.

Suggestions

On the basis of the systematic reviews, the main recommendations for implementation of option 3 are:

- Introduce policies to regulate sugar-sweetened beverages as part of the whole diet.
- Use educational interventions with an environmental strategy to reduce obesity.
- Implement less intensive, multicomponent, multidisciplinary interventions with the involvement of children's families and repeat them for longer (at least 6 weeks); the key is their duration.
- Apply food environment policies on multiple aspects, such as canteen menus, snack bars and vending machines.
- Implement food environment interventions that limit the possibility for compensatory behaviour; when the sale of sugar-sweetened beverages in banned in school cafeterias, purchases of other products (ice-cream) might increase.

- Apply policies to limit the availability of sugar-sweetened beverages and offer healthier foods in schools.
- Use direct intervention methods, such as education or workshops on healthy eating, counselling and parent involvement, rather than indirect methods such as information leaflets.

Option 4. Imposing taxes on sugar-sweetened beverages, subsidizing other food groups and/or substituting alternative beverages

Overview and context

Current financial incentives favour the consumption of highly processed, energy-dense foods: they are consistently cheaper, in terms of energy content for price, than less energy-dense and often more nutrient-rich foods (*75*, *76*). Taxing or increasing the price of less healthy foods could act as a financial incentive for consumers to avoid them. This evidence and the link between obesity, other health problems and consumption of sugar-sweetened beverages should be sufficient for policy-makers to consider taxing these beverages as part of an intervention to reduce the health and economic burden due to obesity (*61*). The poor health outcomes associated with the consumption of energy-dense foods (*76*, *146*) might justify levying taxes on them to pay for health care and to decrease consumption and the negative health effects; such measures have proven to be effective for tobacco control (*77*). The high price of healthy foods is a formidable barrier for many people, especially those of low socioeconomic status (*147*). Food subsidy programmes have been an element of food pricing strategies in the United Kingdom and the USA for many years (*148*). This option therefore also includes food subsidy programmes as a strategy for promoting healthy nutrition and reducing socioeconomic inequalities in health.

Results of the literature review

We found eight systematic reviews of studies on taxation of unhealthy foods, subsidizing other products and substitution of sugar-sweetened beverages with alternative beverages. Only two of the reviews addressed sugar-sweetened beverages specifically (*61*, *149*). The other six covered several products, including sugar-sweetened beverages. We included five of the systematic reviews in this evidence brief and excluded three as they were considered unreliable on the basis of their AMSTAR or Health Evidence rating.

Taxes and subsidies

All four systematic reviews on taxes on unhealthy foods or subsidies for healthy foods showed that these measures influence consumption and may reduce body weight (*61*, *77*, *150*, *151*). Two of the reviews pointed out, however, that there is inadequate evidence to inform policy-making (*77*, *150*).

One review (*77*) suggested that food taxes (including on sugar-sweetened beverages) and subsidies on healthier products can influence consumption. The authors concluded that imposing substantial taxes on energy-dense foods might reduce body weight and the risk for chronic disease. They found that there is uncertainty in the evidence base, that can only be resolved through real-world case studies from countries that have implemented such measures : (1) the findings are limited by a high proportion of modelling studies based on assumptions and subject to data limitations; (2) many of these studies addressed only target food consumption and overlooked shifts in consumption within or across food categories; and (3) no experimental studies were available, probably reflecting the difficulty of designing studies of population interventions. For example, Fletcher et al. (*152*), Oaks (*153*), Fantuzzi (*154*) and Kim et al. (*146*) reported little or no effect of taxes on sugar-sweetened beverages or subsidies on BMI or health outcomes. In contrast, Bahl et al. (*155*) Gabe (*156*), Gustavsen (*157*) and Asfaw (*158*) found effects on BMI and health outcomes (cited in *77*).

Another systematic review (*61*) concluded that application of higher prices for sugar-sweetened beverages increased the demand for other beverages, such as fruit juice and milk, and reduced demand for diet drinks. Six studies included in a systematic review in the USA also showed that higher price could result in decreases in BMI, overweight and obesity. The evidence from Brazil and Mexico is consistent with that from high-income countries (*61*).

A further review (*151*) proposed that an added benefit of taxation is the revenue generated, which could be used to fund and better target noncommunicable disease prevention interventions, thereby ultimately reducing their burden on society and the associated medical costs. For example, in the USA, the revenue from soft drinks is approximately US$ 70 billion per year; therefore, a modest tax would generate billions of dollars in revenue. The authors also found that any subsidy or tax should represent a minimum of 10–15% of the price in order to maximize its effectiveness. Price elasticity studies indicate that a 10% tax on sugar-sweetened beverages would reduce consumption by 8–12% (*159*, *81*). An estimated 80% of tax and subsidy interventions are either cost-saving or cost-effective, and population-based subsidies combined with taxes are likely to be the most effective and cost-effective (cited in *151*).

Subsidies

A systematic review of studies on subsidizing healthy foods found that this intervention significantly increases the purchase and consumption of promoted products (*150*). The review also concluded that policy-makers are not well informed about the potential for wide scale subsidization of healthier foods, as none of the reviewed studies reported the cost–effectiveness of the intervention or evaluated their potential impact on the food industry. The review confirmed the finding of previous reviews of studies on the effectiveness of economic incentives in modifying health behaviour. Kane et al. (*160*) conducted a meta-analysis and concluded that economic incentives improve consumers' preventive health behaviour an average of 73% of the time. Wall et al. (*161*) reported a positive effect of monetary incentives on food purchases, food consumption and weight loss, and Thow et al. (*77*) concluded that a substantial subsidy or tax on food was likely to influence consumption and improve health Jensen et al. (*162*, cited in *150*) found that price incentives were effective in altering children's food and beverage intake at school.

Ruopeng (*150*) also concluded that, although subsidizing healthier foods is effective in modifying dietary behaviour, the evidence is compromised by various study limitations, including use of small convenience samples, which limited the generalizability of the results; the absence of overall diet assessment, which compromises the effectiveness of reducing total caloric intake; short interventions and follow-up, obviating assessment of long-term impact; and lack of cost–effectiveness analyses, which precludes comparison of competing policies.

Substitution of sugar-sweetened beverages with alternative beverages

A systematic review on substitution of sugar-sweetened beverages with water or low-calorie beverages (*149*) found that the few studies on this topic indicate potential beneficial effects on body weight. The effect in healthy adults per 4-year period ranged from 0.5 kg less weight gain (*163*) to a weight loss of 2–3 kg over 6 months to 1 year among overweight and obese subjects (*164*, *165*). Weight stabilization, which, in a context of generally rising weight over time, can be regarded as a positive health outcome, and even relatively small weight losses can improve health and well-being at the population level (*166*, cited in *149*).

The same review found inadequate evidence that substitution of sugar-sweetened beverages also affects other health outcomes, including type 2 diabetes, stroke and cardio-metabolic risk factors, although the initial results are promising. Further studies are required to fully understand the long-term effects, such as on other health outcomes. The optimal alternative to sugar-sweetened beverages has not yet been determined and may depend on the age group or disease outcome. It is important to use age-appropriate substitution strategies for reducing sugar-sweetened beverage consumption in order to achieve the anticipated effects on long-term health outcomes (*149*).

The main findings of the systematic reviews relevant to option 4 are presented in Table 4. Fuller descriptions of the systematic reviews (including citations) are provided in Annex 5.

Table 4. Main findings from systematic reviews relevant to option 4, imposing taxes on sugar-sweetened beverages, subsidizing other food groups and/or substituting alternative beverages

Category	Main findings
Benefits	• Taxes and subsidies: o Higher prices are associated with less demand for sugar-sweetened beverages (*61*). o Higher prices of sugar-sweetened beverages may result in modest reductions in weight in the population (*61*). o A tax of at least 20% is necessary for a beneficial health effect (*151*). o Food taxes and subsidies can influence consumption (*61*, *77*, *150*, 151), and imposing substantial taxes on fattening foods might improve health outcomes, such as decreased body weight and chronic disease risk (*77*). o For maximum effect, food taxes and subsidies should represent a minimum of 10–15% of the price. Taxes and subsidies should preferably be used together (*151*). o Taxes may reinforce the education of consumers: awareness that a product has been taxed because it is unhealthy may discourage purchase (*77*). o Subsidies for healthier foods significantly increase the purchase and consumption of promoted products but evidence on caloric intake is unclear (*150*). o Combining food taxes with subsidies helps consumers to switch to healthier products (*77*). • Substitution of sugar-sweetened beverages: o Replacement of sugar-sweetened beverages with water or low-calorie beverages may have beneficial effects on body weight (*149*).
Potential harm	• Taxes and subsidies: o Taxes impose a greater burden on the poor than the rich (*167*). Combining taxes with subsidies could alleviate any regressive impact by enabling consumers to switch to healthier products without incurring additional cost (cited in *77*). o Harm could arise if taxed sugar-sweetened beverages are substituted by other unhealthy foods or beverages (*77*, *168*); therefore, messages about suitable alternatives should accompany increased taxes (*149*). • Substitution of sugar-sweetened beverages: o No potential harm was found.
Resource use, costs and/or cost-effectiveness	• Taxes and subsidies: o Taxes generate revenue. For example, in the USA, soft drink revenue is approximately US$ 70 billion per year; a modest tax would therefore generate billions of dollars (*61*). o Subsidizing alternative healthy drinks to reduce their price might encourage their consumption (*61*). o Subsidies combined with taxes are likely to be the most cost–effective and effective intervention (*151*). o An estimated 80% of interventions (taxes and/or subsidies) were either cost-saving or cost-effective (*151*). • Substitution of sugar-sweetened beverages: o None of the systematic reviews examined the costs or the cost-effectiveness of substituting sugar-sweetened beverages with alternative products.

Category	Main findings
Uncertainty about benefits and potential harm (Monitoring and evaluation might be warranted if the option were pursued.)	○ There is uncertainty in the evidence base, that can only be resolved through real-world case studies from countries that have implemented such measures. ○ The evidence for the effectiveness of subsidizing healthier products is compromised by study limitations, including: use of small convenience samples, which limits the generalizability of the results; the absence of overall diet assessment, which compromises the effectiveness of reducing total caloric intake; short interventions and follow-up, obviating assessment of long-term impact; and lack of cost–effectiveness analyses, which precludes comparison of competing policies (*150*). ○ Future research should be conducted to estimate price elasticity in low- and middle-income countries and identify potential health gains, the wider impact on jobs, monetary savings to the health sector, implementation costs and government revenue. Context-specific studies of cost-effectiveness would allow policy-makers to weigh these factors (*61*). ○ Many of the studies were based on predictive modelling and price elasticity rather than real interventions. The experimental studies provided relatively weak evidence that larger, population-wide trials are justified. Only a few interventions were conducted in remote communities or low- and middle-income countries. The main factors that would convince the food industry to accept food subsidies or taxation remain unexplored, and defining what foods should be deemed or labelled as healthy or unhealthy continues to be a source of international debate. Implementation of such policies for an entire population will require the involvement of many stakeholders, including industry, nongovernmental organizations, policy-makers and commissions, sponsors and advocacy groups to promote acceptance by the public (*151*).
Key elements of the policy option if it were tested elsewhere	• Taxes and subsidies: ○ When the price of sugar-sweetened beverages is increased, consumption of whole milk, fruit juices and diet soft drinks increases (*61*). ○ The findings support current recommendations that taxes and subsidies should be part of a comprehensive strategy to prevent obesity (*77*). ○ Taxes pose a larger burden on the poor than the rich (*167*). Thus, combining taxes on unhealthy food with subsidies for healthy alternatives could alleviate any regressive impact by enabling consumers to switch to more healthy products without incurring additional costs (cited in *77*). This combined intervention has also been found to be the most effective (*151*). ○ Interventions to reduce the consumption of sugar-sweetened beverages may be more effective when they include messages about suitable alternatives, such as water, tea, coffee, 100% fruit juice, milk and artificially sweetened beverages (*149*). • Substitution of sugar-sweetened beverages: ○ Most of the studies were conducted in high-income countries. As consumption of sugar-sweetened beverages in the USA may be higher than in other parts of the world, the beneficial effects of substituting these beverages with alternative beverages might be greater (*149*). ○ Age-appropriate substitution strategies should be used to reduce consumption of sugar-sweetened beverages in order to achieve long-term beneficial effects on health (*149*).

