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Taxation of unprocessed sugar or sugar-added foods for reducing their consumption and preventing obesity or other adverse health outcomes (Protocol)

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[Intervention Protocol]

Taxation of unprocessed sugar or sugar-added foods for reducing their consumption and preventing obesity or other adverse health outcomes

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ABSTRACT

This is the protocol for a review and there is no abstract. The objectives are as follows:

To assess the effects of taxation of unprocessed sugar or sugar-added foods in the general population on the:

1. consumption of unprocessed sugar or sugar-added foods;
2. prevalence and incidence of overweight and obesity; and
3. prevalence and incidence of diet-related health conditions.

BACKGROUND

Description of the condition

Preventive action and interventions are urgently needed to curb the obesity epidemic and its detrimental health impacts (WHO 2000). Overweight and obesity are serious global public health issues, with increasing prevalences in low-, middle-, and high-income countries (De Onis 2010; James 2004; WHO 2000). Ac-

cording to the most recent report from the World Health Organization (WHO) (WHO 2014), the global prevalences of overweight (body mass index (BMI) $\geq$ 25) are 38% for men and 40% for women, and for obesity (BMI $\geq$ 30), 11% for men and 14% for women. In some African countries, prevalences of overweight and obesity are comparatively low at 16% and 3%, respectively, whereas in the Pacific Islands, prevalences for overweight and obesity are alarming, at up to 81% and 51%, respectively. In 2013, about 42 million children (under 5 years) were estimated to be overweight. Prevalences of childhood overweight and obesity are growing rapidly, specifically in low- and lower-middle income countries. Overweight and obesity are major risk factors for morbidity and mortality, accounting for about 3.4 million deaths per year and 93.6 million disability-adjusted life years (DALYs) worldwide (WHO 2014). From a global perspective, obesity- and overweight-associated morbidity and mortality rates are, generally speaking, lower in middle- and high-income countries than in low-income countries (Dinsa 2012; Drewnowski 2004; Ng 2014; Robroek 2013; Salois 2012; Valera 2015; WHO 2009).

Within a country, the distribution of overweight and obesity usually follows a social gradient, generally with higher prevalences of overweight and obesity observed in people with a lower socioeconomic status (SES). However, in some low-income countries, such as Cameroon and many Pacific Island countries and territories, overweight and obesity are more prevalent in people with a higher SES. In some low- and middle-income countries (e.g. China), the relationship of SES with overweight and obesity, respectively, is unclear (Dinsa 2012; McLaren 2007; Ogden 2015; Wang 2012).

Across the globe, major dietary shifts occur, resulting in nutritional transitions. Nutritional transitions - reflecting changes in diet, physical activity and health - are major components of the globally increasing prevalences of overweight and obesity. In the last four decades, food consumption by calories rose by about 400 calories per person a day on average across the globe. However, the main sources of calorie intake greatly differ between developing and industrial countries. In developing countries, calorie consumption increased between 1963 and 2003 for sugar (by 127%), meat (by 119%), and vegetable oils (by 199%), while in industrial countries, only consumption of vegetable oils increased substantially (by 105%). In China - a major developing country that was classified as an upper-middle income country by the World Bank for the 2016 fiscal year - dramatic nutritional transitions have been observed over the past four decades, resulting in consumption increases of sugar (by 305%), meat (by 349%), and vegetable oils (by 680%) (Kearney 2010; World Bank 2015). However, inside a country such as China, these changes occur more rapidly among people with lower incomes (Popkin 2002). Consumption of sugar notably increased in developing countries with lower incomes, particularly in Asia, Latin America and Africa. In high-income settings, time trends of sugar consumption show regional differences: thus, some industrialised high-income regions, such as North America, show declines in sugar intake, whereas in Europe, consumption of sugar increased modestly (Kearney 2010). The prevalence of obesity and overweight is substantially higher among indigenous populations (e.g. Aboriginal communities) than among the rest of the national populations. A major cause might be excessive consumption of sugar, sugar-sweetened beverages (SSBs), and white flour among indigenous populations (Lee 1994). However, across the globe, indigenous populations underwent an extreme nutritional transition in recent decades. Dietary changes include consumption of less traditional foods that are high in sugar, fat and carbohydrates, and more vitamins, proteins, zinc and magnesium (Kuhnlein 2004). The Third Strategic Report of the Mediterranean Diet Surveillance System has shown that European Mediterranean countries underwent a 'westernisation' of nutritional patterns. Consumption of vegetables declined, but intake of sugar, sweeteners, oil, and meat increased. In contrast, countries in Northern Europe transited into healthier nutritional patterns (Vareiro 2009).

Unprocessed sugar and sugar-added foods play a major role in the causal chain of overweight and obesity. We define unprocessed sugar for the purpose of this review - on the basis of the definitions of "sugars" and "free sugars" given below- as monosaccharides (such as glucose, fructose, and galactose), disaccharides (such as lactose, maltose, sucrose and honey) and higher saccharides (such as cellulose).

Traditionally, the term "sugars" describes mono- and disaccharides (FAO/WHO 1998). Monosaccharides include fructose, galactose, and glucose. Disaccharides include lactose, maltose, sucrose, and trehalose. Some sweeteners, such as corn syrups, mainly consist of higher saccharides. In 2002, the Joint WHO and Food and Agriculture Organization of the United Nations (FAO) Expert Consultation introduced the term "free sugars" (Amine 2002). In 2015, the term was elaborated for the WHO guideline on sugar intake for adults and children. "Free sugars" are defined as mono- and disaccharides (such as lactose, maltose, sucrose and honey) that are added to foods (WHO 2015a).

We define "sugar-added foods" for the purpose of this review - on the basis of the following definitions - as non-liquid food products (i.e. this review does not include drinks) that contain artificially-added sugar in various quantities, where sugar refers to monosaccharides (such as glucose, fructose, and galactose), disaccharides (such as lactose, maltose, sucrose and honey) and higher saccharides (such as cellulose).

Based on the definition of the US Department of Agriculture (USDA), added sugars are sugars and natural products with higher contents of sugar, such as honey, that are added to foods during processing or preparation. In the preparation of a food product, sugars can be processed in any way, e.g. baked or cooked. Added sugar mainly appears in cakes, cookies, desserts, pies, and candy. "Specifically, added sugars include white sugar, brown sugar, raw sugar, corn syrup, corn-syrup solids, high-fructose corn syrup, maple syrup, pancake syrup, fructose sweetener, liquid fructose, honey, molasses, anhydrous dextrose, and crystal dextrose. Added

sugars do not include naturally occurring sugars such as lactose in milk or fructose in fruits" (USDA/HHS 2000).

Overweight and obesity are defined as an excess of adipose tissue in one's body - arising from an imbalance between energy intake and expenditure - due to diverse genetic, environmental, cultural, behavioral, and economic factors (Kopelman 2007; WHO 2015b). Increased energy intake results from overconsumption and surplus quantities of high-caloric foods. Unprocessed sugar and sugar-added foods are a main source of excessive calorie intake (Bowman 2004; Popkin 2003). Thus, a sugar-rich diet and less physical activity may cause overweight and obesity, resulting directly in alterations in blood pressure (e.g. hypertension), dyslipidaemia, peripheral insulin resistance, inflammation, and dental caries (Kopelman 2007; Moynihan 2014; WHO 2015b). These adverse effects of overweight and obesity may lead to numerous severe health impairments which can affect many bodily systems, including disorders of the cardiovascular (e.g. ischaemic heart disease), gastrointestinal (e.g. bowel cancer), musculoskeletal (e.g. osteoarthritis), endocrine (e.g. type 2 diabetes mellitus), and respiratory (e.g. obstructive sleep apnoea) systems (Aronne 2002). In addition to its contribution to specific diseases, obesity can also negatively impact the psychological well-being of individuals, and adversely impact societies (through, for example, inhibiting economic productivity and increasing demands on healthcare resources) (Colditz 1999; Wardle 2005). Overweight and obesity in childhood and adolescence are associated with increased risks of overweight and obesity in adulthood (Power 1997). Thus, early development of overweight and obesity has substantial and long-lasting consequences for a person's physical and mental health status (Must 1999).

