
This material formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.
Additional file 1. References for excluded systematic reviews

Systematic reviews excluded at full-text stage (n=38)


Hider P. Environmental interventions to reduce energy intake or density: a critical appraisal of the literature (Structured abstract). Health Technology Assessment Database 2001.


Nhemachena C, Chakwizira J, editors. Meta analysis of research on climate change adaptation and health in southern Africa: Identifying research gaps. CSIR 3rd biennial conference: science real and relevant; 2010; Pretoria, South Africa: CSIR.


Systematic reviews on genetically modified foods excluded (n=4)


### Additional File 2. Characteristics of included systematic reviews

*Note: Two tables are included in this file in order to show all relevant details – Tables A2a and A2b.*

**Table A2a. Characteristics of included systematic reviews – sorted by intervention type**

<table>
<thead>
<tr>
<th>Systematic review</th>
<th>Objectives</th>
<th>Inclusion criteria – PICOS (Participants, Interventions, Comparisons, Outcomes, Study Types); Years of publication of papers</th>
<th>Date of search; number of papers/studies included; AMSTAR score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agriculture interventions</strong></td>
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</tbody>
</table>
| Berti et al. (2004) | To review the impact of agriculture interventions on nutritional status in participating households, and to analyses the characteristics of interventions that improved nutrition outcomes. | P – Human  
I – Agriculture interventions  
C – NS  
O – Nutrition status and/or anthropometry  
S – NS  
Years: 1985-2001 | November 2001  
34 papers / 30 projects  
AMSTAR – 6 |
| Masset et al. (2011); Masset et al. (2012b) | To assess the effectiveness of agricultural interventions in improving the nutritional status of children in developing countries. | P – Human; middle or low income countries  
I – Agriculture interventions (bio-fortification, home gardens, small scale fisheries and aquaculture, dairy development, and animal husbandry and poultry development).  
C – NS  
O – Nutritional status, and/or intermediate outcomes: participation, household income, diversity of diet, and micronutrient intake  
S – Only studies that used a valid counterfactual analysis and written in English were included.  
Years: 1990-2010 | July to September 2010.  
23 studies  
Note: includes the meta-analysis by Gunaratna et al. 2010.  
AMSTAR – 8 |
| Webb Girard et al. (2012b); Webb Girard et al. (2012a) | The objective of this review is to systematically examine and summaries the effects of agricultural interventions to increase household food production on the nutrition and health outcomes of women and young children and provide recommendations for future research and programming. | P – Children 0–59 months and/or women of reproductive age, regardless of pregnancy status in low-income countries and LMIC  
I – Interventions aimed at increasing the quantity and/or quality of household food production  
C – NS  
O – Maternal, neonatal and young child nutrition and health outcomes  
S – Intervention studies (observational studies were excluded) | NS  
35th papers, representing 27 unique projects  
AMSTAR – 6 |
## Systematic review

<table>
<thead>
<tr>
<th><strong>Organic farming / diet</strong></th>
<th><strong>Objectives</strong></th>
<th><strong>Inclusion criteria – PICOS (Participants, Interventions, Comparisons, Outcomes, Study Types); Years of publication of papers</strong></th>
<th><strong>Date of search; number of papers/studies included; AMSTAR score</strong></th>
</tr>
</thead>
</table>
| Dangour et al. (2010)     | We sought to assess the strength of evidence that nutrition-related health benefits could be attributed to the consumption of foods produced under organic farming methods. | P – Human; (animal or human cell lines and serum; animal models)  
I – Consumption of or exposure to foodstuffs produced by organic farming methods.  
C – Conventionally produced foodstuffs.  
O – Nutrition-related health outcomes  
S – Randomized and nonrandomized controlled trials and studies with cohort, case-control, and cross-sectional designs; (in vitro and ex vivo studies in human or animal cell lines and serum; animal studies); abstract written in English.  
Years: 1990-? (NS) | 15 September 2008; 10 March 2010 for update  
8 studies in humans (plus 4 studies in animals or human cell lines or serum).  
AMSTAR – 8 |