Category	Main findings
Stakeholders' views and experiences	o The food industry opposes imposition of targeted subsidies or taxation of foods (*167*, cited in *77*). o The factors that would persuade the food industry to accept food subsidies and/or taxation are not known, and the definition of which foods should be deemed or labelled as healthy or unhealthy continues to be debated internationally (*151*). o Imposition of taxes in an entire population will require the involvement of many stakeholders, including industry, nongovernmental organizations, policy-makers and commissions, sponsors and advocacy groups to promote acceptance by the public (*151*). o In a public opinion survey in the USA, the majority of respondents were against a tax on sugar-sweetened beverages (*169*).

Suggestions

On the basis of the systematic reviews, the main recommendations for implementation of option 4 are:

- Impose taxes and apply subsidies as part of a comprehensive strategy to prevent obesity.
- For maximum effect, impose taxes and apply subsidies that represent a minimum of 10–15% of the price.
- Impose taxes and apply subsidies for the entire population to ensure cost–effectiveness and effectiveness and alleviate any regressive impact of tax.
- Use age-appropriate strategies for substituting sugar-sweetened beverages to ensure long-term health benefits.
- In addition to taxes and other policies, provide education about suitable substitute beverages to prevent substitution of sugar-sweetened beverages with other unhealthy products.

Equity-related observations on the four options

Option 1: Food advertising to adults may be more effective in women than men because of a greater influence of normative cues and restrictive eating patterns, with associated greater attention to food cues (*85*).

Option 2: Counselling for parents of preschool-aged children is more effective than for parents of older children (*103*). Group counselling is promising for people of low socioeconomic status; however, parents in low-income settings may experience logistical barriers, such as unstable schedules, lack of transport or child-care, and interpersonal barriers, such as mistrust of providers and fear of stigmatization (*103*).

Front-of-package labels are read less often by people who are not nutrition-conscious, such as those of low socioeconomic status, with a high BMI and who have children living in their household. To increase the effect on public health, education about front-of-package labelling should target these consumers rather than those who are nutrition-conscious (*99*). Further, nutrition-specific labels that incorporate colours, wording and symbols perform better among low SES and minority ethnic groups (*170*).

Option 3: Interventions on BMI and other obesity measures were found to have a greater effect among girls than boys (*115*). Women may, however, be more susceptible to health information in general and to nutrition education in particular (*171*). Interventions should be designed more carefully to target children individually (*115*).

Option 4: Taxes may pose a larger burden on the poor than the rich (*167*). For example, Nnoaham et al. (*172*) found that taxes on unhealthy foods had a regressive effect that was not counterbalanced by greater health gains, although they may have underestimated the gains in poor people. Smed et al. (*173*) found that food taxes were only slightly regressive and that lower-income households reduced their consumption proportionately more than wealthier households, as has been observed with tobacco taxes (*174*).

Combining food taxes with subsidies could alleviate any regressive impact by enabling consumers to switch to more healthy products without incurring additional costs (cited in *77*).

The most recent study, from Mexico (*175*), was not included in the evidence base, as it was not published at the time of the literature search and is not systematic review. The authors found, however, that consumption of sugar-sweetened beverages after imposition of a tax decreased to the same extent, irrespective of socioeconomic status.

CONSIDERATIONS FOR IMPLEMENTATION

Potential barriers

Potential barriers can be identified at various levels. Those at individual level include the difficulty of engaging parents, especially those with a low income who may have unstable schedules, lack of transport, lack of child-care and fear of stigmatization; furthermore, people of lower socioeconomic background might be unwilling to change their eating habits. At the level of care providers, potential barriers include lack of human and financial resources in primary care to accept extra tasks and competing responsibilities or interests in schools. At the level of organizations, the food industry is opposed to taxes, statutory advertising restrictions and labelling changes, and other organizations have inadequate resources to start new counselling services or are unwilling to change resource allocation. At the system level, it is difficult to control advertising in new media channels, and there is no nutrient-profiling model in Estonia for changing labelling and advertising.

Option 1, regulation of food advertising

Potential barriers to implementing option 1 may exist at organizational and system levels. The Estonian Food Industry Association is opposed to statutory regulations on marketing and accepts only voluntary regulations. The industry is in a strong position, which appears to be non-negotiable; furthermore, all means, including the media, are used to support it. We found no information on whether the effects of advertising depend on the medium (radio, television, Internet); it is difficult to control and monitor online advertising. Currently, there is no nutrient-profiling model in Estonia. Political support and changes in regulations and laws will be required to implement this option.

Option 2, labelling of sugar-sweetened beverages and raising awareness about their health effects

There are potential barriers to implementation of option 2 at all four levels. At the individual level, educational programmes and counselling are difficult to conduct in the home setting because it is difficult to engage parents, although this is important in changing children's diets. Parents with low incomes experience logistical barriers to participating in interventions, including unstable schedules, lack of transport and child-care and fear of stigmatization (*176*, *177*). Education about front-of-package labelling should target consumers of low socioeconomic status and high BMI rather than consumers who are nutrition-conscious (*99*). According to a study conducted in 2012, 52% of Estonians did not consider that additional labelling would make purchasing choices easier. Additional labelling was supported more often by young and middle-aged people, non-Estonians and people with higher education (*178*). Consumer organizations have expressed no clear interest or support for front-of-package nutrient-specific schemes (*179*).

At the level of care providers, there is a lack of primary health care professionals in Estonia, and they have a heavy work load: in 2012, nearly 26% of family physicians worked longer hours than stipulated in their contract (*180*). Therefore, dietary counselling by primary health care professionals might be problematic, and additional training and capacity-building would be required.

At the organizational level, the Estonian Ministry of Social Affairs would not have adequate resources to set up a counselling programme for improving children's diets with their parents' help. The industry is strongly opposed to additional labelling, even though no health-based labelling system is in place. The United Kingdom's Food Standard Agency urged food manufacturers and retailers to use a colour labelling scheme voluntarily; however, a consortium of food companies continues to use "guideline daily amounts"

and other front-of-package labels (*112*, cited in *99*). The Estonian food industry uses "reference intake" labels (the former "guideline daily amounts" system) and is unlikely to change to another system voluntarily.

At system level, there are no educational or counselling programmes to change children`s diet with their parents' help. If Estonia decides to use front-of-package labelling, a system must be devised in accordance with directive 1169/2011 (*181*).

Option 3, school interventions and nutrition policies

Children will not maintain a healthy diet at school if the school environment does not support them continually. Longer interventions should be considered (*119*).

Motivating and sustaining parental or family involvement in interventions remains a challenge. The main barriers identified by parents were limited time and unwillingness to be tutored by schools (*117*). Teachers can train pupils in choosing nutritious, low-calorie foods, and training can be reinforced in the curriculum. Most overweight children prefer to eat fatty, sweetened and salty snacks and prefer "fast food". Teachers involved in obesity prevention programmes can create an environment in which children purchase healthy snacks and foods. Families can create circumstances that facilitate dietary and behavioural change. Furthermore, parents who recognize the importance of weight control will be motivated to persuade their children to control their weight (*116*).

Care providers may be unwilling to carry out and evaluate long-term interventions.

At organization level, schools may have an economic interest in having vending machines and cafés. Furthermore, the effects of a policy could diminish over time if food manufacturers adapt their marketing practices to maintain sales of sugar-sweetened beverages or if individuals adapt by consuming other low-nutrition, energy-dense foods (*121*).

At system level, the Government should ensure that any school food policy is part of wider public health policy (*119*). Although current legislation prohibits advertising of sugar-sweetened beverages in schools, sponsorship activities should be investigated. The school programme described by Sichieri et al. (*135*) encouraged consumption of water instead of sugar-sweetened beverages and resulted in a significant, 23% decrease in mean daily intake of carbonated drinks; however, consumption of fruit juices increased, perhaps to compensate for reduced energy intake. It was therefore concluded that interventions to reduce energy consumption from liquids should cover all sugar-sweetened beverages, including juices with added sugar (cited in *22*).

Option 4, imposing taxes on sugar-sweetened beverages, subsidizing other food groups and/or substituting alternative beverages

At the individual level, taxes pose a larger burden on the poor than the rich (*167*); however, Smed et al. (*173*) found that food taxes were only slightly regressive and that lower-income households reduced their consumption proportionately more than wealthier households, as has been observed for tobacco taxes (*174*). Thus, combining food taxes with subsidies could alleviate any regressive impact by enabling consumers to switch to more healthy products without incurring additional costs (cited in *77*).

The opinions of Estonians about a tax on sugar-sweetened beverages tax are unknown; however, according to the Alcohol yearbook of the Estonian Institute for Health Development in 2015 (*182*), 22% of Estonians considered that the excise tax on alcohol should be higher, 39% thought it might be higher, and 31% were opposed to taxes. Thus, only 31% of Estonians were against a tax on unhealthy food or drink products. According to the Estonian Institute of Economic Research (*183*) in 2011, only 2% of Estonians bought illegal agricultural products, while 19% did so from time to time.

At organizational level, the food industry is opposed to targeted subsidies and taxation of foods (*167*, cited in *77*). We were unable to determine either the organizational and other costs of applying taxes or subsidies or the cost–effectiveness of the policy; the Ministry of Finance will require this information before implementing this option.

At system level, there are currently no taxes on particular food groups in Estonia. An impact analysis should be conducted to evaluate the possible barriers before any system for taxing certain food groups is devised. The implementation and administrative costs of imposing taxes should be determined, as they represent further barriers to such interventions.

Potential opportunities

We also considered potential opportunities or "windows of opportunity" for implementing the options. The Estonian Government 2015–2019 programme, in which the Minister for Health and Labour is requested to conduct analyses of the effect of potential restrictions on energy drinks for children under 18 years (*6*) and a green paper on nutrition and physical activity being prepared by the Ministry of Social Affairs will remove many potential barriers.

In order to counter the industry lobby and to raise general awareness, the public sector should have a good communication strategy to increase knowledge about the negative health effects of sugar-sweetened beverages and about the effectiveness and potential outcomes of the various policy options.

Option 1, regulation of food advertising

A stepwise approach should be used for imposing restrictions, starting with television advertising, which remains the most important channel for marketing, and then extending over time to emerging fora for marketing, such as digital marketing, as evidence grows on the effectiveness of the restrictions. The Government could also consider using international nutrient profile models or adapting them to the Estonian context.

Option 2, labelling of sugar-sweetened beverages and raising awareness about their health effects

Estonia is restructuring and renewing its primary care service with the help of European regional funds. New primary care centres will be built, with extended services, which should reduce the workload of family physicians.