Overweight and obesity are the most often cited effects of a sugar-rich diet. However, the effects of a sugar-rich diet are far-reaching. For instance, in the USA, dental caries is one of the most prominent childhood diseases with a minimum of one filing or caries lesion among 77.1% of the children aged 0 to 17 years (Touger-Decker 2003). Worldwide, one in ten people is affected by diabetes (Basu 2013).

Different anthropometric measures, including body weight, BMI, skinfold thickness, bone-mineral density, waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR), are used to evaluate overweight and obesity. Useful measures are also derived from more advanced measurement tools, such as bioelectrical impedance analysis (BIA), magnetic resonance imaging (MRI), isotope dilution analysis (IDA), ultrasound and computed tomography (CT) (WHO 2000).

Overweight and obesity incur both direct costs (e.g. disease-related preventive, treatment and diagnosis service costs) and indirect costs (e.g. disease-related costs of lost productivity) (Van Nuys 2014; Wolf 1998). A systematic review on the direct costs of obesity estimated that it accounts on average for 0.7% to 2.8% of a country's total healthcare expenditure (Withrow 2011). In the USA, 5% (equal to 120.1 billion US dollars) to 10% of the total healthcare costs arise as a consequence of overweight and obesity (Tsai 2011). Indirect costs of overweight and obesity are higher than direct costs, accounting for 54% to 59% of the total cost estimates (Dee 2014). Moreover, a systematic review reports on overweight and obesity affecting wage penalties specifically in white females in the USA. Weight differences of two standard deviations (about 65 pounds) were found to result in a wage difference of 9% (Cawley 2004).

Description of the intervention

Food-related fiscal policies

Food-related fiscal policies may either aim to lower prices (e.g. subsidisation) or increase prices for specific goods (e.g. taxation). We will evaluate the effects of imposed taxes on unprocessed sugar and sugar-added foods. The Organization for Economic Co-Operation and Development (OECD) defines taxes as "compulsory unrequited payments to general government" (OECD 2014). There are two types of taxes on products: (1) indirect taxes levied within national borders (e.g. sales tax, value added tax (VAT), excise tax), and (2) import taxes including custom duties and import sales taxes (Fletcher 2010; Meessen 2007; Mytton 2012).

Indirect taxes are paid by the consumer, collected by the seller or intermediary, and forwarded to government. Sales taxes - as one form of indirect taxes - are paid by the consumer at the moment of purchase of the taxed goods and services. Sales taxes are frequently-implemented tax interventions to reduce the consumption of a specific good, such as unprocessed sugar or sugar-added foods (Brownell 2009). The VAT is the most popular tax across the globe and the major form of indirect tax. The term "VAT" is used as a synonym for "goods and service tax". The underlying principle of the VAT system includes "the application to goods and services of a general tax on consumption exactly proportional to the price of the goods and services" (Schenk 2015). The VAT is more commonly applied to different food categories as compared to targeted food taxes (Mytton 2007). The level of a sales tax may differ according to the type of product and service. Sales taxes and VAT are added to the price of an item and they do not consider the volume of the item. Thus, goods of a larger size are comparably cheaper than the same goods of smaller sizes, resulting in a lower impact of the tax in goods with larger package sizes. An excise tax is an inland tax on the (production for) sale and the goods produced for sale. In contrast to indirect taxes, custom duties are taxes applied to imported products. The Cook Islands and Fiji implemented custom duties (also called "border taxes") on SSBs to increase the cost of these drinks and to fight the obesity epidemic (Snowdon 2013). Import sales taxes are applied similarly. An import sales tax is a tax on goods imported from countries which are not a contracting party of the importing country (Cnossen 1993). All taxes may encourage reformulation of the taxed item.

Fiscal policies such as excise taxes on food have been proposed, developed and implemented, generally with the goal of curbing overweight and obesity, but sometimes also for the purpose of increasing governmental revenue (Kim 2006). Taxes raise revenue for government and these revenues may or may not be hypothecated for public health programs. These types of food taxation policies include taxes on salt, fats, SSBs, and unprocessed sugar or sugar-added foods (other than beverages) more generally. This review will focus specifically on the taxation of unprocessed sugar and sugar-added foods.

The underlying policy and economic rationale for implementing food taxation policies, including those on unprocessed sugar and sugar-added foods, is a government's motivation to create or increase a financial charge for a specific good in order to increase consumer prices and usually also to raise revenues. This may lead to a decrease in demand with the intention to reduce the intake of this food product by changing consumption patterns (Ecorys 2014). As a response to the implementation of a tax on unprocessed sugar or sugar-added foods, food industries may reformulate their products (Brownell 2009). This may lead to products with lower added sugar content. However, this reformulation of the product may make it even unhealthier, e.g. by adding other ingredients, such as fat.

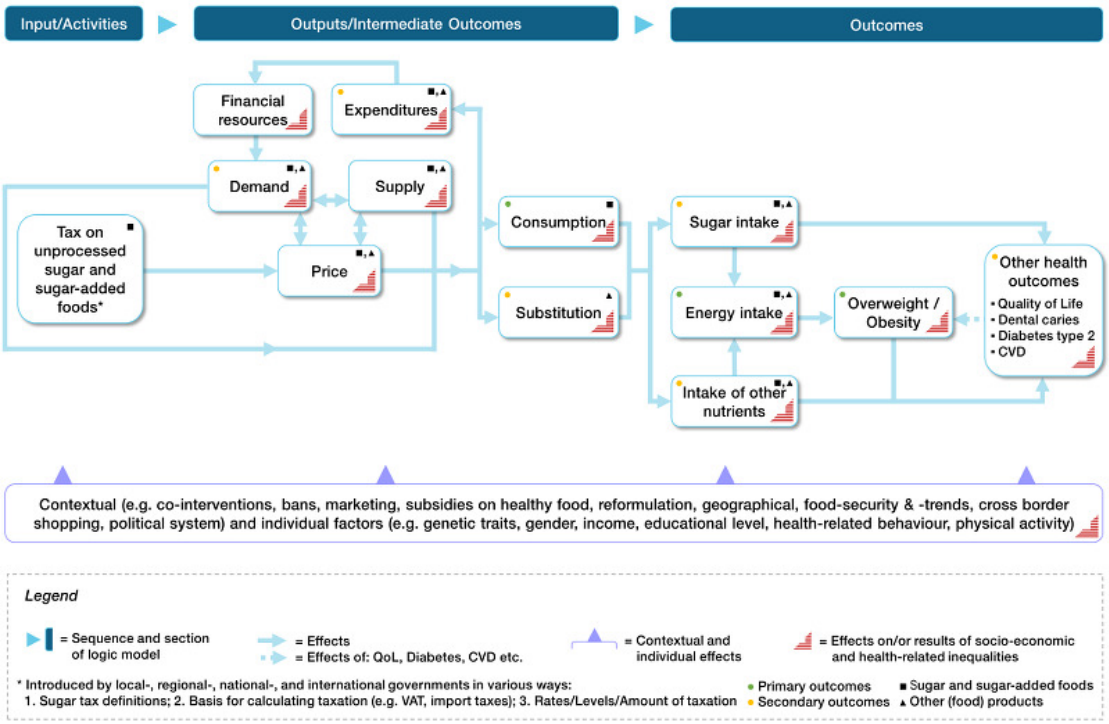
This review will examine studies with artificial increases of selling prices for unprocessed sugar and/or food products that contain added sugar (e.g. sweets, ice cream, confectionery, bakery products) regardless of the taxation level.

