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## Review

# Healthy food subsidies and unhealthy food taxation: A systematic review of the evidence



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## ABSTRACT

The Global Burden of Disease Study and related studies report unhealthy diet is the leading risk for death and disability globally. Given the evidence associating diet and non-communicable diseases (NCDs), international and national health bodies including the World Health Organization and United Nations have called for population health interventions to improve diet as a means to target NCDs. One of the proposed interventions is to ensure healthy foods/beverages are more accessible to purchasers and unhealthy ones less accessible via fiscal policy, namely taxation and subsidies. The objective of this systematic review was to evaluate the evidence base to assess the effect of healthy food/beverage subsidies and unhealthy food/beverage taxation. A comprehensive review was conducted by searching PubMed, Medline, and Google Scholar for peer-reviewed publications and seventy-eight studies were identified for inclusion in this review. This review was performed in keeping with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidance. Although moderate in quality, there was consistent evidence that taxation and subsidy intervention influenced dietary behaviors. The quality, level and strength of evidence along with identified gaps in research support the need for further policies and ongoing evaluation of population-wide food/beverage subsidies and taxation. To maximize success and effect, this review suggests that food taxes and subsidies should be a minimum of 10 to 15% and preferably used in tandem. Implementation of population-wide policies for taxation and subsidies with ongoing evaluation of intended and unintended effects are supported by this review.

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## Introduction

Preventable diet-related non-communicable health risks and diseases (NCDs), such as obesity, hypertension, heart disease, stroke, diabetes, kidney disease, or cancer, continue to increase globally [1–8]. These largely result from unhealthy lifestyles and cost billions of dollars every year threatening economies and the sustainability of health care systems around the world [1]. NCDs account for over 60% of deaths and it is estimated 40% of these NCD-related deaths are attributed to dietary factors [6,9–12], namely: lack of fruits and vegetables, excess intakes of sodium, sugar-sweetened beverages, and saturated fats and trans-fatty

acids, much of which is added during food processing [4,7,13–18]. To reduce the burden of NCDs, population-wide dietary interventions are recommended [5]. Food subsidies and/or higher pricing (taxation) are two potential population-wide interventions that can enhance healthier eating through swaying of dietary behaviors. However, implementation, to include legislative approval and industry proponents, remains a barrier beyond the scope of this review to explore.

## Methods

To explore the potential effectiveness of food subsidies and taxation on healthy population-wide dietary intake, a literature search strategy was implemented to identify articles that assessed the effect of these interventions. The search strategy was designed to answer specific questions on health effects, benefits and risks, optimum schemes used, and preferred usage of funds generated. PubMed, Medline and Cochrane Library databases

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(June 2003–November 2013) and Google Scholar (June and November 2013) were searched using the medical subject headings and key terms: “healthy food”, “subsidies”, “subsidy”, “unhealthy food”, “taxation”, “sweetened beverages”, “food policy”, and “fat tax”. Titles and abstracts were reviewed for randomized controlled trials, systematic reviews, empirical studies, and experimental studies on healthy food subsidies and unhealthy food taxation.

Included are studies, reviews, and/or predictive models for adults and children in Western Europe, Canada, United States, Australia, and New Zealand that assessed the subsidy and/or tax effect on: (1) nutrition related health indicators to include blood pressure, body mass index (BMI), blood lipids or glucose, (2) healthy food purchases (fruits and vegetables) by consumers, and (3) increased consumption of healthier foods, and reduced consumption of unhealthy foods to include sugar-sweetened beverages. Full text articles were obtained and those that were not in English, did not involve humans, were based on data previously published, focused strictly on dietary salt, or were not full reports (e.g., abstracts) were excluded. Articles that failed to document any outcomes of interest were also excluded. Only one citation was selected from the search for duplicate articles or those appearing in more than one publication. The references of all included publications were searched for additional relevant citations. This review was consistent with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidance [19]. Further, all selected references were evaluated for quality of evidence and strength of recommendations using “Grading of Recommendations Assessment, Development, and Evaluation” (GRADE) [20].

## Results

The search retrieved 1174 published citations and 315 were identified as potentially relevant along with 76 “gray” literature articles. These along with one paper provided by an expert, 78 articles were identified as relevant, evaluated in full and included in this review. For greater clarity in presentation and to be consistent with other reviews, the selected articles were placed into five categories based on design or intent. Although some articles had category overlap, the authors categorized based on best fit. A very brief summary of each study selected and their primary outcomes is provided in [Appendix 1](#).