Parents could be encouraged to engage in programmes through support groups in which they share experiences and motivate each other.

Sugar-sweetened beverages should be labelled according to international nutrient profile models or profiles adapted to the Estonian context.

Option 3, school interventions and nutrition policies

In its green paper on nutrition and physical activity, the Ministry of Education has agreed to the proposal to restrict the sale of sugar-sweetened beverages in schools.

Option 4, imposing taxes on sugar-sweetened beverages, subsidizing other food groups and/or substituting alternative beverages

The Ministry of Finance is leading a working group of sustainable health care financing, which is considering extending revenue collection through taxes on food and drinks, especially sugar-sweetened beverages. Taxes on energy drinks are mentioned in the Estonian Government 2015–2019 programme (*6*).

REFERENCES

1. Centers for Disease Control and Prevention. The CDC guide to strategies for reducing the consumption of sugar-sweetened beverages. Atlanta, Georgia; 2010 (http://www.cdph.ca.gov/SiteCollectionDocuments/StratstoReduce_Sugar_Sweetened_Bevs.pdf, accessed 9 June 2016).

2. Jemenez-Cruz A, Bacardi-Gascon M, Pichardo-Osuna A, Mandujano-Trujillo Z, Catillo-Ruiz O. Infant and toddlers feeding practices and obesity amongst low-income families in Mexico. Asia Pac J Clin Nutr 2010;19:316–323.

3. Perez-Morales R, Bacardi-Gascon M, Jimenez-Cruz A. Sugar-sweetened beverages intake before 6 years of age and weight or BMI status among older children; systematic review of prospective studies. Nutr Hosp 2012;28:47–51.

4. Kessler DA. The end of overweight: taking control of the instable American appetite. New York: Rodale; 2009.

5. Lavin R, Timpson H. Exploring the acceptability of a tax on sugar-sweetened beverages. Brief evidence review. Liverpool: Applied Health and Wellbeing Partnership, Centre of Public Health, Liverpool John Moores University; 2013.

6. Estonian Government. 2015–2019 programme. Tallinn; 2015 (https://valitsus.ee/sites/default/files/content-editors/failid/re-sde-irl-valitsusliidu-lepe-2015.pdf, accessed 9 June 2016).

7. Ministry of Social Affairs. [National Health Plan 2009-2010 performance report for 2013-2014.] Tallinn; 2015 (http://www.sm.ee/sites/default/files/content-editors/Ministeerium_kontaktid/Uuringu_ja_analuusid/Tervisevaldkond/rta_2013-2014._aasta_tulemusaruanne_eng.pd.pdf, accessed 9 June 2016).

8. Singh GM, Micha R, Khatibzadhe S, Shi P, Lim S, Andrews KG, et al. Global, regional and national consumption of sugar-sweetened beverages, fruit juices and milk: a systematic assessment of beverages intake in 187 counties. PLoS One 2015;10:e0124845.

9. Aasvee K, Rahno J. HBSC study 2013/2014 report. Tallinn: Estonian National Institute for Health Development; 2015 (https://intra.tai.ee/images/prints/documents/144776947825_HBSC_2014_kogumik.pdf, accessed 9 June 2016).

10. Pitsi T, Gluškova N, Martverk M, Oja L, Liiv K. Energy drinks study report. Tallinn: Estonian National Institute for Health Development; 2013 (https://intra.tai.ee/images/prints/documents/138253572643_Energiajookide%20uuring.pdf, accessed 9 June 2016).

11. European Food Safety Authority. "Energy" drinks report. Parma; 2013 (http://www.efsa.europa.eu/en/press/news/130306, accessed 9 June 2016).

12. Nowak D, Jasionowski A. Analysis of the consumption of caffeinated energy drinks among Polish adolescents. Int J Environ Res Public Health 2015;12:7910–7921.

13. Sokmann S, Consumption of sugar sweetened-beverages in relation to the socioeconomic factors among 10–17-year-old Estonian adolescents. Dissertation, Faculty of Medicine, University of Tartu, 2016.

14. World Health Organization. Guideline: Sugars intake for adults and children. Geneva; 2015 (http://apps.who.int/iris/bitstream/10665/149782/1/9789241549028_eng.pdf?ua=1, accessed 9 June 2016).

15. Currie C, Zanotti C, Morgan A, Currie D, de Looze M, Roberts C, et al. Social determinants of health and well-being among young people. Health Behaviour in School-aged Children (HBSC) study: international report from the 2009/2010 survey. Copenhagen: WHO Regional Office for Europe; 2012 (Health Policy for Children and Adolescents, No. 6).

16. Bucher Della Torre S, Keller A, Depeyre LJ, Kruseman M. Sugar-sweetened beverages and obesity risk in children and adolescents: a systematic analysis on how methodology quality may influence conclusions. J Acad Nutr Diet 2016;116:638–659.

17. Block G. Foods contributing to energy intake in the US: data from NHANES III and NHANES 1999–2000. J Food Consumption Anal 2004;17:439–447.

18. Bleich SN, Wang YC, Gortmaker SL. Increasing consumption of sugar-sweetened beverages among US adults: 1988–1994 to 1999–2004. Am J Clin Nutr 2009;89:372–381.

19. Guthrie JF, Morton F. Food sources of added sweeteners in the diets of Americans. J Am Diet Assoc 2000;100:43–51.

20. Duffey KJ, Huybrechts I, Mouratidou T, Libuda L, Kersting M, De Vriendt T, et al. Beverage consumption among European adolescents in the HELENA study. Eur J Clin Nutr 2012;66:244–252.

21. Ng SW, Mhurchu CN, Jebb SA, Popkin BM. Patterns and trends of beverage consumption among children and adults in Great Britain, 1986–2009. Br J Nutr 2012;108:536–551.

22. Avery A, Bostock L, McCullough F. A systematic review investigating interventions that can help reduce consumption of sugar-sweetened beverages in children leading to changes in body fatness. J Hum Nutr Diet 2015;28(Suppl.1):52–64.

23. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. Am J Clin Nutr 2006;84:274–288.

24. Morenga LT, Mallard S, Mann J. Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies. BMJ 2013;346:e7492.

25. Malik VS, Pan A, Willett WC, Hu FB. Sugar-sweetened beverages and weight gain in children and adults: a systematic review and meta-analysis. Am J Clin Nutr 2013;98:1084–1102.

26. Woodward-Lopez G, Koa J, Ritchie L. To what extent have sweetened beverages contributed to the obesity epidemic? Public Health Nutr 2010;1:1–11.

27. Bray GA, Nielsen SJ, Popkin BM. Consumption of high-fructose corn syrup in beverages may play a role in the epidemic of obesity. Am J Clin Nutr 2004;79:537–543.

28. Elliott SS, Keim NL, Stern JS, Teff K, Havel PJ. Fructose, weight gain, and the insulin resistance syndrome. Am J Clin Nutr 2002;76:911–922.

29. Hu FB. Resolved: there is sufficient scientific evidence that decreasing sugar-sweetened beverage consumption will reduce the prevalence of obesity and obesity-related diseases. Obes Rev 2013;14:606–619.

30. Malik VS, Popkin BM, Bray GA, Despres JP, Willett WC, Hu FB. Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. Diabetes Care 2010;33:2477–2483.

31. Vartanian LR, Schwartz MB, Brownell KD. Effects of soft drink consumption on nutrition and health: a systematic review and meta-analysis. Am J Public Health 2007;97:667–675.

32. Apovian CM. Sugar-sweetened soft drinks, obesity, and type 2 diabetes. J Am Med Assoc 2004;292:978–979.

33. Montonen J, Järvinen R, Knekti P, Heliövaara M, Reunanen A. Consumption of sweetened beverages and intakes of fructose and glucose predict type 2 diabetes occurrence. J Nutr 2007;137:1447–1454.

34. Imamura F, O'Connor L, Ye Z, Mursu J, Hayashino Y, Bhupathiraju SN, et al. Consumption of sugar sweetened beverages, artificially sweetened beverages, and fruit juice and incidence of type 2 diabetes: systematic review, meta-analysis, and estimation of population attributable fraction. BMJ 2015;351:h3576.

35. World Health Organization. Noncommunicable diseases, Fact sheet, updated January 2015 (http://www.who.int/mediacentre/factsheets/fs355/en/, accessed 27 September 2015).

36. Department of Health and Human Services. The Surgeon General's call to prevent and decrease overweight and obesity. Rockville, Maryland: Public Health Services; 2001.

37. Sheiham A. Dietary effects on dental diseases. Public Health Nutr 2001;4:569–591.

38. Touger-Decker R, van Loveren C. Sugars and dental caries. Am J Clin Nutr 2003;78:881S–892S.

39. Tahmassebi JF, Duggal MS, Malik-Kotru G, Curzon ME. Soft drinks and dental health: a review of the current literature. J Dent 2006;34:2–11.

40. Dhingra R, Sullivan L, Jacques PF, Wang TJ, Fox CS, Meigs JB, et al. Soft drink consumption and risk of developing cardiometabolic risk factors and the metabolic syndrome in middle-aged adults in the community. Circulation 2007;116:480-488.

41. Stanhope KL, Griffen SC, Bair BR, Swarbrick MM, Keim NL, Havel PJ. Twenty-four-hour endocrine and metabolic profiles following consumption of high-fructose corn syrup-, sucrose-, fructose-, and glucose-sweetened beverages with meals. Am J Clin Nutr 2008;87:1194–1203.

42. Fung TT, Malk V, Rexrode KM, Manson JE, Willett WC, Hu FB. Sweetened beverage consumption and risk of coronary heart disease in women. Am J Clin Nutr 2009;89:1037–1042.

43. Ouyang X, Cirillo P, Sautin Y, McCall S, Bruchette JL, Diehl AM, et al. Fructose consumption as a risk factor for non-alcoholic fatty liver disease. J Hepatol 2008;48:993–999.

44. Choi JW, Ford ES, Gao X, Choi HK. Sugar-sweetened soft drinks, diet soft drinks, and serum uric acid level: the third National Health and Nutrition Examination Survey. Arthritis Rheumatol 2008;59:109–116.

45. Choi HK, Curhan G. Soft drinks, fructose consumption, and the risk of gout in men: prospective cohort study. BMJ 2008;336:309–312.

46. Temple JL. Caffeine use in children: What we know, what we have left to learn, and why we should worry. Neurosci Biobehav Rev 2009;33:793–806.

47. Committee on Nutrition and the Council on Sports Medicine and Fitness. Clinical report. Sports drinks and energy drinks for children and adolescents: are they appropriate? Pediatrics 2011;127:1182–1189.

48. Rath M. Energy drinks: What is all the hype? The dangers of energy drink consumption. J Am Assoc Nurse Pract 2012;24:70–76.

49. Seifert SM, Schaechter JL, Hearshorin ER, Lipshultz SE. Health effects of energy drinks on children, adolescents, and young adults. Pediatrics 2011;127:511–528.

50. Tekkel M, Veideman T. Health behaviour among Estonian adult population 2014. Tallinn: National Institute for Health Development; 2015 (http://rahvatervis.ut.ee/bitstream/1/6049/1/Tervisek%C3%A4itumine2015.pdf, accessed 9 June 2016).

51. European Health Interview Survey 2008. Eurostat database. Brussels: European Commission; 2008 (http://ec.europa.eu/eurostat/data/database, accessed 9 June 2016).

52. Health Insurance Fund. School health reports, 2015. Tallinn; 2015 (https://www.haigekassa.ee/sites/default/files/ennetusedendus/ennetuse_projektide_tulemused_2014.pdf, accessed 9 June 2016).