In this review, the taxation - as a form of intervention - focuses on unprocessed sugar and sugar-added foods.

How the intervention might work

See Figure 1.

Figure 1. Study's Logic Model with Causal Pathways



The typical aim of effective prevention and treatment of overweight and obesity is weight reduction. This can be achieved by decreasing energy intake through changes in dietary habits (e.g. reducing consumption of foods high in added sugar and fats), drug treatment, a surgical intervention, and/or increased energy expenditure through physical activity (Wadden 2002). Taxation of food might be an effective mechanism in the reduction of overweight

and obesity prevalence.

In general, food taxes are often hypothesised to lead to better health outcomes (Mytton 2012). However, the decrease in the percentage share of unprocessed sugar and sugar-added foods consumption in the total energy intake is likely to have one of two effects on health-related behavior: it may either lead to a reduction in total daily energy intake, or the consumption of unprocessed sugar and sugar-added foods may be substituted by other products that are unhealthy, such as cigarettes and salt for example, or foods that are also relatively high in calories (e.g. high fat content) (Briggs 2013). While the former may lead to weight reduction, the latter may result in (1) weight gain, (2) a zero effect, or (3) weight reduction (Ecorys 2014). However, the effects of food taxation on public health and consumption patterns take some time to become detectable (Fletcher 2010; Meessen 2007).

According to economic theory, the taxation of unprocessed sugar or sugar-added foods is expected to cause an increase in price which in turn will lead to a decrease in demand, sales, and consumption (Mytton 2012). Moreover, with regard to within-country inequalities, as the price of a product determines the level of affordability, low-income groups are usually more strongly affected by taxation policies than higher-income groups (Eyles 2012; Maniadakis 2013). If low-income populations have higher prevalences of overweight, obesity, type 2 diabetes, dental caries and other sugar-related diseases and conditions than middle- and high-income populations, then unprocessed sugar or sugar-added foods tax policies may disproportionately reduce consumption of unprocessed sugar and sugar-added foods among the low-income population, and thus improve health equity in the population. Furthermore, with regard to between-country inequalities, these tax interventions may reduce overweight, obesity, type 2 diabetes, dental caries and other sugar-related diseases and conditions differently across countries of different income levels. For example, it is theoretically plausible that such taxes are more effective in reducing sugar-related diseases and conditions in low-income countries than in middle- and high-income countries. Thus, taxes on unprocessed sugar and sugar-added foods have the potential to also improve between-country health equity (Eyles 2012; Lorenc 2012; Maniadakis 2013).

In some countries, taxes on unprocessed sugar and sugar-added foods have already been implemented. For example, Norway taxes unprocessed sugar and chocolate (Ecorys 2014; Norwegian Ministry of Finance 2014); Finland taxes ice cream and confectionery (Ecorys 2014); Hungary taxes pre-packaged foods high in added-sugar content (i.e. chocolates, sweets, biscuits and ice creams) (Ecorys 2014; Holt 2011), and Denmark temporary taxed ice cream, chocolate and confectionery (Wilkins 2010).

Our concept of the taxation of unprocessed sugar and sugar-added foods is described in a logic model with causal pathways in Figure 1. The taxation of unprocessed sugar and sugar-added foods - introduced by local, regional, national, and multinational governments - is hypothesised to result in price changes (e.g. increased prices of chocolate, ice cream, and bakery products) (Epstein 2012; Jensen 2013; Maniadakis 2013), which in turn may lead to altered expenditure patterns for food. Financial resources - also dependent on expenditures on food - and contextual and individual factors (e.g. income), determine the demand for food products. These market components impact consumer purchases and consumption choices for different food categories, including unprocessed sugar and sugar-added foods (Briggs 2013; Sharma 2014). This may result in a lower intake of the taxed food products (unprocessed sugar and sugar-added foods) and in a substitution of these by other (food) products (Fowler 2015; Yang 2010). As a consequence, food tax-induced changes in consumption patterns result directly in changes to unprocessed sugar and sugar-added foods intake (Epstein 2012; Maniadakis 2013). A decrease in the intake of unprocessed sugar and sugar-added foods - as one hypothesised consequence of taxing these foods - can reduce overweight, obesity, and other health outcomes directly and indirectly. To exemplify the direct path from the intake of unprocessed sugar and sugar-added foods to other health outcomes, a decrease in the intake of unprocessed sugar and sugar-added foods has the potential to reduce the risk of dental caries (Moynihan 2014; WHO 2015a). The indirect path from the intake of unprocessed sugar and sugar-added foods to overweight and obesity goes through energy intake. For example, a decreased energy intake as a consequence of decreased intake of unprocessed sugar and sugar-added foods can result in lower risks for overweight and obesity (Kim 2006; Malik 2013). Moreover, food tax-induced changes in consumption patterns may directly result in changes in nutrient intake (Epstein 2012; Maniadakis 2013). The direct path from intake of other nutrients (e.g. fat or dietary minerals) as a consequence of substitution effects has the potential to directly increase, decrease or not affect the risk of other health outcomes (e.g. fatty liver). The indirect path from intake of other nutrients to overweight, obesity and other health outcomes goes through energy intake. To illustrate this, a higher intake of other nutrients (e.g. saturated or unsaturated fat) as a substitution effect of decreased intake of unprocessed sugar and sugar-added foods affects energy intake (increase, decrease or zero effect) and is therefore associated with the risk of overweight, obesity and other health outcomes (Marriott 2010). Decreased risks of overweight and obesity, in turn, can reduce the risk of developing other diet-related diseases and conditions (e.g. chronic diseases such as type 2 diabetes, cardiovascular diseases, dental caries) (Guh 2009).

Contextual and individual factors influence the process from the input to the outcomes, alter effect sizes and help us to understand the causal relationships (Qi 2012). Alternative interventions may be possible comparators but also potential co-interventions (i.e. complementary interventions to reduce the consumption of unprocessed sugar and sugar-added foods, such as bans on marketing, which are designed to enhance intervention effectiveness). Therefore the effect of taxation may be modified by other interventions by governments, communities and the food industry to reduce

consumption of unprocessed sugar and sugar-added foods (Jou 2012; Thow 2011). Social factors such as gender and educational qualification may determine the effectiveness of a tax intervention, and tax interventions may thus impact health equity (Anderson 2011b).

Why it is important to do this review

There is increasing public health interest in the taxation of unprocessed sugar and sugar-added foods as an intervention, following recently implemented food taxes in countries such as Mexico. However, the implementation of a tax on unprocessed sugar and sugar-added foods is only one of many policy options for reducing consumption of these foods (Hawkes 2015).

Consumption of unprocessed sugar and sugar-added foods is far above recommended levels. Data from 2010 and 2011 suggest that the average daily per capita consumption of sugar is about 63 grams. This differs by country, with the lowest intake being observed in Bangladesh (approx. 22 grams) and the highest in Israel (approx. 181 grams) (Groupe Sucre et Denrées 2015).

WHO recommends a daily sugar consumption of less than 10% of the total energy intake. Thus, the recommended maximum level in adults is approximately 50 grams. Keeping the daily sugar intake on a level below 5% (approx. 25 grams) of the recommended total energy intake might have even greater health benefits (WHO 2015a). In view of the excess consumption of sugar and the worldwide increase in overweight and obesity prevalence, governmental action is urgently required. Taxes for unprocessed sugar and sugar-added foods are interventions that may fulfil the policy aim of reducing the prevalence and healthcare costs of overweight and obesity.