| **Smith-Spangler et al. (2012)** | To review evidence comparing the health (nutrition, safety) effects of organic and conventional foods. | P – Human; foods grown conventionally or organically.  
I – Consumption of or exposure to foodstuffs produced by organic farming methods.  
C – Conventionally produced foodstuffs.  
O – NS, though reported health outcomes for the human studies and nutrient and contaminant levels for the food studies.  
S – Peer-reviewed studies of comparisons of organically and conventionally grown food or of populations consuming these foods; written in English.  
Years: 1958 to March 2010 | May 2009  
17 studies (14 unique populations) in humans and 223 studies of nutrient and contaminant levels in foods  
AMSTAR – 7 |

| **Reduction in meat production and consumption** | This review evaluates existing co-benefit models for emission and health outcomes of counterfactual scenarios of reduced meat consumption at a population level. | P – Human; defined study population.  
I – Meat consumption mitigation strategies with respect to both reduced greenhouse gas emissions and health benefits for a defined study population.  
C – NS  
O – Study focused on both emission and health outcomes of shared scenarios; and quantified at | NS  
7 reports / 5 studies  
AMSTAR – 6 |
<table>
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<tr>
<th>Systematic review</th>
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<th>Inclusion criteria – PICOS (Participants, Interventions, Comparisons, Outcomes, Study Types); Years of publication of papers</th>
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</table>
| **Bio-fortification of maize, rice or wheat**  
Gunaratna et al. (2010) | To evaluate the existing evidence for nutritional impact of Quality Protein Maize on child growth. | least one of the two outcomes: greenhouse gas emissions and human health outcomes directly associated with dietary meat intake.  
S – Model-based co-benefit studies of reduced meat consumption in peer-reviewed journal articles and official reports.  
Years: No limit | NS  
7 reports / 9 studies  
AMSTAR – 7 |
| **Genetically modified (GM) foods**  
Loevinsohn et al. (2013) | The primary question addressed by this review is: Under what circumstances and conditions does adoption of technology result in increased agricultural productivity? | | NS  
5 papers  
AMSTAR – 4 |
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<tr>
<td>Solari et al. (2011)</td>
<td>To review systematically the existing publications from the medical literature on the potential adverse effects of consuming GM foods on human health.</td>
<td>French. Years: Any P – Humans (for SR 1); Humans and Animals (for SR 3) I – Consumption of GM food C – NS O – Adverse events (on health) S – Primary Studies (case reports, case series) on adverse events with GM food consumption Years: Up to 4th May 2011</td>
<td>NS 3 papers in humans; 7 papers in animals AMSTAR – 3</td>
</tr>
<tr>
<td>Agriculture policies</td>
<td>Dangour et al. (2013b)</td>
<td>To systematically review the available evidence on whether national or international agricultural policies that directly affect the price of food influence the prevalence rates of undernutrition or nutrition-related chronic disease in children and adults.</td>
<td>P – Human I – Existing or proposed national or international agricultural policies that could directly affect the price of food: defined as output price policies; trade liberalization policies or public distribution system polices. C – NS O – Prevalence rates of undernutrition (measured with anthropometry or clinical deficiencies) and overnutrition (obesity and nutrition-related chronic diseases including cancer, heart disease and diabetes). S – Studies presenting multivariate quantitative analysis specifically designed to evaluate (ex post) or simulate (ex ante) the effects of the policies; written in English. Years: Data collected post-1990 to Dec 2012</td>
</tr>
<tr>
<td>McCorriston et al. (2013)</td>
<td>This systematic review focuses on the evidence for links between agricultural</td>
<td>P – Human; developing countries I – Agriculture trade liberalization intervention</td>
<td>NS</td>
</tr>
<tr>
<td>Systematic review</td>
<td>Objectives</td>
<td>Inclusion criteria – PICOS (Participants, Interventions, Comparisons, Outcomes, Study Types); Years of publication of papers</td>
<td>Date of search; number of papers/studies included; AMSTAR score</td>