53. National Institute for Health Development. Health statistics and health surveys database. Tallinn; 2008 (http://pxweb.tai.ee/esf/pxweb2008/dialog/statfile1.asp, accessed 9 June 2016).

54. Runnel R. Oral health among elementary school children and the effects of polyol candies on the prevention of dental caries. Dissertation, Faculty of Medicine, University of Tartu, 2015.

55. Larson N, Story M. Food and beverage marketing to children and adolescents: What changes are needed to promote healthy eating habits? Princeton, New Jersey: Robert Wood Johnson Foundation; 2008 (http://healthyeatingresearch.org/wp-content/uploads/2013/12/HER-Food-Mktg-Brief-2008-FINAL.pdf, accessed 9 June 2016).

56. Miller SA, Taveras EM, Rifas-Shiman SL, Gillman MW. Association between television viewing and poor diet quality in young children. Int J Pediatr Obes 2008;3:168–176.

57. Wang YC, Bleich SN, Gortmaker SL. Increasing caloric contribution from sugar-sweetened beverages and 100% fruit juices among US children and adolescents, 1988–2004. Pediatrics 2008;121:e1604–e1614.

58. Elfhag K, Tholin S, Rasmussen F. Consumption of fruit, vegetables, sweets and soft drinks are associated with psychological dimensions of eating behaviour in parents and their 12-year-old children. Public Health Nutr 2008;11:914–923.

59. Grimm GC, Harnack L, Story M. Factors associated with soft drink consumption in school-aged children. J Am Diet Assoc 2004;104:1244–1249.

60. Paes VM, Hesketh K, O'Malley C, Moore H, Summerbell C, Griffin S, et al. Determinants of sugar-sweetened beverages consumption in young children: a systematic review. Obes Rev 2015;16:903–913.

61. Escobar MAC, Veerman JL, Tollman SM, Bertram MY, Hofman KJ. Evidence that a tax on sugar sweetened beverages reduces the obesity rate: a meta-analysis. BMC Public Health 2013;13:1072.

62. Haerens L, Craeynest M, Defroche B, Maes L, Cardon G, De Bourdeaudhij I. The contribution of psychosocial and home environmental factors in explaining eating behaviours in adolescents. Eur J Clin Nutr 2008;62:51–59.

63. Vereecken CA, Keukelier E, Maes L. Influence of mother's educational level on food parenting practices and food habits of young children. Appetite 2004;43:93–103.

64. World Health Organization Regional Office for Europe. European Food and Nutrition Action Plan 2015–2020. Copenhagen; 2015 (http://www.euro.who.int/__data/assets/pdf_file/0003/294474/European-Food-Nutrition-Action-Plan-20152020-en.pdf?ua=1, accessed 9 June 2016).

65. Cairns G, Angus K, Hastings G. The extent, nature and effects of food promotion to children: a review of the evidence to December 2008. Geneva: World Health Organization; 2009 (http://www.who.int/dietphysicalactivity/Evidence_Update_2009.pdf, accessed 9 June 2016).

66. McGinnis JM, Gootman AJ, Kraak VI. Food marketing to children and youth: threat or opportunity? Washington, DC: Institute of Medicine; 2006 (http://www.nap.edu/read/11514/chapter/1, accessed 9 June 2016).

67. Kelly B, Halford JC, Bayland EJ, Chapman K, Bautista-Castano I, Berg C, et al. Television food advertising to children: a global perspective. Am J Public Health 2010;100:1730–1736.

68. Rodd HD, Patel V. Content analysis of children's television advertising in relation to dental health. Br Dent J 2005;199:710–712.

69. Pearson N, Ball K, Crawford D. Mediators of longitudinal associations between television viewing and eating behaviours in adolescents. Int J Behav Nutr Phys Act 2011;8:23.

70. Vereecken CA, Inchley J, Subramanian SV, Hublet A, Maes L. The relative influence of individual and contextual socio-economic status on consumption of fruit and soft drinks among adolescents in Europe. Eur J Public Health 2005;15:224–232.

71. Jones SC, McVie D, Noble G. Parents' inferences about other parents' motives for food choices for children: a pilot study. Wollongong, New South Wales: University of Wollongong; 2005 (http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1075&context=hbspapers, accessed 9 June 2016).

72. van der Horst K, Oenema A, Ferreira I, Wendel-Vos W, Giskes K, van Lenthe F, et al. Systematic review of environmental correlates of obesity-related dietary behaviours in youth. Health Educ Res 2007;22:203–226.

73. Butland B, Jebb S, Kopelman P, McPherson K, Thomas S, Mardell J, et al. Tackling obesities: future choices – project report. 2nd edition. London: Government Office for Science; 2007.

74. Kalavana T, Maes S, de Guht V. Interpersonal and self-regulation determinants of healthy and unhealthy eating behaviour in adolescents. J Health Psychol 2010;15:44–54.

75. Drewnowski A. Obesity and the food environment: dietary energy density and diet costs. Am J Prev Med 2004;27:154–162.

76. Finkelstein EA, Ruhm CJ, Kosa KM. Economic causes and consequences of obesity. Annu Rev Public Health 2005;26:239–257.

77. Thow AM, Jan S, Leeder S, Swinburn B. The effect of fiscal policy on diet, obesity and chronic diseases: a systematic review. Bull World Health Organ 2010;88:609–614.

78. Soft drinks in Estonia. London: Euromonitor International Ltd; 2016 (http://www.euromonitor.com/soft-drinks-in-estonia/report, accessed 9 June 2016).

79. Mytton OT, Clarke D, Rayner M. Taxing unhealthy food and drinks to improve health. BMJ 2012; 344:2931.

80. Powell LM, Chaloupka FJ. Food prices and obesity: evidence and policy implications for taxes and subsidies. Milbank Q 2009;87:229 –257.

81. Powell LM, Chriqui JF, Khan T, Wada R, Chaloupka FJ. Assessing the potential effectiveness of food and beverage taxes and subsidies for improving public health: a systematic review of prices, demand and body weight outcomes. Obes Rev 2013,14:110–128.

82. IARC. Handbook of Cancer Prevention Vol. 14: Effectiveness of Tax and Price Policies for Tobacco Control 2011.

83. Pomeranz JL. Advanced policy options to regulate sugar-sweetened beverages to support public health. J Public Health Policy 2012;33:75–88.

84. Lopez RA, Fantuzzi KL. Demand for carbonated soft drinks: implications for obesity policy. Appl Econ 2012;44:2859–2865.

85. Mills SD, Tanner LM, Adams J. Systematic literature review of the effects of food and drink advertising on food and drink-related behaviour, attitudes and beliefs in adult population. Obes Rev 2013;14:303–314.

86. Wilcox BL, Kunkel D, Cantor J, Dowrick P, Linn S, Palmer E. Report of the APA Task Force on Advertising and Children. Washington DC: American Psychological Association; 2004

87. Chambers SA, Freeman R, Anderson AS, MacGillivray S. Reducing the volume, exposure and negative impacts of advertising for foods high in fat, sugar and salt to children: a systematic review of the evidence from statutory and self-regulatory actions and educational measures. Prev Med 2015;75:32–43.

88. Boush DM. Mediating advertising effects. In: Brvant J, editor, Television and the American family. 2nd edition. Mahwah, New Jersey: Lawrence Erlbaum Associates Publishers; 2001:397–412.

89. Cairns G, Angus K, Hastings G, Caraher M. Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. Appetite 2013;62:209–215.

90. Hastings G, Stead M, McDermott L, Forsyth A, MacKintosh AM, Rayner M, et al. Review of research on the effects of food promotion to children. Glasgow: University of Strathclyde; 2003.

91. Hawkes C. Regulating food marketing to young people: worldwide: trends and policy drivers. Am J Public Health 2007;97:1962–1973.

92. Hawks C, Lobstein T for the Polmark Consortium. Regulating the commercial promotion of food to children: a survey of actions worldwide. Int J Pediatr Obes 2011;6:83–94.

93. Galbraith-Emami S, Lobstein T. The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review. Obes Rev 2013;14:960–974.

94. International Food and Beverages Alliance. Responsible marketing and advertising to children. Geneva; 2016 (https://ifballiance.org/our-commitments/responsible-marketing-advertising-to-children/, accessed 9 June 2016).

95. The EU Pledge commitments. Brussels: World Federation of Advertisers; 2016 (http://www.eu-pledge.eu/content/eu-pledge-commitments, accessed 9 June 2016).

96. Bergsma LJ, Carney ME. The effectiveness of health-promoting media literacy education: a systematic review. Health Education Research 2008,23:522–542

97. Knowlden AP, Sharma M. Systematic review of family and home-based interventions targeting paediatric overweight and obesity. Obes Rev 2012;13:499–508.

98. Morris H, Skouteris H, Edwards S, Rutherford L. Obesity prevention interventions in early childhood education and care settings with parental involvement: a systematic review. Early Child Dev Care 2015;185:1283–1313.

99. Hersey JC, Wohlgenant KC, Arsenault JE, Kosa KM, Muth MK. Effects of front-of-package and shelf nutrition labeling systems on consumers. Nutr Rev 2013;71:1–14.

100. van't Riet J. Sales effects of product health information at points of purchase: a systematic review. Public Health Nutr 2013;16:418–429.

101. Summerbell CD, Waters E, Edmunds LD, Kelly S, Brown T, Campbell KJ. Interventions for preventing obesity in children. Cochrane Database Syst Rev 2005;3:CD001871.

102. Campbell KJ, Hesketh KD. Strategies which aim to positively impact on weight, physical activity, diet and sedentary behaviourism children from zero to five years. A systematic review of the literature. Obes Rev 2007;8:327–338.

103. Kader M Sundblom E, Elinder LS. Effectiveness of universal parental support interventions addressing children's dietary habits, physical activity and bodyweight: A systematic review. Prev Med 2015;77:52–67.

104. Golley RK, Hendrie GA, Slater A, Corsini N. Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns – What nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness? Obes Rev 2011;12:114–130.

105. Talvia S, Lagström H, Räsänen M, Salminen M, Räsänen L, Salo P, et al. A randomized intervention since infancy to reduce intake of saturated fat: calorie (energy) and nutrient intakes up to the age of 10 years in the Special Turku Coronary Risk Factor Intervention Project. Arch Pediatr Adolesc Med 2004;158:41–47.

106. Balcombe K, Fraser I, Di Falco S. Traffic lights and food choice: a choice experiment examining the relationship between nutritional food labels and price. Food Policy 2010;35:211–220.

107. McGowan L, Cooke LJ, Gardner B, Beeken RJ, Croker H, Wardle J. Healthy feeding habits: efficacy results from a cluster-randomized, controlled exploratory trial of a novel, habit-based intervention with parents. Am J Clin Nutr 2013;98:769–777.

108. Anand SS, Atkinson S, Davis AD, Blimkie C, Ahmed R, Brouwers M, et al. A family-based intervention to promote healthy lifestyles in an aboriginal community in Canada. Can J Public Health 2007;95:447–452.

109. Paineau DL, Beaufils F, Boulier A, Cassuto DA, Chwalow J, Combris P, et al. Family dietary coaching to improve nutritional intakes and body weight control: a randomized controlled trial. Arch Pediatr Adolesc Med 2008;162:34–43.

110. Bialkova S, van Trijp H. What determines consumer attention to nutrition labels? Food Qual Preference 2010;21:1042–1051.