Previous systematic reviews have investigated relevant public health effects of taxing fast food (Powell 2013), SSBs (Maniadakis 2013; Powell 2013; Welsh 2013), and saturated fat (Eyles 2012; Maniadakis 2013; Powell 2013), and subsidies of fruits and vegetables (Eyles 2012; Powell 2013), or all foods (Green 2013; Niebylski 2015; Powell 2013). Some of these reviews have combined diverse fiscal policy interventions in assessing the association between food pricing strategies and relevant public health outcomes (Maniadakis 2013; Powell 2013; Welsh 2013). Results as to the effectiveness of fat taxes and food subsidies are inconsistent across systematic reviews, suggesting no effects (Maniadakis 2013; Powell 2009) or beneficial effects for relevant public health outcomes (Eyles 2012; Green 2013; Powell 2013). Inconsistency of results across systematic reviews may arise from the investigation of different policy interventions, the inclusion of studies differing across the populations' SES, and inclusion of different study types (e.g. modelling studies only or cross-sectional studies in combination with other study types).

This review is different to previous reviews that investigated the effectiveness of food taxes and subsidies for the improvement of population health and changes in consumption patterns (Eyles 2012; Maniadakis 2013; Niebylski 2015; Powell 2009; Powell 2013). This is the first systematic review to investigate the effects of taxes of unprocessed sugar and non-liquid sugar-added foods. Evidence is required regarding the effectiveness of taxing unprocessed sugar and sugar-added foods so that policy makers can make evidence-based decisions.

This research will be part of a set of three systematic reviews of different types of food taxation carried out by the same author group using a similar methodological approach. For reasons of comparability, the methodological content is similar across the three reviews. These reviews will focus on the effects of governmental taxation to increase the prices of: (1) unprocessed sugar or sugar-added foods (this review), (2) processed or packaged food with high content of saturated fat (Lhachimi 2016), and (3) SSBs (Heise 2016).

OBJECTIVES

To assess the effects of taxation of unprocessed sugar or sugar-added foods in the general population on the:

1. consumption of unprocessed sugar or sugar-added foods;
2. prevalence and incidence of overweight and obesity; and
3. prevalence and incidence of diet-related health conditions.

METHODS

Criteria for considering studies for this review

Types of studies

Pre-screening of studies evaluating implemented taxation of unprocessed sugar or sugar-added foods revealed heterogeneous study designs and inherent limitations. Beside small field studies, individual and cluster randomisation are probably impossible for evaluations of interventions on unprocessed sugar or sugar-added foods at the national level (Wansink 2014). Meanwhile, methodological limitations inevitably derive from the lack of blinding of participants and study personnel for the major intervention component - changes in prices of products with unprocessed sugar or sugar-added foods (Block 2010).

We will therefore consider evidence from various study designs and adopt an approach previously used in at least two other Cochrane reviews in order to summarise 'best available evidence' (Gruen 2004; Turley 2013). This approach clearly separates studies into two broad categories: (1) studies meeting rigorous Cochrane Effective Practice and Organisation of Care (EPOC) criteria, and (2)

supporting studies - those not meeting EPOC criteria with greater risk of bias as well as external generalisability.

First, for the synthesis of main results, in line with EPOC criteria we will include:

- randomised controlled trials (RCTs);
- cluster randomised controlled trials (cRCTs);
- non-randomised controlled trials (nRCTs);
- controlled before and after (CBA) studies; and
- interrupted time series (ITS) studies.

According to EPOC, controlled studies require more than one intervention or control site and ITS studies require a clearly defined intervention time and at least three data points before and three after the intervention (EPOC 2012).

There will be no restriction by publication date and language, but we will only include studies focusing on human populations (CPH 2011). We will have no restriction on study duration and participants. Closed field experiments suggest that consumer behaviour adaptations - expressed in terms of unprocessed sugar or sugar-added foods sales - become apparent within a short time frame, such as one month (Block 2010). Implementation of taxes on sugar or sugar-added foods at a national level might feature a longer time lag between intervention and outcomes, especially for health outcomes. However, in one study the efficacy of food taxes with respect to purchases was apparent after one year (Popkin 2016). In general, field experiments on food taxes recruit small numbers of participants. Nevertheless, they are a valuable source to identify important outcome pathways and effects on food patterns relevant to the taxation of unprocessed sugar or sugar-added foods (Epstein 2012).

We will exclude simulation studies, due to their potential limitations provoked by their basic assumptions (e.g. lack of potential supply-side changes, static models to predict weight loss), and other methodological restrictions (e.g. the use of a combination of heterogeneous data sources) (Lin 2011; Shemilt 2015).

Supporting studies

We will include as supporting studies:

- studies that use an RCT, cRCT, nRCT, CBA, or ITS design but do not fulfil the EPOC criteria (hence, are not included in the main results as outlined above);
- prospective cohort studies;
- prospective cohort studies;
- retrospective/non-concurrent cohort studies;
- repeated cross-sectional studies; and
- uncontrolled before-after (UBA) studies.

Those studies classified as 'supporting studies' will not be included in the statistical synthesis of the primary included studies (i.e. those meeting EPOC criteria) but will be narratively synthesised in addition to the main findings. We will extract the same type of data from these supporting studies as we do for the included studies and will document these in a separate 'Characteristics of supporting studies' table. We will carry out 'Risk of bias' assessments on these studies, and undertake quality assessment, utilising the GRADE approach, and present the findings from these supporting studies separately, as supplemental information in the results section and in a separate 'Summary of findings' table. Observations as to similarities and/or differences of findings from the included studies and the supporting studies will be made in the 'Discussion' section, to help summarise the breadth, quality and the findings of the totality of research on the effects of these interventions.

Supporting studies may support or challenge results in the main findings and highlight uncertainty and potential research gaps. We will consider known limitations of UBA studies, cohort studies, and repeated cross-sectional studies, especially confounding and/or time trends, in assessing these studies for inclusion. If UBA studies, cohort studies, and repeated cross-sectional studies are likely to be biased and do not use analytic strategies (e.g. stratification) or other designs (e.g. regression discontinuity) to control for known confounders and/or time trends, we will consider excluding these studies from the 'supporting studies' analysis.

Types of participants

We will include studies of children (0 to 17 years) and adults (18 years and over) from any country and setting.

We will exclude studies investigating the effects of taxing unprocessed sugar or sugar-added foods focusing on specific subgroups, particularly:

- people receiving a pharmaceutical intervention;
- people undergoing a surgical intervention;
- pregnant females;
- elite athletes;
- ill people who are overweight or obese as side-effect of their treatment or condition, such as those with thyroiditis and depression; and
- people with chronic illness(es);

at baseline and at the post-intervention phase due to higher or lower health risks compared to the general population.

Types of interventions

This review will include studies of the taxation of unprocessed sugar or sugar-added foods, defined as:

- a tax of goods;
- imposed by and/or paid to international organisations or local, regional, or national governments;
- of any value;
- added to sales prices of foods with unprocessed sugar and/or sugar-added foods, and
- provided for any duration.

Interventions can be public policies of local, regional, national, and multinational governments or they can be field experiments that imitate taxation effects for research purposes in clearly defined environments (e.g. cafeterias, supermarkets and vending machines). We will include any comparator intervention (e.g. no intervention, educational interventions, bans, media campaigns, and subsidies on healthy food). We will also include studies that compare an eligible tax with another eligible tax that is of a lower value.