### Cost-effectiveness reviews

Three recent review articles assessing cost-effectiveness (value-added, return on investment) of healthy food subsidies and unhealthy food taxation were identified ([Appendix 1 \[21–23\]](#)). In sum, these articles used economic evaluation and price elasticity to determine the following: (1) pairing subsidies on healthy food with taxation on unhealthy food were recommended to be the most effective, (2) establishing a tax of at least 20% was necessary to have a beneficial health effect, (3) an estimated 80% of interventions were either cost-saving or cost-effective, and (4) population-based subsidies combined with taxes are likely to be the most cost-effective and effective.

### Modelling studies

Thirty-three modelling studies (simulation, sensitivity analysis, regression models) were included for analysis. Findings from these studies indicate subsidies on healthy foods, especially fruits and vegetables, and taxes more than an estimated 10–15% threshold on unhealthy food can be beneficial. Though highly suggestive, the exact health effects on NCDs remain unclear ([Appendix 1 \[24–56\]](#)). There were several noteworthy findings with moderate quality of evidence and strength of recommendations. A review of 160 price elasticity studies indicated a 10% tax on soft drinks would reduce consumption by 8–10% [26] whereas another review suggested a 10% tax on sugar-sweetened beverages would reduce consumption by 12% but with no significant effect on weight loss [48]. On top of this, substantial food taxes and subsidies of >15%

generally improved food consumption as well as body weight [54]. Based on the estimated reduction in disability-adjusted life years, most food subsidy and taxation interventions were effective particularly subsidies for fruits and vegetables, taxes on fatty foods, and marketing healthy foods [29]. Looking at beverages, a penny-per-ounce tax on sugar-sweetened beverages in the United States was projected to reduce consumption by 15%, reduce many cases of cardiovascular disease, stroke, and diabetes thereby saving more than \$17 billion in medical costs and generating an estimated \$13 billion in annual tax revenue [56].

### Empirical studies

Thirteen empirical studies (observational, natural experiments, current use) were included in this review ([Appendix 1 \[57–69\]](#)). A 2012 review determined subsidies improved consumption of healthy foods (fruits, vegetables and low fat snacks sold in markets, restaurants, vending machines and cafeterias) in 19 out of 20 studies [57]. Another review of 38 studies found food consumption and body weight outcomes in adults could be improved by taxing unhealthy food (fast foods, sugar-sweetened beverages) and subsidizing the cost of fruits and vegetables [60]. In another report, there was a 6.8% increase in sugar-sweetened beverage purchases after reduction in a sales tax [58]; however, when the tax was 1–8% there was no significant effect on adolescent body weight [67].

### Experimental studies

Beyond review articles mentioned previously, only 10 experimental studies (localized, controlled) were included in this review and most studies were localized to targeted settings and therefore not demographically representative ([Appendix 1 \[68–79\]](#)). One review of 24 various studies suggested price changes modify purchases of targeted foods but the overall nutritional quality of food purchases is uncertain because of potential substitution effects [73]. A randomized control trial found limited effect of price discounts and tailored nutrition education on supermarket food purchases [77]. Large scale discounts in a web-based supermarket of 50% on fruits and vegetables significantly increased their purchase in a Dutch population [78,79].

### Miscellaneous articles

An additional 19 miscellaneous articles were included in this review ([Appendix 1 \[80–98\]](#)). They fell within the search inclusion criteria and shed light on feasibility, concerns, potential barriers, and limitations to consider when reviewing and discussing all of the articles included herein. A public opinion survey found more respondents sided with anti-sugar-sweetened beverage tax arguments [80]. A Canadian research paper recommended a 5 cent per liter tax on sugar-sweetened beverages, capable of generating \$6.5 billion annually, but concluded such a tax should be part of a multipronged approach to improve diet relative to NCDs [84]. An examination of evidence-based population prevention interventions to improve diet has been recently published by the American Heart Association and offers a blueprint to guide policy makers, advocacy groups, researchers, clinicians, communities, and other stakeholders to in policy decision-making [95]. The review concluded the effects of food taxation and subsidies tend to be proportional to the price differences with larger price changes being associated with greater

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