111. Drichoutis AC, Lazaridis P, Nayga RM Jr. Would consumers value food-away-from-home products with nutritional labels? Agribusiness 2009;25:550–575.

112. Lobstein T, Davies S. Defining and labelling "healthy" and "unhealthy" food. Public Health Nutr 2009;12:331–340.

113. Grunert GK, Fernández-Celemín L, Wills JM, Storcksdiesk genannt Bonsmann S, Nureeva L. Use and understanding of nutrition information on food labels in six European countries. J Public Health 2010;18:261–277.

114. Grunert KG, Wills JM, Fernández-Celemín L. Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. Appetite 2010;55:177–189.

115. De Bourdeaudhuij I, Van Cauwenberghe E, Spittaels H, Oppert JM, Rostami C, Brug J, et al. School-based interventions promoting both physical activity and healthy eating in Europe: a systematic review within the HOPE project. Obes Rev 2011;12:205–216.

116. Kelishadi R, Azizi-Soleiman F. Controlling childhood obesity: a systematic review on strategies and challenges. J Res Med Sci 2014;19:993–1008.

117. Verstraeten R, Roberfroid D, Lachat C, Leroy JL, Holdsworth M, Maes L, et al. Effectiveness of preventive school-based obesity interventions in low- and middle-income countries: a systematic review. Am J Clin Nutr 2012;96:415–438.

118. Silveira JA, Taddei JA, Guerra PH, Nobre MR. The effect of participation in school-based nutrition education interventions on body mass index: a meta-analysis of randomized controlled community trials. Prev Med 2013;56:237–243.

119. Jamie PC, Lock K. Do school based food and nutrition policies improve diet and reduce obesity? Prev Med 2009;48:45–53.

120. Driessen CE, Cameron AJ, Thornton LE, Lai SK, Barnett LM. Effect of changes to the school food environment on eating behaviours and/or body weight in children: a systematic review. Obes Rev 2014;15:968–982.

121. Levy DT, Friend KB, Wang YC. A review of the literature on policies directed at the youth consumption of sugar sweetened beverages. Adv Nutr 2011;2:182S–200S.

122. Johnson DB, Bruemmer B, Lund AE, Evens CC, Mar CM. Impact of school district sugar-sweetened beverage policies on student beverage exposure and consumption in middle schools. J Adolesc Health 2009;45:S30–S37.

123. Briefel RR, Crepinsek MK, Cabili C, Wilson A, Gleason PM. School food environments and practices affect dietary behaviors of US public school children. J Am Diet Assoc 2009;109:S91–S107.

124. Briefel RR, Wilson A, Gleason PM. Consumption of low-nutrient, energy-dense foods and beverages at school, home, and other locations among school lunch participants and nonparticipants. J Am Diet Assoc 2009;109:S79–S90.

125. Cullen KW, Watson K, Zakeri I, Ralston K. Exploring changes in middle-school student lunch consumption after local school food service policy modifications. Public Health Nutr 2006;9:814–820.

126. Cullen KW, Watson K, Zakeri I. Improvements in middle school student dietary intake after implementation of the Texas Public School Nutrition Policy. Am J Public Health 2008;98:111–117.

127. de Ruyter JC, Olthof MR, Seidell JC, Katan MB. A trial of sugar-free or sugar-sweetened beverages and body weight in children. N Engl J Med 2012;367:1397–1406.

128. Haerens L, Deforche B, Maes L, Cardon G, Stevens V, De Bourdeaudhuij I. Evaluation of a 2-year physical activity and healthy eating intervention in middle school children. Health Educ Res 2006;21:911–921.

129. Haerens L, Deforche B, Maes L, Stevens V, Cardon G, De Bourdeaudhuij I. Body mass effects of a physical activity and healthy food intervention in middle schools. Obesity 2006;14:847–854.

130. Haerens L, De Bourdeaudhuij I, Maes L, Cardon G, Deforche B. School-based randomized controlled trial of a physical activity intervention among adolescents. J Adolesc Health 2007;40:258–265.

131. Haerens L, De Bourdeaudhuij I, Maes L, Vereecken C, Brug J, Deforche B. The effects of a middle-school healthy eating intervention on adolescents' fat and fruit intake and soft drinks consumption. Public Health Nutr 2007;10:443–449.

132. Singh AS, Chin APM, Brug J, van Mechelen W. Short-term effects of school-based weight gain prevention among adolescents. Arch Pediatr Adolesc Med 2007;161:565–571.

133. Singh AS, Chin APM, Kremers SP, Visscher TL, Brug J, van Mechelen W. Design of the Dutch Obesity Intervention in Teenagers (NRG-DOiT): systematic development, implementation and evaluation of a school-based intervention aimed at the prevention of excessive weight gain in adolescents. BMC Public Health 2006;6:304.

134. Gaglianone CP, Taddei JAAC, Colugnati FAB, Magalhães CG, Davanco CM, Macedo L, et al. Nutrition education in public elementary schools of São Paulo, Brazil: the Reducing Risks of Illness and Death in Adulthood project. Rev Nutr 2006;19:309–320.

135. Sichieri R, Trotte AP, de Souza RA, Veiga GV. School randomised trial on prevention of excessive weight gain by discouraging students from drinking sodas. Public Health Nutr 2009;12:197–202.

136. Hingle MD, O'Connor TM, Dave JM, Baranowski T. Parental involvement in interventions to improve child dietary intake: a systematic review. Prev Med 2010;51:103–111.

137. Christakis NA, Fowler JH. The spread of obesity in a large social network over 32 years. N Engl J Med 2007;357:370–379.

138. Quann EE, Adams D. Impact on milk consumption and nutrient intakes from eliminating flavored milk in elementary schools. Nutr Today 2013;48:127–134.

139. Rito AI, Carvalho MA, Ramos C, Breda J. Program obesity zero (POZ) – a community-based intervention to address overweight primary-school children from five Portuguese municipalities. Public Health Nutr 2013;16:1043–1051.

140. Muckelbauer R, Libuda L, Clausen K, Toschke AM, Reinehr T, Kersting M. Promotion and provision of drinking water in schools for overweight prevention: randomized, controlled cluster trial. Pediatrics 2009;123:E661–E667.

141. Wordell D, Daratha K, Mandal B, Bindler R, Butkus SN. Changes in a middle school food environment affect food behavior and food choices. J Acad Nutr Diet 2012;112:137–141.

142. French SA, Jeffery RW, Story M, Breitlow KK, Baxter JS, Hannan P, et al. Pricing and promotion effects on low-fat vending snack purchases: the CHIPS Study. Am J Public Health 2001;91:112–117.

143. French SA. Pricing effects on food choices. J Nutr 2003;133:S841–S843.

144. Cullen KW, Hartstein J, Reynolds KD, Vu M, Resnicow K, Greene N, et al. Improving the school food environment: results from a pilot study in middle schools. J Am Diet Assoc 2007;107:484–489.

145. Lavelle HV, Mackay DF, Pell JP. Systematic review and meta-analysis of schoolbased interventions to reduce body mass index. J Public Health 2012;34:360–369.

146. Kim D, Kawachi I. Food taxation and pricing strategies to "thin out" the obesity epidemic. Am J Prev Med 2006;30:430–437.

147. Darmon N, Drewnowski A. Does social class predict diet quality? Am J Clin Nutr 2008;87:1107–1117.

148. Black AP, Brimblecombe J, Eyles H, Morris P, Vally H, O'Dea K. Food subsidy programs and the health and nutritional status of disadvantaged families in high income countries: a systematic review. BMC Public Health 2012;12:1099.

149. Zheng M, Allman-Farinelli M, Heitmann BL, Rangan A. Substitution of sugar-sweetened beverages with other beverage alternatives: a review of long-term health outcomes. J. Acad Nutr Diet 2015;115:767–779.

150. Ruopeng A. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. Public Health Nutr 2013;16:1215–1228.

151. Niebylski ML, Redburn KA, Duhaney T, Campbell NR. Healthy food subsidies and unhealthy food taxation: a systematic review of the evidence. Nutrition 2015;31:787–795.

152. Fletcher JM, Frisvold D, Tefft N. Can soft drink taxes reduce population weight? Contemp Econ Policy 2009;28:23–35.

153. Oaks B. An evaluation of the snack tax on the obesity rate of Maine. San Marcos, Texas: Texas State University, Department of Political Science; 2005.

154. Fantuzzi K. Carbonated soft drink consumption: implications for obesity policy. Storrs, Connecticut: University of Connecticut; 2008.

155. Bahl R, Bird R, Walker MB. The uneasy case against discriminatory excise taxation: soft drink taxes in Ireland. Public Finance Rev 2003;31:510–533.

156. Gabe T. Fiscal and economic impacts of beverage excise taxes imposed by Maine Public Law 629. Orono, Maine: University of Maine, School of Economics; 2008.

157. Gustavsen G. Public policies and the demand for carbonated soft drinks: a censored quantile regression approach. In: The future of rural Europe in the global agri-food system: Proceedings of the XIth congress of the European Association of Agricultural Economists, Copenhagen, 24–27 August 2005. The Hague: European Association of Agricultural Economists; 2006.

158. Asfaw A. Do government food price policies affect the prevalence of obesity? Empirical evidence from Egypt. World Devel 2007;35:687–701.

159. Andreyeva T, Long MW, Brownell KD. The impact of food prices on consumption: a systematic review of research on price elasticity of demand for food. Am J Public Health 2010;100:216–222.

160. Kane RL, Johnson PE, Town RJ, Butler M. A structured review of the effect of economic incentives on consumers' preventive behavior. Am J Prev Med 2004;27:327–352.

161. Wall J, Mhurchu CN, Blakely T, Rodgers A, Wilton J. Effectiveness of monetary incentives in modifying dietary behavior: a review of randomized, controlled trials. Nutr Rev 2006;64:518–531.

162. Jensen JD, Hartmann H, de Mul A, Schuit A, Burg J. Economic incentives and nutritional behavior of children in the school setting: a systematic review. Nutr Rev 2011;69:660–674.

163. de Koning L, Malik VS, Rimm EB, Willett WC, Hu FB. Sugarsweetened and artificially sweetened beverage consumption and risk of type 2 diabetes in men. Am J Clin Nutr 2011;93:1321–1327.

164. Stookey JD, Constant F, Popkin BM, Gardner CD. Drinking water is associated with weight loss in overweight dieting women independent of diet and activity. Obesity 2008;16:2481–2488.

165. Tate DF, Turner-McGrievy G, Lyons E, Stevens J, Erickson K, Diamond M, et al. Replacing caloric beverages with water or diet beverages for weight loss in adults: main results of the Choose Healthy Options Consciously Everyday (CHOICE) randomized clinical trial. Am J Clin Nutr 2012;95:555–563.

166. National Health and Medical Research Council. New clinical practice guidelines for managing overweight and obesity. Canberra; 2013 (http://www.nhmrc.gov.au/media/releases/2013/new-clinical-practice-guidelinesmanaging-overweight-and-obesity, accessed 9 June 2016).

167. Caraher M, Cowburn G. Taxing food: implications for public health nutrition. Public Health Nutr 2005;8:1242–1249.

168. Maniadakis N, Kapaki V, Damianidi L, Kourlaba G. A systematic review of the effectiveness of taxes on nonalcoholic beverages and high-in-fat foods as a means to prevent obesity trends. Clinicoecon Outcomes Res 2013;5:519–543.