Types of outcome measures

Our outcome selection and grouping was guided by preliminary evidence already discussed in the Background and on the basis of the logic model (Figure 1), and following feedback from the review advisory board members (email and online survey) (Table 1). All pre-selected outcomes achieved 'critical' or 'important' ratings on average, following the GRADE approach. For primary outcomes we favored outcomes of critical importance in line with our review scope and Objectives (Table 2). Detailed information on advisory group involvement is provided in the section Searching other resources under the subheading 'Advisory group'. Primary outcomes include intermediate non health-related outcomes directly affected by tax-induced changes in prices for unprocessed sugar or sugar-added foods. As a result, consumption of unprocessed sugar or sugar-added foods may directly alter primary health outcomes including overweight and obesity. Secondary outcomes will focus on food patterns (substitution and diet), expenditures, and other health outcomes directly or indirectly influenced by the taxation of unprocessed sugar or sugar-added foods. We include demand as a proxy for the consumption of unprocessed sugar or sugar-added foods.

Primary outcomes

The review will include changes from baseline to post-intervention of the following primary outcomes:

Consumption of unprocessed sugar or sugar-added foods

- consumption of unprocessed sugar or sugar-added foods (e.g. frequency, amount)

Energy intake

- energy intake through unprocessed sugar or sugar-added foods
- total energy intake

Overweight and obesity

- incidence of overweight and obesity
- prevalence of overweight and obesity

All outcomes can be measured by physicians and other professionals, or self-reported. Overweight and obesity can be measured by different anthropometric body mass indices (e.g. BMI, WC, WHR, WHtR, etc.). We will report changes in body mass indices if no data are available on incidence or prevalence of overweight and obesity.

Secondary outcomes

The review will include changes from baseline to post-intervention of the following secondary outcomes:

Substitution and diet

- composition of diet (expressed as food groups or ingredients e.g. fat, sugar, salt, alternative low-caloric sweeteners)

Expenditures

- total expenditures on food
- total expenditures on unprocessed sugar or sugar-added foods

Demand

- total sales of unprocessed sugar or sugar-added foods

Other health outcomes

- health-related quality of life (e.g. Short Form 36 (SF-36), Health-Related Quality of Life (HRQOL-14))
- mortality
- any other health outcomes (e.g. dental caries, type 2 diabetes, cardiovascular diseases, etc.)

Outcomes can be measured by physicians and other professionals, or self-reported.

Search methods for identification of studies

Electronic searches

We will search the following 12 databases:

- Cochrane Central Register of Controlled Trials (CENTRAL) (1948 to present);
- Cochrane Database of Systematic Reviews (CDSR) (1995 to present);
- MEDLINE via OvidSP (1946 to present);
- Excerpta Medica database (Embase) via OvidSP (1947 to present);
- PsycINFO via OvidSP (1887 to present);
- Current Contents Medicine Database of German and German-Language Journals (CCMed) via LIVIVO (2000 to present);
- Latin American and Caribbean Health Sciences (LILACS) via BIREME/VHL (1982 to present);
- EconLit via EBSCO (1969 to present);
- Campbell Library via Campbell Collaboration (2004 to present);
- Food Science and Technology Abstracts (FSTA) via OvidSP (1969 to present);

- Cumulative Index to Nursing and Allied Health Literature (CINAHL) via EBSCO (1937 to present);
- Web of Science (SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, IC) via Thomson Reuters (1900 to present).

We will apply a search strategy with additional keywords for possible comparators (e.g. "subsidy") and we will not use filters for study types, in order to maximise the sensitivity of the literature search (Higgins 2014, chapter 6.4.4). We present the strategy to search MEDLINE in Appendix 1. We will modify this strategy to fit the syntax of other databases. We will not search African Index Medicus (AIM) - a valuable resource for low- and middle-income country literature - in our review, as a sensitive pre-search with intervention keywords (e.g. tax, taxation etc.) resulted in zero hits.

Grey literature databases

We will search the following six grey literature databases:
- ProQuest Dissertations & Theses Database (PQDT) via ProQuest;
- System for Information on Grey Literature in Europe - OpenGrey via INIST/CNRS;
- The Directory of Open Access Repositories - OpenDOAR via CRC;
- EconPapers via ORU;
- Social Science Research Network - SSRN eLibrary via SSRN;
- National Bureau of Economic Research (NBER) via NBER.

We will search the following two databases for completed or ongoing studies:
- WHO International Clinical Trials Registry Platform (WHO ICTRP) (includes references of the ClinicalTrials.gov database); and
- Trials Register of Promoting Health Interventions (TRoPHI);

with keywords relevant to the intervention (e.g. taxation, pricing).

Internet search engines

The first 30 hits in Google Scholar will be screened. We will use the same terms as in our searches of the academic and grey literature databases.

Targeted internet searching of key organisational and institutional websites

We will search websites of major organisations and institutions, specifically:
- World Obesity Federation (www.worldobesity.org);
- The Obesity Society (www.obesity.org);
- OECD (www.oecd.org);
- WHO (www.who.int);
- European Commission (ec.europa.eu/index˙en.htm);
- DG Sanco (ec.europa.eu/dgs/health˙food-safety/index˙en.htm);
- Centers for Disease Control and Prevention (www.cdc.gov);
- National Institute for Health and Care Excellence (www.nice.org.uk);
- World Trade Organization (www.wto.org);
- World Cancer Research Fund Institute (www.wto.org).

Searching other resources

We will handsearch the reference list of all records of included studies.

Advisory group

We have established a review advisory group of experts in the field of food taxation and health to comment and to provide advice and suggestions to improve the manuscript in the protocol and review stages. Following the GRADE approach, the advisory group members participated in an online survey and ranked pre-selected outcomes according to their relative importance on a 9-point Likert scale (categories: 1 to 3: of limited importance; 4 to 6: important; 7 to 9: critical) (GRADE 2013). The review advisory group consists of policymakers, researchers and academics.
We have provided the members of the review advisory group with detailed background information on this review. At the protocol stage, the review advisory group members were asked to provide feedback specifically on the focus and the relevance of this review's research question, selected endpoints, study design, search strategy, database selection, and ongoing or unpublished studies (Higgins 2014, chapter 2.3.4.3). We received feedback via email and the online survey. All members of the advisory group and results from the online survey are found in Table 1 and Table 2 .

Data collection and analysis

Selection of studies

An information specialist will conduct the database searches. We will conduct screening in six stages. If a reference, an abstract or a full-text report is in a language other than English, German or French, translation will be performed by internet-based translation tools or by native speakers. First, studies' titles and abstracts (when available) will be reviewed by at least two authors independently. If an abstract is not provided by the database it originates from, and the title appears to be potentially relevant, we will progress the record to full-text review. Second, both review authors will compare their list of relevant studies and in the case of any disagreement the opinion of a third author will be sought to

achieve consensus. Third, full texts of potentially relevant studies will be retrieved or obtained. Fourth, the full texts will be screened by the two authors independently. Fifth, both authors will create a list with studies that are considered to fulfil the inclusion criteria. Sixth, the authors will compare their list with each other and in case of any disagreement the opinion of a third author will be decisive. Based on these six steps, studies will be included in the review. We will present a PRISMA flowchart to display the selection of included studies (Liberati 2009).