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<tr>
<td>trade liberalization in developing countries and food security.</td>
<td>policy, including: export subsidies, tariffs (import or export), quotas, trade-restricting taxes, trade-restricting laws, import subsidies, other non-tariff barriers, and trade agreements C – NS O – Food security, including: income/poverty levels, food expenditure, food consumption, nutritional status, and food prices S – NS; written in English Years: NS</td>
<td>34 studies AMSTAR – 7</td>
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<tr>
<td><strong>Taxes and subsidies</strong></td>
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<tr>
<td><strong>Eyles et al.</strong> (2012)</td>
<td>Specific objectives were to assess: (1) the magnitude of the association of food taxes and subsidies with changes in food and nutrient intake, (2) the magnitude of the association of taxes and subsidies with health and disease states, and (3) the evidence for heterogeneity in these findings by socio-economic position.</td>
<td>P – Human; countries in the Organization for Economic Co-operation and Development. I – Food pricing strategies (taxes and subsidies) C – NS O – At least one of: food consumption (intake or food purchases), health status (biological risk factors such as blood pressure and cholesterol), and NCDs S – Simulation modelling studies; written in English Years: 1990 to 24 October 2011</td>
<td>24 October 2011 32 studies (30 with food consumption outcomes and 19 with health and disease outcomes) AMSTAR – 9</td>
</tr>
<tr>
<td><strong>Powell and Chaloupka</strong> (2009)</td>
<td>This article examines whether altering the cost of unhealthy, energy-dense foods, compared with healthy, less-dense foods through the use of fiscal pricing (tax or subsidy) policy instruments would, in fact, change food consumption patterns and overall diet enough to significantly reduce individuals’ weight outcomes.</td>
<td>P – Human, USA only I – Food prices (or taxes or subsidies) C – NS O – Body weight, BMI S – Provide peer-reviewed, original quantitative empirical evidence; written in English Years: 1990-2008</td>
<td>September 2008 9 papers / 7 separate studies AMSTAR – 1</td>
</tr>
<tr>
<td><strong>Powell et al.</strong> (2013)</td>
<td>The aim of this review of studies that examined prices and weight outcomes was to assess the extent to which changes in food or beverage prices have the potential to translate into significant</td>
<td>P – Human, USA only I – Food prices, taxes or subsidies (reporting was limited to taxes on sugar-sweetened beverages (SSBs) and fast food and subsidies on fruits and vegetables)</td>
<td>March 2012 36 papers in total, of which 20 studies reported weight outcomes and 22 studies</td>
</tr>
<tr>
<td>Systematic review</td>
<td>Objectives</td>
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</table>
| Thow et al. (2010) | To assess the effect of food taxes and subsidies on diet, body weight and health through a systematic review of the literature. | C – NS  
O – Consumption or weight outcomes  
S – Peer-reviewed or a research report from the Economic Research Service of the USDA; provided original quantitative evidence; was not an intervention study or pilot study; assessed demand for product categories (i.e. regular carbonated soda) rather than brands (i.e. Coke or Pepsi); for weight outcomes, contained direct estimates and was not a modelling study that drew on price elasticity estimates to derive simulated impacts on weight; written in English.  
Years: 2007 to March 2012 | reported consumption  
AMSTAR – 2 |
|                   |            | P – Human  
I – Monetary subsidies or taxes levied on specific food products (i.e. general agricultural subsidies or food taxes were excluded)  
C – NS  
O – Health outcome such as food consumption, body weight or disease.  
S – Empirical (i.e. assessed the effect of an actual tax) or modelling study (i.e. predicted rather than measured outcomes); written in English.  
Years: NS (all published between 2000 and 2009) | NS  
24 studies, including 18 with food consumption outcomes and 15 with body weight and/or disease outcomes.  
AMSTAR – 2 |

GM – genetically modified; LMIC – low / middle-income countries; NCD – non-communicable diseases; NS – not specified; SR – systematic review

*a This was revised down from 36 articles (as cited in the journal paper) following correspondence with the lead author (Dr Amy Webb-Girard) due to discrepancies in the number of studies.