169. Barry CL, Niederdeppe J, Gollust SE. Taxes on sugar-sweetened beverages: results from a 2011 national public opinion survey. Am J Prev Med 2013;44:158–163.

170. Gorton D. Nutrition labelling - Update of scientific evidence on consumer use and understanding of nutrition labels and claims. Prepared for New Zealand Food Safety Authority and the Ministry of Health. Auckland: The University of Auckland 2007.

171. Vandelanotte C, De Bourdeaudhuij I, Brug J. Acceptability and feasibility of an interactive computer-tailored fat intake intervention in Belgium. Health Promot Int 2004;19:463–470.

172. Nnoaham KE, Sacks G, Rayner M, Mytton O, Gray A. Modelling income group differences in the health and economic impacts of targeted food taxes and subsidies. Int J Epidemiol 2009;38:1324–1333.

173. Smed S, Jensen JD, Denver S. Socio-economic characteristics and the effect of taxation as a health policy instrument. Food Policy 2007;32:624–639.

174. Remler DK. Poor smokers, poor quitters, and cigarette tax regressivity. Am J Public Health 2004;94:225–229.

175. Colchero MA, Popkin BM, Rivera JA, Ng SW. Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study. BMJ 2016;352:h6704.

176. Spoth, R, Redmond C, Shin C. Modeling factors influencing enrollment in family-focused preventive intervention research. Prev Sci 2000;1:213–225.

177. Keller J, McDade K. Attitudes of low-income parents toward seeking help with parenting: implications for practice. Child Welfare 2000;79:285–312.

178. Voog A, Sarv K. [Estonian population eating habits and food purchasing preferences.] Tallinn: TNS Emor; 2012 (http://rahvatervis.ut.ee/bitstream/1/5541/1/Voog2012.pdf, accessed 9 June 2016).

179. Consumer Protection Alliance. [Promoting consumers literacy.] Tallinn; 2012 (http://www.tarbijakaitse.ee/modules.php?op=modload&name=News&file=article&sid=10384, accessed 9 June 2016).

180. National Institute for Health Development. [Changing the collection of healthcare personnel statistics.] Tallinn; 2012 (https://intra.tai.ee/images/prints/documents/135513133361_Arstide%20pilootuuring.pdf, accessed 9 June 2016).

181. Regulation (EU) No. 1169/211. Guidance on the provision of food information to consumers. Brussels; 2013 (http://www.fooddrinkeurope.eu/uploads/publications_documents/FDE_Guidance_WEB.pdf. Accessed 9 June 2016).

182. National Institute for Health Development. [Alcohol market, consumption and harms in Estonia.] Tallinn; 2015 (https://intra.tai.ee/images/prints/documents/144793567273_Alkoholi_aastaraamat_2015.pdf, accessed 9 June 2016).

183. Institute of Economic Research. Hidden economy. Tallinn; 2012 (https://www.mkm.ee/sites/default/files/varimajandus_eestis_2011_elanike_hinnangute_alusel.pdf, accessed 9 June 2016).

ANNEXES

The tables below describe in detail the systematic reviews identified for each option. In Annex 1, we have listed all the systematic reviews we found, their reliability and acceptability and whether we included them in the review. In annexes 2–5, the option is listed in the first column, and the focus of the review is described in the second column. Findings from the review that relate to the option are listed in the third column, and the fourth column gives the rating of the overall reliability of the review assessed with AMSTAR (A Measurement Tool to Assess Reviews), which rates overall reliability on a scale of 0 to 11, where 11/11 represents a review of the highest reliability, or the Health Evidence rating, which scores a study as of weak, moderate or high reliability. As the AMSTAR tool was developed to assess reviews of studies of clinical interventions, not all the criteria apply to systematic reviews of studies on delivery or financial or governance arrangements in health systems. When the denominator is not 11, some aspect of the tool was considered irrelevant for the rates. In comparing ratings, it is therefore important to keep in mind both parts of the score, i.e. the numerator and the denominator. For example, a review that scores 8/8 is generally of comparable quality to a review that scores 11/11; both ratings are considered "high scores." A high score indicates that readers of the review can have a high level of confidence in its findings. A low score does not indicate that the review should be discarded, merely that less confidence can be placed in its findings and that the review should be examined closely to identify its limitations.[1]

The last column gives the proportion of studies that were conducted in Europe, and the fourth column in Annex 1 indicates the local acceptability of the systematic reviews.

All the information in the annex tables was taken into account by the authors of the evidence brief in compiling tables 1–5 in the brief.

Annex 1. Reliability and acceptability of the systematic reviews found for the four policy options according to the AMSTAR or Health Evidence rating

Option	Systematic review	Rating	Local acceptability	Inclusion in policy brief
Option 1. Regulation of food advertising	Enwald HPK, Huotari MLA. Preventing the obesity epidemic by second generation tailored health communication: an interdisciplinary review. J Med Internet Res 2010;12:e24.	AMSTAR: 4/11 (weak)	Not assessed	Not included
	Sharma M. Behavioural interventions for preventing and treating obesity in adults. Obes Rev 2007;8:441–449.	AMSTAR: 2/11 (weak)	Not assessed	Not included
	Chambers SA, Freeman R, Anderson AS, MacGillivray S. Reducing the volume, exposure and negative impacts of advertising for foods high in fat, sugar and salt to children: a systematic review of the evidence from statutory and self-regulatory actions and educational measures. Prev Med 2015;75:32–43.	AMSTAR: 5/11 (moderate)	Acceptable	Included

[1] Lewin S, Oxman AD, Lavis JN, Fretheim A. Support tools for evidence-informed health policymaking (STP): 8. Deciding how much confidence to place in a systematic review. Health Res Policy Syst (in press).

Option	Systematic review	Rating	Local acceptability	Inclusion in policy brief
	Galbraith-Emami S, Lobstein T. The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review. Obes Rev 2013;14:960–974.	AMSTAR: 6/11 (moderate)	Acceptable	Included
	Mills SD, Tanner LM, Adams J. Systematic literature review of the effects of food and drink advertising on food and drink-related behaviour, attitudes and beliefs in adult population. Obes Rev 2013;14:303–314.	AMSTAR: 9/11 (strong)	Acceptable	Included
Option 2. Labelling of sugar-sweetened beverages and raising awareness about their health effects	Golley RK, Hendrie GA, Slater A, Corsini N. Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns – what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness? Obes Rev 2011;12:114–130.	AMSTAR: 7/11 (moderate)	Acceptable	Included
	Kader M, Sundblom E, Elinder LS. Effectiveness of universal parental support interventions addressing children's dietary habits, physical activity and bodyweight: a systematic review. Prev Med 2015;77:52–67.	AMSTAR: 5/11 (moderate)	Acceptable	Included
	Knowlden AP, Sharma M. Systematic review of family and home-based interventions targeting paediatric overweight and obesity. Obes Rev 2012;13:499–508.	AMSTAR: 2/11 (weak)	Not assessed	Not included
	Morris H, Skouteris H, Edwards S, Rutherford L. Obesity prevention interventions in early childhood education and care settings with parental involvement: a systematic review. Early Child Dev Care 2015;185:1283–1313.	AMSTAR: 4/11 (weak)	Not assessed	Not included
	Hersey JC, Wohlgenant KC, Arsenault JE, Kosa KM, Muth MK. Effects of front-of-package and shelf nutrition labeling systems on consumers. Nutr Rev 2013;71:1–14.	AMSTAR: 6/11 (moderate)	Acceptable	Included

Option	Systematic review	Rating	Local acceptability	Inclusion in policy brief
	van't Riet J. Sales effects of product health information at points of purchase: a systematic review. Public Health Nutr 2013;16:418–429.	AMSTAR: 3/11 (weak)	Not assessed	Not included
Option 3. School interventions and nutrition policies	Bautista-Castaño I, Doreste J, Serra-Majem L. Effectiveness of interventions in the prevention of childhood obesity. Eur J Epidemiol 2004;19:617–622.	AMSTAR: 3/11 (weak)	Not assessed	Not included
	De Bourdeaudhuij I, Van Cauwenberghe E, Spittaels H, Oppert JM, Rostami C, Brug J, et al. School-based interventions promoting both physical activity and healthy eating in Europe: a systematic review within the HOPE project. Obes Rev 2010;12:205–216.	AMSTAR: 7/11 (moderate)	Acceptable	Included
	Silveira JAC, de Aguira Carrazedo Taddei JA, Guerra PH, Nobre MRC. The effect of participation in school-based nutrition education interventions on body mass index: a meta-analysis of randomized controlled community trials. Prev Med 2014;61:81–89.	AMSTAR: 7/11 (moderate)	Acceptable	Included
	Chriqui JF, Pickel M, Story M. Influence of school competitive food and beverage policies on obesity, consumption and availability. JAMA Pediatr 2014;168:279–286.	AMSTAR: 6/11 (moderate)	Not acceptable. All the studies were conducted in the USA and were on state laws and district policies for foods and beverages. Nearly all the studies were cross-sectional, included different age groups (elementary, middle or high school), with limited lags between the policy date and the outcomes examined.	Not included
	Jamie PC, Lock K. Do school based food and nutrition policies improve diet and reduce obesity? Prev Med 2009;48:45–53.	Health Evidence: moderate	Acceptable	Included

Option	Systematic review	Rating	Local acceptability	Inclusion in policy brief
	Driessen CE, Cameron AJ, Thornton LE, Lai SK, Barnett LM. Effect of changes to the school food environment on eating behaviours and/or body weight in children: a systematic review. Obes Rev 2014; 15:968–982.	Health Evidence: strong	Acceptable	Included
	Johnson T, Weed LD, Touger-Decker R. School-based interventions for overweight and obesity in minority school children. J Sch Nurs 2012;28:116–123.	Health Evidence: weak	Not assessed	Not included
	Kelishadi R, Azizi-Soleiman F. Controlling childhood obesity: a systematic review on strategies and challenges. J Res Med Sci 2014;19:993–1008.	Health Evidence: moderate	Acceptable	Included
	Niebylski ML, Lu T, Campbell NRC, Arcand J, Schermel A, Hua D, et al. Healthy food procurement policies and their impact. Int J Environ Res Public Health 2014;11;2608–2627.	Health Evidence: moderate	Not acceptable Studies conducted in different settings, with different durations, age groups and educational components	Not included
	Steyn NP, Lambert EV, Parker W, Mchiza Z, De Villiers A. A review of school nutrition interventions globally as an evidence base for the development of the HealthKick programme in the Western Cape, South Africa. S Afr J Clin Nutr 2009;22:145–152.	AMSTAR: 3/11 (weak)	Not assessed	Not included
	Van Cauwenberghe E, Maes L, Spittaels H, van Lenthe FJ, Brug J, Oppert J, De Bourdeaudhuij I. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and "grey" literature. Br J Nutr 2010;103:781–797.	Health Evidence: strong	Not acceptable. The authors excluded interventions not designed for primary prevention and studies that did not report effects on dietary behaviour and anthropometrics.	Not included