Data extraction and management

Data extraction will be performed independently by at least two authors, who will both compare the extracted data. Disagreements will be resolved by a third author. We will use a modified data extraction and assessment template from Cochrane Public Health (CPH) (CPH 2011). Prior to the main data extraction process, the authors will pilot the data extraction form to ensure standardised extraction (Higgins 2014, chapter 7.6.3). We will extract general information (publication type, country of study, funding source of study, potential conflict of interest), study eligibility (type of study, participants, type of intervention, duration of intervention, and type of outcome measures), study details (study aim, methods, results, intervention group, confounders, and confounder-adjusted and unadjusted outcomes), indicators of changes in food prices (price of unprocessed sugar or sugar-added foods, price of other food categories), and other relevant information. Effect estimates for study populations based on PROGRESS categories (place of residence, race/ethnicity/culture/language, occupation, gender/sex, religion, education, socioeconomic status, social capital) will be extracted to evaluate impacts on equity. We will also extract contextual factors (e.g. political system, co-interventions, reason for implementation, reason for particular tax level, intended beneficiaries, implementation costs, country and region-specific level of gross domestic product (GDP), food security (availability, access, and use)), and process evaluation criteria (e.g. satisfaction of participants, adherence) that facilitate or hinder the implementation of the taxation on unprocessed sugar or sugar-added foods (Anderson 2011a).

Data will be entered into RevMan 5.3 by one author, and a second author will double-check the data entered (RevMan 2014).

Assessment of risk of bias in included studies

The risk of bias of every included study will be evaluated independently by at least two authors. In case of any disagreement, discrepancies will be discussed with a third author and resolved by consensus. Based on the template provided by CPH, the risk of bias will be assessed using the criteria for judging risk of bias in Cochrane's 'Risk of bias' assessment tool (Higgins 2011) and the Cochrane Effective Practice and Organisation of Care (EPOC) Group's guidance (EPOC 2015). Both tools examine the following biases: selection, performance, detection, attrition, reporting, and others. The EPOC 'Risk of bias' tool for ITS examines three further risks of bias: "Was the intervention independent of other changes?", "Was the shape of the intervention effect pre-specified?" and "Was the intervention unlikely to affect data collection?". For studies included in the main synthesis (i.e. RCTs, cRCTs, nRCTs, CBA and ITS studies), we will assess the risk of bias using the 'Risk of bias' criteria for EPOC reviews, based on the Cochrane Collaboration's tool for assessing risk of bias (Higgins 2014, Table 8.5.a).

Study quality and risk of bias of 'supporting studies' (i.e. studies that do not meet EPOC criteria, cohort studies, repeated cross-sectional studies, uncontrolled before and after studies) will be assessed with the Quality Assessment Tool for Quantitative Studies, developed by the Effective Public Health Practice Project (EPHPP) (EPHPP 2007).

To judge the risk of bias according to Cochrane's 'Risk of bias' assessment tool, the following three categories will be used: "low", "high", and "unclear" (adequate information is unavailable or there is uncertainty about the risk of bias) (Higgins 2014, chapter 8.6). To judge the risk of bias according to the Quality Assessment Tool for Quantitative Studies, the following three categories will be used: "strong", "moderate", and "weak" (EPHPP 2007). We will provide 'Risk of bias' tables for all included studies.

Measures of treatment effect

Data synthesis aims to pool the results of different studies. Effects of the treatment on dichotomous outcomes will be reported as odds ratios (ORs), risk ratios (RRs) or risk differences (RDs). In accordance with the recommendations from CPH, RRs will be the preferred reporting measure of treatment effect (CPH 2011). If RRs are not presented in the study, but data to calculate the RRs are provided, we will calculate them. This also applies to data suitable to calculate ORs (e.g. obesity prevalence). If data to calculate the RRs are not provided, we will contact the corresponding author of the study, by email or phone, to request the RRs or the data to calculate the RRs. If we cannot obtain RRs, we will report the treatment effect from the study report.

Continuous data will be expressed as mean differences (MDs) where applicable, or as standardised mean differences (SMDs). Shorter ordinal data will be translated into dichotomous data (expressed as ORs, RRs or RDs) and longer ordinal data will be treated as continuous data (expressed as MDs or SMDs). It is unclear whether there is a cut-off point which is common across the studies and can be used for dichotomisation (Higgins 2014, chapter 7). The cut-off point will be part of the sensitivity analysis. Count data and Poisson data will be expressed as rate ratios. Time-to-event data (survival data) will be translated into dichotomous data when appropriate, or into hazard ratios (HRs).

If feasible, we will report the adjusted treatment effect. If a study does not present adjusted treatment effect measures, we aim to adjust the treatment effect measures for baseline variables by addi-

tional multivariate analyses as far as we have access to the dataset, or by contacting the corresponding author of the study by email or phone for the adjusted treatment effect measures. If studies present intention-to-treat effect estimates, then we will prioritise these over average causal treatment effect estimates (Higgins 2014, chapter 9).

Conversion of cost estimates will be used to harmonise food expenditure outcomes and contextual data (e.g. implementation costs). Cost data of included outcomes will be pooled for meta-analysis if possible. When the treatment effect is described in cost estimates as derived from economic studies, we will convert the cost estimates to US dollars (USD) and the price year 2015 to compare cost estimates from different studies with each other. To convert cost estimates into USD, we will apply an international exchange rate based on Purchasing Power Parities (PPPs). To convert cost estimates to the year 2015, we will apply GDP deflators or implicit price deflators for GDP. PPP conversion rates and GDP deflator values will be derived from the International Monetary Fund in the World Economic Outlook Database (www.imf.org/external/data.htm) (Higgins 2014, chapter 15.6.1).

Unit of analysis issues

We will collect data on studies irrespective of whether individuals or groups are allocated to an intervention or control group. The analysis will consider the level at which allocation occurred, e.g. cluster-randomised trials, cross-over trials, and multiple observations (repeated observations on subjects, recurring events, multiple body parts, and multiple intervention groups) for the same outcome (Higgins 2014, chapter 9.3.1). As far as possible, we will consider data from cross-over trials (e.g. by incorporating the study data similar to a parallel group trial) and studies with multiple observations (e.g. by defining different periods of follow-up) (Higgins 2011, chapter 9.3.4; chapter 16.4.5).

If control for clustering is missing or, insufficient and if individual-level data are not presented in the study, we will request individual-level data from the corresponding author of the study. If feasible, we will reduce the size of each trial to its 'effective sample size' in order to correct intervention effects of cluster-randomised trials. The effective sample size of an intervention group is the original sample size divided by the 'design effect'. We will calculate the design effect by the formula 1 + (M - 1) ICC. M is the average cluster size and ICC is the intracluster correlation coefficient (Higgins 2014, chapter 16.3.4).

For dichotomous data, the total number of participants and the number of participants who experience the event will be divided by the same design effect. For continuous data, only the sample size will be reduced; means and standard deviations will remain unchanged (Higgins 2014, chapter 16.3.4).

Dealing with missing data

We will request all missing information and data from principal study authors via email or phone. The following steps will be taken to deal with relevant missing data:

- contact the authors;
- screen the study and investigate important numerical data such as randomised individuals as well as intention-to-treat (ITT), as-treated and per-protocol (PP) populations;
- investigate attrition rates as part of the 'Risk of bias' assessment in terms of drop-outs, losses to follow-up and withdrawals;
- critically appraise issues of missing data and imputation methods (e.g. last observation carried forward (LOCF));
- impute missing standard deviations if contacted authors do not respond (Higgins 2014, chapter 16.1);
- apply sensitivity analyses to estimate the impact of imputation on meta-analyses.

Data "not missing at random" due to systematic loss to follow-up or systematic exclusion of individuals from studies will be requested from principal study authors (Higgins 2014, chapter 16.1.2).

Assessment of heterogeneity

In the event of substantial conceptual, methodological or statistical heterogeneity, we will not perform meta-analytic pooling.

Heterogeneity will be detected through visual inspection of the forest plots and by using a standard Chi² test with a significance level of $P < 0.1$ (Higgins 2014, chapter 9.5.2). The I^2 statistic will be applied and considered to quantify inconsistency across studies and to assess the impact of heterogeneity on the meta-analysis (Higgins 2014, chapter 9.5.2).

Methodological heterogeneity and PICO (population, intervention, comparison, outcome) heterogeneity will be assessed with tables and explanations inside the review. We will consider potential sources of heterogeneity, such as:

- study population;
- intervention area/setting;
- intervention characteristics (tax definition, basis for calculating taxation, level of taxation);
- implementation level;
- comparisons;
- co-interventions; and
- outcomes.

Assessment of reporting biases

Reporting bias, including publication bias, time lag bias, multiple (duplicate) publication bias, location bias, citation bias, language bias, and outcome reporting bias occur when the dissemination of research results depends on their magnitude and/or direction (Higgins 2014, chapter 10). If we find 10 or more studies of the same outcome, we will produce funnel plots and assess

these plots for study effects resulting from reporting biases. When testing asymmetry in funnel plots (small study effects), we will investigate whether the relationship between a measure of study size and the estimated intervention effect is asymmetrical (Higgins 2014, chapter 10). We will draw funnel plots using RevMan 5.3 (RevMan 2014).

Data synthesis

If two or more studies report the same outcome and are sufficiently homogenous conceptually, methodologically, and statistically, we will perform meta-analyses of these studies, using RevMan 5.3 (RevMan 2014). For dichotomous outcomes, we will apply the Mantel-Haenszel method, and for continuous outcomes, we will apply the inverse variance method. For all analyses, the random-effects method will be used as we expect differences in the underlying effect sizes due to contextual and implementation differences (Higgins 2014, chapter 9.5.4). If a study reports two or more measures for the same outcome, then we will report the measure that is most commonly reported by the other included studies. If a study reports multiple follow-ups for the same outcome (e.g. six months during the intervention, one year during the intervention, and six months after the intervention), we will prioritise the longest follow-up during the intervention (e.g. one year during the intervention, in the example given). Nevertheless, all follow-up data will be extracted.

Study results with insufficient homogeneity will be narratively synthesised. We will structure narrative synthesis by the outcome categories of this review. Within these categories, we will make further separation according to the intervention setting and the study design or study quality (Ryan 2016). In addition to reporting findings as text and tables, we may consider both harvest plots and effect direction plots to summarise data not suitable for meta-analyses. Harvest plots are graphical summaries of data represented by multiple shaded or non-shaded bars with varying heights, and can be utilised to indicate effect directions across included studies with non-standardised effect estimates of outcomes (e.g. anthropometric measures). Similarly, effect direction plots can be used to visualise information on effect directions, with more focus on direct comparisons across studies (Ogilvie 2008; Thomson 2013).

We will provide a 'Summary of findings' table with primary and secondary outcomes (Higgins 2014, chapter 11.5). This will include incidence/prevalence of overweight/obesity, consumption of unprocessed sugar and sugar-added foods, energy intake (total/via unprocessed sugar and sugar-added foods), substitution with other foods/nutrients, sales/expenditures on unprocessed sugar and sugar-added foods/foods in general, diabetes and other health outcomes. This pre-selection of outcomes is based on external referee suggestion.

These tables will include information on the outcomes, illustrative comparative risks, the relative effect, the number of participants, the number of studies included, the quality of evidence based on the GRADE guideline, and additional comments. If feasible, we will use the computer software GRADEprofiler Guideline Development Tool to prepare the 'Summary of findings' table (GRADEpro GDT). Furthermore, results of data synthesis will be mapped against our initial logic model, to refine the theory of change and assess the credibility of the assumed causal pathways (Anderson 2011a; Thomson 2013).

Subgroup analysis and investigation of heterogeneity

We will conduct meta-analyses and harvest plots for studies assessing the following subgroups for primary outcomes, where feasible:

- high-income countries versus middle- and low-income countries;
- high-income groups versus middle- and low-income groups;
- high-educated groups versus low-educated groups;
- different tax values of unprocessed sugar or sugar-added foods;
- single tax on unprocessed sugar or sugar-added foods versus multiple taxes on unprocessed sugar or sugar-added foods;
- tax on unprocessed sugar or sugar-added foods alone versus tax on unprocessed sugar or sugar-added foods accompanied by other fat taxes or interventions (e.g. bans, minimum pricing, media campaigns, or subsidies on healthy foods);
- different types of taxation: (1) indirect taxes levied within national borders (e.g. excise tax, sales tax, value added tax (VAT)); and (2) import taxes including custom duties and import sales taxes;
- children versus adults;
- BMI subgroups;
- indigenous populations;
- chronically ill people with overweight and obesity as side-effects.

If data are available in PROGRESS categories (e.g. age, gender, education, and ethnicity), we will perform additional subgroup analyses according to these social determinants of health (Anderson 2011b).

If feasible, we will investigate the statistical significance of differences in the treatment effect between subgroups using t-tests and Chi² tests (Higgins 2011a, chapter 9.6.2).

Sensitivity analysis

Sensitivity analyses will be performed to determine the robustness of our results by conducting meta-analyses and harvest plots for the studies included in our review:

- with respect to source of funding;
- with studies considered as 'low risk of bias' compared to studies considered as 'high risk of bias';
- with published versus unpublished studies;
- with respect to the intervention duration;
- with respect to follow-up time;

- with objective measures versus subjective measures;
- with respect to study design;
- with respect to cut-off points of the measures of treatment effect;
- with respect to imputation of data.

Studies assessed as having a high or unclear risk of bias with respect to incomplete outcome data and baseline differences will not be included in these analyses. For cRCTs with adequate data provided, we will perform intracluster correlation value sensitivity analysis. We will report findings of sensitivity analyses as a summary table (Higgins 2011a, chapter 9.7).

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* *Indicates the major publication for the study*

ADDITIONAL TABLES

Table 1. Advisory group members

Name	Occupation
Cristina Cleghorn	Department of Public Health, University of Otago, Wellington, NZ
Emilia Crighton	Faculty of Public Health, London, UK
Peter Faassen de Heer	CMO and Public Health Directorate Scottish Government, Edinburgh, UK
Dionne Mackison	Department for International Development, UK Government, Glasgow, UK
Barry Popkin	Professor of Global Nutrition, University of North Carolina, Chapel Hill, US
Torben Jørgensen	Professor Department of Public Health University of Copenhagen, Copenhagen, DK

Table 2. Feedback advisory group (online survey)

1.1. Rank outcomes according to their relative importance for the scope of the reviews and general public health decision-making in the context of food taxation; 9-point Likert scale (categories: 1 to 3 - of limited importance; 4 to 6 - important; 7 to 9 - critical)

Outcomes:	Average score:	Rank:
prevalence of overweight	7.67	3
prevalence of obesity	7.67	3
incidence of overweight	8.00	1
incidence of obesity	8.00	1
caloric intake through SSBs or unprocessed sugar/sugar-added foods	7.33	8
total calorie consumption	6.67	11
consumption of SSBs or unprocessed sugar/sugar-added foods (e.g. frequency, amount)	7.33	8
health-related quality of life	4.00	16
total sales of SSBs or unprocessed sugar/sugar-added foods	5.33	15
composition of diet (e.g. fat, sugar, salt)	6.67	11

Table 2. Feedback advisory group (online survey) (*Continued*)

total expenditures on food	4.00	16
total expenditures on SSBs or unprocessed sugar/sugar-added foods (e.g. frequency, amount)	5.67	14
any health outcomes or health-related unintended consequences	7.67	3
e.g. mortality	7.00	10
e.g. dental caries	6.00	13
e.g. diabetes	7.67	3
e.g. CVD	7.67	3