Option	Systematic review	Rating	Local acceptability	Inclusion in policy brief
	Verrotti A, Penta L, Zenzeri L, Agostinelli S, De Feo P. Childhood obesity: prevention and strategies of intervention. A systematic review of school-based interventions in primary schools. J Endocrinol Invest 2014;37:1155–1164.	Health Evidence: weak	Not assessed	Not included
	Verstraeten R, Roberfroid D, Lachat C, Leroy JL, Holdsworth M, Maes L, et al. Effectiveness of preventive school-based obesity interventions in low- and middle-income countries: a systematic review. Am J Clin Nutr 2012;96:415–438.	AMSTAR: 8/11 (strong)	Acceptable	Included
	Levy DT, Friend KB, Wang YC. A review of the literature on policies directed at the youth consumption of sugar sweetened beverage. Adv Nutr 2011; 2:182S–200S.	AMSTAR: 5/11 (moderate)	Acceptable	Included
	Avery A, Bostock L, McCullough F. A systematic review investigating interventions that can help reduce consumption of sugar-sweetened beverages in children leading to changes in body fatness. J Hum Nutr Diet 2015;28:52–64.	Health Evidence: moderate	Acceptable	Included
Option 4. Imposing taxes for sugar-sweetened beverages, subsidizing other food groups and/or substituting alternative beverages	Escobar MAC, Veerman JL, Tollman SM, Bertram MY, Hofman KJ. Evidence that a tax on sugar sweetened beverages reduces the obesity rate: a meta-analysis. BMC Public Health 2013;13:1072.	AMSTAR: 5/11 (moderate)	Acceptable	Included
	Maniadakis N, Kapaki V, Damianidi L, Kourlaba G. A systematic review of the effectiveness of taxes on nonalcoholic beverages and high-in-fat foods as a means to prevent obesity trends. Clinicoecon Outcomes Res 2013;5:519–543.	AMSTAR: 3/11 (weak)	Not assessed	Not included

Option	Systematic review	Rating	Local acceptability	Inclusion in policy brief
	Powell LM, Chriqui JF, Khan T, Wada R, Chaloupka FJ. Assessing the potential effectiveness of food and beverage taxes and subsidies for improving public health: a systematic review of price, demand and body weight outcomes. Obes Rev 2013;14:110–128.	AMSTAR: 3/11 (weak)	Not assessed	Not included
	Niebylski ML, Redburn KA, Duhaney T, Campbell NR. Healthy food subsidies and unhealthy food taxation: a systematic review of the evidence. Nutrition 2015; 31:787–795.	Health Evidence: moderate	Acceptable	Included
	Powell LM, Chaloupka FJ. Food prices and obesity: evidence and policy implications for taxes and subsidies. Milbank Q 2009; 87:229–257.	Health Evidence: weak	Not assessed	Not included
	Ruopeng A. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. Public Health Nutr 2013;16:1215–1228.	Health Evidence: moderate	Acceptable	Included
	Thow AM, Jan S, Leeder S, Swinburn B. The effect of fiscal policy on diet, obesity and chronic diseases: a systematic review. Bull World Health Organ 2010;88:609–614.	AMSTAR: 6/11 (moderate)	Acceptable	Included
	Zheng M, Allman-Farinelli M, Heitmann BL, Rangan A. Substitution of sugar-sweetened beverages with other beverage alternatives: a review of long-term health outcomes. J Acad Nutr Diet 2015; 115:767–779.	AMSTAR: 6/11 (moderate)	Acceptable	Included

Annex 2. Summary of systematic reviews relevant to option 1, regulation of food advertising

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Galbraith-Emami S, Lobstein T. The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review. Obes Rev 2013;14:960–974. Marketing of food and beverages to children	Changes in children's exposure to marketing of food and beverages, especially those high in sugar, fats or salt, after introduction of regulation or self-regulatory pledges. Also, absolute levels of exposure in recent years	Evidence of continuing, extensive promotion of less healthy food products, with wide exposure of children. Small or no reduction in recent years, except in response to statutory regulations. A narrow range of media, weak definitions of marketing, the absence of many large food companies and the lack of enforceability or penalties for failure suggest that self-regulatory pledges are unlikely to reduce children's exposure to promotional marketing of unhealthy food products unless tied to stronger government oversight. Comprehensive, preferably statutory measures are recommended, with adequate monitoring of compliance and adequate sanctions for non-compliance, based on government definitions of the media to be used, the products to be controlled and the population to be protected.	AMSTAR: 6/11 (moderate)	21 policy papers from 21 countries or regions; 57% from Europe

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Chambers SA, Freeman R, Anderson AS, MacGillivray S. Reducing the volume, exposure and negative impacts of advertising for foods high in fat, sugar and salt to children: a systematic review of the evidence from statutory and self-regulatory actions and educational measures. Prev Med 2015;75:32–43. Advertising foods to children and advertising literacy	Effectiveness of policy in reducing the volume, exposure and negative impacts of advertising of foods high in fat, sugar and salt to children and the role of educational measures	Statutory regulation might be effective. The results of seven of nine studies of actual situations indicated that statutory regulation had reduced the volume of or exposure to advertising of foods high in fats, sugars and salt and the purchase of these foods. The results of the studies on self-regulation were varied and did not allow firm conclusions on the effect. There were clear differences in the results of studies funded by industry and those funded by national research bodies, government and advocacy groups: studies funded by industry found that the initiatives were effective. Government and other leadership could result in robust standards for monitoring compliance. Useful standardized outcomes could include consumption behaviour, health outcomes, exposure to advertising, advertising expenditure and valid nutrient criteria. Limited support was found for the effect of educational measures for parents and children. Little evidence was found that advertising literacy is effective against advertising of foods high in fats, sugars and salt. Particularly important is recognition that change may be long-term and cumulative. While no single intervention can be expected to have a large impact on a child's risk for overweight, at least in the short term, reducing the volume of and children's exposure to advertising of foods high in fats, sugars and salt can be justified as a precautionary policy.	AMSTAR: 5/11 (moderate)	Of 47 studies included, 19 were on statutory regulations (5 from Europe), 25 on self-regulation (4 from Europe) and 6 on educational regulations (1 from Europe). The topics and settings of the remaining 3 studies were not reported.

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Mills SD, Tanner LM, Adams J. Systematic literature review of the effects of food and drink advertising on food and drink-related behaviour, attitudes and beliefs in adult population. Obes Rev 2013; 14:303–314. Advertising of foods to adults	Experimental evidence for the effects of food advertising on food-related behaviour, attitudes and beliefs in adult populations. All of the studies reviewed referred to television food advertising.	The potential effects of food advertising on adults cannot be ignored and merit further research. Adult women may be more strongly influenced by food advertising than men because of a greater likelihood of influence from normative cues, restrictive eating patterns and associated increased attention to food cues.	AMSTAR: 9/11 (strong)	All 9 studies in the review were conducted in economically developed countries (France, the Netherlands and the USA).

Annex 3. Summary of systematic reviews relevant to option 2, labelling of sugar-sweetened beverages and raising awareness about their health effects

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Golley RK, Hendrie GA, Slater A, Corsini N. Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns – what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness? Obes Rev 2011; 12:114–130. Counselling	Interventions targeting parents to improve children's weight and dietary and/or activity patterns	General healthy eating and food choice behaviour were most frequently targeted. Most programmes to prevent obesity in children have been in schools, with limited success, particularly in the long term. Interventions in which support was given tended to be of better quality. Most interventions were based on behavioural or ecological (environmental) models of behaviour change. Behaviour change techniques that support prevention and management of relapse should be included in interventions.	AMSTAR: 7/11 (moderate)	Of 17 studies included, 2 were carried out in Belgium, 1 in Canada, 3 in Finland, 1 in France, 1 in the United Kingdom and 9 in the USA. Thus, 41% of the studies were conducted in Europe.
Kader M, Sundblom E, Elinder LS. Effectiveness of universal parental support interventions addressing children's dietary habits, physical activity and bodyweight: A systematic review. Prev Med 2015,77:52–67 Counselling	Effectiveness of parental support to promote healthy dietary habits, physical activity or prevent overweight and obesity among children Effectiveness in relation to family socioeconomic position	Interventions to improve diet were more successful than those to increase physical activity. In developed countries, people of lower socioeconomic position have higher obesity rates than those with higher education and income. Intensive support to parents of low socioeconomic position in group interventions gave promising results. The most effective intervention was long-term individual biannual counselling. Shorter individual parent counselling, face-to-face or by telephone, was the most effective for changing children's diets.	AMSTAR: 5/11 (moderate)	Of the 35 studies included, 4 were conducted in Australia, 4 in Belgium, 2 in Canada, 1 in China, 6 in Finland, 1 in France, 1 in Italy, 3 in the United Kingdom and 13 in the USA; thus, 43% were conducted in Europe.

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Hersey JC, Wohlgenant KC, Arsenault JE, Kosa KM, Muth MK. Effects of front-of-package and shelf nutrition labeling systems on consumers. Nutr Rev 2013;71:1–14. Front-of-package labelling	Effects of front-of-package labelling systems on consumer response (attention and processing, understanding, reported and observed use and likely purchase and consumption.	Consumers more easily interpret and select healthier products with nutrient-specific front-of-package labels with text, symbols and colour indicating nutrient levels than labels that give only numerical information, such as "guideline daily amount" expressed as percentages or in grams. Summary systems (single or multiple icons or a "traffic light" system (e.g. colour codes signifying high, medium or low levels of each nutrient) may encourage consumers to purchase healthier products. More research should be conducted on the influence of nutrient-specific labels on consumers' purchases.	AMSTAR: 6/11 (moderate)	Of the 38 studies, 2 were conducted in Australia, 1 in Canada, 18 in the European Union 4 in New Zealand and 13 in the USA. Thus, 47% were conducted in Europe (France, Greece, Hungary, Germany, Italy, Netherlands, Poland, Sweden, United Kingdom).

Annex 4. Summary of systematic reviews relevant to option 3, school interventions and nutrition policies

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
De Bourdeaudhuij I, Van Cauwenberghe E, Spittaels H, Oppert JM, Rostami C, Brug J, Van Lenthe F, et al. School-based interventions promoting both physical activity and healthy eating in Europe: a systematic review within the HOPE project. Obes Rev 2010;12(3):205–216. School interventions	Effectiveness of school interventions targeting diet and physical activity in primary (6–12 years) and secondary (12–18 years) schoolchildren in Europe. Interventions were evaluated in terms of behavioural determinants, diet and physical activity and weight (BMI or other indicator of obesity).	Combining educational and environmental components had better, more relevant effects. Multicomponent programmes gave more favourable results than those with only education. Computer-based, personalized education in the classroom had better results than the generic classroom curriculum. Environmental interventions might include organized physical activities during breaks or before and after school; greater availability of physical activity opportunities in and around school, longer physical education lesson time, better availability or accessibility of healthy food options and restricted availability and accessibility of unhealthy food options.	AMSTAR: 7/11 Health Evidence: moderate	Of the 11 studies included, 6 were in primary schools and 5 in secondary schools. All the studies were conducted in Europe: most in western Europe (Belgium, Germany, Netherlands, United Kingdom), some in southern Europe (Greece, Italy) and one in northern Europe (Norway).
Silveira JAC, de Aguira Carrazedo Taddei JA, Guerra PH, Nobre MRC. The effect of participation in school-based nutrition education interventions on body mass index: a meta-analysis of randomized controlled community trials. Prev Med 2014;61:81–89. School interventions	Effectiveness of school nutrition education in reducing or preventing overweight and obesity among children and adolescents. The first systematic review with a meta-analysis only of randomized controlled trials on school nutrition education, no limit on the date of publication and with BMI as the primary outcome.	School nutrition education is effective in reducing children's and adolescents' BMI, regardless of the components and especially if the duration is longer than one school year. A less intensive, multicomponent intervention repeated for longer period is more likely to create behavioural change, resulting in better anthropometric outcomes.	AMSTAR: 7/11 Health Evidence: moderate	The 8 studies eligible for a random-effects meta-analysis were conducted in 7 countries in the Americas, Asia and Europe among pupils from low- , middle- and high-income families in different cultural and socioeconomic contexts. 63% of the studies were conducted in Europe.