2.1. How well do the presented outcomes cover the basic review scope?

Answers:	**Rating:**	**Number of responses:**
Important outcomes are presented	66.67%	2
Important outcomes are missing	33.33%	1
Comments (1):	I imagine some evidence will be presented as simply a change in BMI or other markers of obesity rather than a change in incidence or prevalence of obesity (Cristina Cleghorn)	

3.1. Do you think the same outcomes are appropriate for both reviews (SSB; sugar or sugar added foods)?

Answers:	**Rating:**	**Number of responses:**
The same group of outcomes should be utilised in both reviews	66.67%	2
Different outcomes should be utilised in the two reviews	33.33%	1
Comments (1):	Foods study: Hard to go beyond kcal and weight and minimal cardio metabolic outcomes as the Morenga et al. review shows (Barry Popkin)	

Participants n = 3

APPENDICES

Appendix 1. MEDLINE search strategy

1. exp Taxes/
2. exp Government Programs/ec, lj [Economics, Legislation & Jurisprudence]
3. exp Health Policy/ec, lj [Economics, Legislation & Jurisprudence]
4. exp Food Dispensers, Automatic/ec, lj, sn [Economics, Legislation & Jurisprudence, Statistics & Numerical Data]
5. exp Health Promotion/ec, lj [Economics, Legislation & Jurisprudence]
6. exp Nutrition Policy/ec, lj [Economics, Legislation & Jurisprudence]
7. exp Public Health/ec, lj [Economics, Legislation & Jurisprudence]
8. "demand elasticity".tw.
9. "policy intervention*".tw.
10. "sales tax".tw.
11. "thin subsidies".tw.
12. "vending machine*".tw.
13. budget.tw.
14. excise.tw.
15. fiscal.tw.
16. levied.tw.
17. levy.tw.
18. price.tw.
19. priced.tw.
20. prices.tw.
21. pricing.tw.
22. subsidy.tw.
23. subsidies.tw.
24. tax.tw.
25. taxation.tw.
26. taxed.tw.
27. taxes.tw.
28. taxing.tw.
29. OR/1-28
30. exp Dietary Carbohydrates/
31. exp Dietary Sucrose/
32. exp High Fructose Corn Syrup/
33. "chewing gum".tw.
34. "dietary sucrose".tw.
35. (("energy dens*" or "highenergy" or "high energy" or "high-energy" or "low energy" or chips) and (fat* or sugar* or sweet* or food or diet* or nutrition or overweight or drink* or beverage* or protein* or carbohydrate*)).tw.
36. "HED calori*".tw.
37. "HED-calori*".tw.
38. "highcalori* food*".tw.
39. "high calori* food*".tw.
40. "high-calori* food*".tw.
41. "lowcalori* food*".tw.
42. "low calori* food*".tw.
43. "low-calori* food*".tw.
44. "ice cream*".tw.
45. "unhealthy food*".tw.
46. bakery.tw.
47. biscuit*.tw.

48. cacao.tw.
49. cake*.tw.
50. calorie*.tw.
51. candy.tw.
52. candies.tw.
53. bonbon*.tw.
54. chocolate*.tw.
55. confectionar*.tw.
56. cookie*.tw.
57. isoglucose.tw.
58. jam.tw.
59. jelly.tw.
60. jellies.tw.
61. liquorice.tw.
62. macronutrient*.tw.
63. maltose.tw.
64. marmalade.tw.
65. marzipan.tw.
66. pastr*.tw.
67. sucrose.tw.
68. sugar.tw.
69. sugars.tw.
70. sugary.tw.
71. sweet*.tw.
72. exp Butter/
73. exp Dietary Fats/
74. exp Energy Intake/
75. exp Fast Foods/
76. exp Margarine/
77. exp Plant Oils/ec [Economics]
78. "fastfood*".tw.
79. "fast food*".tw.
80. "fast-food*".tw.
81. "fattening-food*".tw.
82. "fattening food*".tw.
83. "fried food*".tw.
84. (coconut OR cooking OR palm OR vegetable OR soya OR soybean OR rapeseed OR linseed OR sunflower OR sesame OR peanut OR groundnut OR copra OR babassu OR olive OR thistle ADJ Oil).tw.
85. "salty-snack*".tw.
86. "salty snack*".tw.
87. "snack food*".tw.
88. "snack-food*".tw.
89. "takeaway food*".tw.
90. "takeaway-food*".tw.
91. "take away food*".tw.
92. "take away-food*".tw.
93. "take-away food*".tw.
94. "take-away-food*".tw.
95. "whole milk".tw.
96. burger*.tw.
97. butter.tw.
98. cheese.tw.
99. cream.tw.

100. crisps.tw.
101. (egg AND (fat* or sugar* or sweet* or food or diet* or nutrition or overweight or drink* or beverage* or protein* or carbohydrate*)).tw.
102. (eggs AND (fat* or sugar* or sweet* or food or diet* or nutrition or overweight or drink* or beverage* or protein* or carbohydrate*)).tw.
103. (fat AND (Food* or diet* or nutrition or nutrient or eat* or meal* or oil* or carbohydrate* or protein* or obesity or obese)).tw.
104. (fatty AND (Food* or diet* or nutrition or nutrient or eat* or meal* or oil* or carbohydrate* or protein* or obesity or obese)).tw.
105. fats.tw.
106. fattening.tw.
107. fries.tw.
108. ghee.tw.
109. lard.tw.
110. margarine.tw.
111. mono-unsat*.tw.
112. monounsat*.tw.
113. omega3.tw.
114. "omega 3".tw.
115. omega-3.tw.
116. pizza.tw.
117. polyunsat*.tw.
118. poly-unsat*.tw.
119. sausage*.tw.
120. suet.tw.
121. exp Carbonated Beverages/
122. exp Food Preferences/
123. exp Food Habits/
124. "caloric-drink*".tw.
125. "caloric drink*".tw.
126. "carbonated-beverage*".tw.
127. "carbonated beverage*".tw.
128. "carbonated-drink*".tw.
129. "carbonated drink*".tw.
130. "energy-drink*".tw.
131. "energy drink*".tw.
132. "fizzy-drink*".tw.
133. "fizzy drink*".tw.
134. "high-calori* drink*".tw.
135. "high calori* drink*".tw.
136. "soda pop".tw.
137. "soft-drink*".tw.
138. "soft drink*".tw.
139. "sport-drink*".tw.
140. "sport* drink*".tw.
141. "sport*-drink*".tw.
142. cola.tw.
143. soda.tw.
144. SSB*.tw.
145. syrup*.tw.
146. OR/30-145
147. 29 AND 146
148. (animals NOT (humans AND animals)).sh.
149. 147 NOT 148

CONTRIBUTIONS OF AUTHORS

Manuela Pfinder: protocol draft, contributed to all stages of the protocol development

Thomas Heise: protocol draft, contributed to all stages of the protocol development

Srinivasa Vittal Katikireddi: reviewed and contributed to the development of the draft protocol and search strategy

Frank Pega: reviewed and contributed to the development of the draft protocol and search strategy

Candida Fenton: search strategy development

Gerald Gartlehner: reviewed and contributed to the development of the draft protocol

Ursula Griebler: reviewed the draft protocol

Isolde Sommer: reviewed the draft protocol

Stefan K. Lhachimi: conceived and initiated the review and contributed to all stages of the protocol development

DECLARATIONS OF INTEREST

Manuela Pfinder: none declared

Thomas Heise: none declared

Srinivasa Vittal Katikireddi is a member of the steering group of Obesity Action Scotland, to whom he provides unpaid advice on the evidence base for public health actions to tackle obesity

Frank Pega: Frank Pega is a Technical Officer at the World Health Organization

Candida Fenton: none declared

Gerald Gartlehner: none declared

Ursula Griebler: none declared

Isolde Sommer: none declared

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