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Jamie PC, Lock K. Do school based food and nutrition policies improve diet and reduce obesity? Prev Med 2009;48:45–53. School interventions	Effectiveness of school food and nutrition policies in improving the school food environment and pupils' dietary intake and in decreasing overweight and obesity in preschools and primary and secondary schools. Three categories of food or nutrition policy: guidelines, regulation of food and/or beverage availability and price interventions	The most effective interventions combined nutrition guidelines and price changes. Evidence for the effectiveness of regulation of food and beverage availability was more limited. Only two studies suggested a small, significant decrease in the sale of foods of minimal nutritional value after a regulation limiting access to vending machines and control of the portion size of sweetened drinks and snacks. Regulations on a single unhealthy food are less likely to be effective than those implemented as part of the whole diet. Some school policies have been effective in improving the food environment and dietary intake in schools, but their impact on BMI has rarely been evaluated.	Moderate (Health evidence assessment) Health Evidence: moderate	Of the 18 included, 6 were conducted in Europe and 12 in the USA. Thus, 33% of the studies were conducted in Europe.
Driessen CE, Cameron AJ, Thornton LE, Lai SK, Barnett LM. Effect of changes to the school food environment on eating behaviours and/or body weight in children: a systematic review. Obes Rev 2014;15:986–982. School interventions	Effect of isolated food environment interventions on eating behaviour (including food purchasing) and body weight	17 of 18 studies found a positive outcome on BMI (or change in BMI) or the amount of healthy food sold or consumed. A school environment supportive of healthy eating is essential to combat heavy marketing of unhealthy food. Modification of the school food environment (including high-level policy changes at state or national level) can improve eating behaviour.	Health Evidence: strong	Of the 16 studies (18 reports), 4 were conducted in the United Kingdom and 14 in the USA. Thus, 22% of the studies were conducted in Europe.

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Levy DT, Friend KB, Wang YC. A review of the literature on policies directed at the youth consumption of sugar sweetened beverage. Adv Nutr 2011;2:182S–200S. School interventions	Effectiveness of school nutrition policies and price interventions on consumption of sugar-sweetened beverages by young people.	School nutrition and price policies reduced consumption of sugar-sweetened beverages, associated with a reduction in energy intake, which can influence BMI. Policies to reduce the consumption of sugar-sweetened beverages can play an important role in reducing overweight and obesity among young people.	AMSTAR: 5/10 (moderate)	Of the 23 studies included, 1 was conducted in Belgium, 1 in Brazil, 1 in Canada, 1 in the Netherlands, 2 in the United Kingdom and 17 in the USA. Thus, 17% of the studies were conducted in Europe.
Avery A, Bostock L, McCullough F. A systematic review investigating interventions that can help reduce consumption of sugar-sweetened beverages in children leading to changes in body fatness. J Hum Nutr Diet 2015;28:52–64. School interventions	Effectiveness of school interventions to reduce consumption of sugar-sweetened beverages by children and subsequent changes in body fat	Six interventions (of eight included) achieved significant reductions in sugar-sweetened beverage intake. Education programmes for reducing sugar-sweetened beverage consumption that include follow-up are effective and sustainable. Peer support and changing the school environment (e.g. providing water or replacement drinks) to support educational programmes could improve their effectiveness.	Health Evidence: moderate	Of the 8 studies included, 2 were conducted in Brazil, 1 in England, 1 in Germany, 3 in the Netherlands and 1 in the USA. Thus, 63% of the studies were conducted in Europe.
Kelishadi R, Azizi-Soleiman F. Controlling childhood obesity: a systematic review on strategies and challenges. J Res Med Sci 2014; 19:993–1008. Multidimension intervention including involvement of children's families, eating and physical activity behaviour, counselling	Various family, school and clinic interventions among obese children aged 2–18 years. Of 105 relevant publications, 70 reported studies conducted as high-quality clinical trials.	School programmes can have long-term effects in a large target group. A multidisciplinary approach in schools in which children's families are involved may be the most effective, sustainable approach for managing childhood obesity. Experts recommend specific eating and physical activity behaviour through counselling, with nutrition education, changing dietary habits and increasing physical activity in structured programmes. The effects of such interventions are maintained for several years.	Health Evidence: moderate	39% of the studies were conducted in Europe, including 2 in Finland and 5 in Sweden.

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Verstraeten R, Roberfroid D, Lachat C, Leroy JL, Holdsworth M, Maes L, Kolsteren PW. Effectiveness of preventive school-based obesity interventions in low- and middle-income countries: a systematic review. Am J Clin Nutr 2012;96(2): 415–438. Multicomponent education delivered by teachers, with additional physical activity sessions or classes about healthy foods, nutrition or physical activity	Effectiveness of school interventions targeting dietary behaviour and/or physical activity for primary prevention of obesity in children aged 6–18 years in low- and middle-income countries.	School interventions can improve dietary and physical activity behaviour and prevent unhealthy body weights in low- and middle-income countries. Interventions that changed both proximal and distal outcomes were generally multicomponent education interventions delivered by teachers, with additional physical activity sessions or classes about healthy foods, nutrition or physical activity. Most of the interventions (82%) had a positive effect on dietary and physical activity behaviour. BMI decreased in 8 studies.	AMSTAR: 8/11	Of the 25 studies included, most were conducted in Asia and Latin America (Brazil, Chile, China, Hungary, India, Mexico, Russian Federation, South Africa, Thailand, Trinidad and Tobago) Only 2 studies (8%) were conducted in Europe (Hungary, Russian Federation).

Annex 5. Summary of systematic reviews relevant to option 4, imposing taxes on sugar-sweetened beverages, other food groups and/or substituting alternative beverages

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Escobar MAC, Veerman JL, Tollman SM, Bertram MY, Hofman KJ. Evidence that a tax on sugar sweetened beverages reduces the obesity rate: a meta-analysis. BMC Public Health 2013;13:1072. Imposing taxes on sugar-sweetened beverages	Effectiveness of increasing the price of sugar-sweetened beverages on consumption, obesity and overweight and BMI	Increasing the price of sugar-sweetened beverages decreases consumption; the higher the price increase, the greater the reduction in consumption. As the price of sugar-sweetened beverages rises, consumption of fruit juices and whole milk tends to increase and consumption of diet drinks decreases. These alternative beverages are probably better for health than sugar-sweetened beverages. The few available studies suggest that raising the price of sugar-sweetened beverages results in modest reductions in body weight.	AMSTAR: 5/11 (moderate)	Of 32 articles in English, 15 presented quantitative data and 17 reported qualitative data. Of the 9 studies included in the meta-analysis, 1 was conducted in Brazil, 1 in France, 1 in Mexico and 6 in the USA. Thus, 11% were conducted in Europe.
Niebylski ML, Redburn KA, Duhaney T, Campbell NR. Healthy food subsidies and unhealthy food taxation: A systematic review of the evidence. Nutrition 2015,31(6): 787–795 Taxies and subsidies	Effect of healthy food and beverage subsidies and taxation of unhealthy foods and beverages Included studies of effects on: nutrition-related health indicators, including blood pressure, BMI, blood lipids or glucose; healthy food purchases (fruits and vegetables); and increased consumption of healthier foods and reduced consumption of unhealthy foods, including sugar-sweetened beverages	Supports healthy food subsidies and unhealthy food taxation on a population-wide basis. In the absence of contradictory evidence or rationale, it is recommended that these measures be implemented and evaluated in a variety of populations and settings, especially where food is purchased by government or nongovernmental organizations. Prior or simultaneous ancillary education, marketing of healthy eating and supportive pricing policies are likely to be critical factors for success.	Health Evidence: moderate	78 (of 1174) articles included and placed in five categories of design or intent (cost-effectiveness, modelling, empirical studies, experimental studies, miscellaneous) Studies, reviews and predictive models for adults and children in Australia, Canada, western Europe, New Zealand and the USA

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Ruopeng A. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. Public Health Nutr 2013;16: 1215–1228 Subsidies on healthier products	Effectiveness of monetary subsidies in promoting healthier food purchases and consumption, addressing: (1) Are subsidies effective in promoting healthier food purchases and consumption? (2) What level of subsidy is required to be effective? (3) Is there evidence of a dose–response relation? (4) Does the effectiveness differ by population subgroup? (5) Are subsidies more or less effective than other interventions? (6) Does the impact remain after withdrawal of the incentive?	Subsidizing healthier foods tends to be effective in modifying dietary behaviour. All but one study indicated that subsidies on healthier foods significantly increase the purchase and consumption of promoted products. Policy-makers are poorly informed about the potential for large-scale application of subsidies on healthier foods, as none of the reviewed studies explicitly measured the cost–effectiveness of the interventions or evaluated the potential impact on the food industry.	Health Evidence: moderate	Of the 20 experiments included, 4 were conducted in Europe, 1 in New Zealand, 1 in South Africa and 14 in the USA. Thus, 20% were conducted in Europe (1 in France, 1 in Germany, 1 in Netherlands and 1 in the United Kingdom).
Thow AM, Jan S, Leeder S, Swinburn B. The effect of fiscal policy on diet, obesity and chronic diseases: a systematic review. Bull World Health Organ 2010; 88:609–614 Subsidies on healthier products and/or applying taxes on unhealthy products	Effects of subsidies or taxes levied on specific food products on consumption habits, body weight and chronic conditions	Taxes and subsidies influenced consumption in the desired direction, higher taxes being associated with more significant changes in consumption, body weight and disease incidence. Studies on a single target food or nutrient might have overestimated the impact of taxes by failing to take into account shifts in consumption to other foods. The quality of the evidence was generally low, and it provides inadequate evidence for informing policy-making. Only six studies had observational data; the others used predictive models. Studies of taxes on soft drinks were the most common (10 studies).	AMSTAR: 6/11 (moderate)	Of the 24 studies included, 1 was conducted in Egypt, 10 in Europe and 13 in the USA. Thus, 42% were conducted in Europe (2 in Denmark, 1 in France, 1 in Ireland, 1 in Norway, 1 in Scotland, 1 in Sweden and 3 in the United Kingdom). All except one study were conducted in high-income countries.

Reference and option element	Focus of systematic review	Main findings	Rating	Proportion of studies conducted in Europe
Zheng M, Allman-Farinelli M, Heitmann BL, Rangan A. Substitution of sugar-sweetened beverages with other beverage alternatives: a review of long-term health outcomes. J Acad Nutr Diet 2015, 115(5):767–779 Substitution of sugar-sweetened beverages with alternative beverages	Long-term health outcomes of substitution of sugar-sweetened beverages with alternative beverages	Although there are few studies on this topic, the evidence suggests a potential beneficial effect on body weight of replacing sugar-sweetened beverages with water or low-calorie beverages. Various beverage alternatives were associated with long-term lower energy intake and lower weight gain.	AMSTAR: 6/11 (moderate)	Of the 10 studies included, 1 was conducted in Chile and 9 in the USA.

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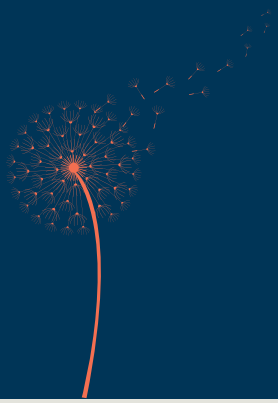

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