*b Note: this review builds on a previous review by the same authors (Powell and Chaloupka 2009). There are significant limitations with the conduct of this systematic review. The lead author for the review was an author on 12 (out of 20) of the included studies that reported weight outcomes but declared no conflict of interest.
Table A2b. Characteristics of included systematic reviews – sorted by intervention type

<table>
<thead>
<tr>
<th>Systematic review</th>
<th>Details of interventions studied (number of studies)</th>
<th>Country / Region of studies (number)</th>
<th>Link with sustainable development / dimensions of integrated framework</th>
<th>Summary of findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agriculture interventions</strong></td>
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<tr>
<td>Berti et al. (2004)</td>
<td>Vegetable/home gardening (13) Livestock (3) Mixed garden and livestock (2) Cash cropping a (7) Irrigation (2) Other (3) - land redistribution, promotion of production with credit and extension services, duck–fish production system.</td>
<td>Africa (12), Asia (14) &amp; the Americas (4)</td>
<td>Well-conducted agriculture interventions ↑ productivity (Econ) and possibly nutrition (Social). Some interventions will also have environmental benefits (Env).</td>
<td>Most agriculture interventions increased food production, but not necessarily improved nutrition or health. Nutrition was improved in 11 of 13 home gardening interventions, and in 11 of 17 other types of intervention. Among the projects reviewed, home gardening projects usually had a higher success rate than other types of intervention, with at least some positive nutrition outcomes in all nine of the projects weighted as mid and high. Investing broadly in five types of capital, especially human capital, increases the prospects for nutrition improvement.</td>
</tr>
<tr>
<td>Masset et al. (2011); Masset et al. (2012b)</td>
<td>Bio-fortification (2) Home gardens (16) Small scale fisheries and aquaculture (3) Dairy development (1) Animal husbandry and poultry development (1)</td>
<td>Middle or low income countries</td>
<td>The adoption of a technology increases household income (Econ) and leads to better diets, which in turn lead to improvements in nutritional status (Social). Home gardens will also have environmental benefits as may bio-fortification (Env).</td>
<td>The interventions had a positive effect on the production of the agricultural goods promoted. The overall effect on household income remains unclear. The interventions were successful in promoting the consumption of food rich in protein and micronutrients, but the effect on the overall diet of poor people remains unclear. No evidence was found of an effect on the absorption of iron, but some evidence exists of a positive effect on absorption of vitamin A. Very little evidence was found of a positive effect on the prevalence of stunting, wasting, and underweight among children aged under 5 years.</td>
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<tr>
<td>Webb</td>
<td>Promotion and support of home</td>
<td>Low-income</td>
<td>Improvements in</td>
<td>The lack of impact of agricultural interventions on child nutrition were attributed to methodological weaknesses of the studies reviewed rather than to specific characteristics of these interventions. Although studies were too heterogeneous to</td>
</tr>
</tbody>
</table>
### Systematic Review Details of Interventions Studied (Number of Studies) | Country / Region of Studies (Number) | Link with Sustainable Development / Dimensions of Integrated Framework | Summary of Findings
---|---|---|---
Girard et al. (2012b); Webb Girard et al. (2012a) | gardens or the enhancement of existing gardens with improved, micronutrient-rich fruits, vegetables and/or tubers (16). Support for small livestock production, namely poultry rearing and fish farming alone or in combination with home gardens (9). Promotion of dairy production with cattle or goats alone or in combination with home gardens (2). | countries and LMIC | household food production can increase income (Econ), the quantity and quality of foods for household consumption, and potentially nutrition and health (Social). An intergenerational cycle of malnutrition can improve productivity and economic potential. (Econ) Home gardens will also have environmental benefits (Env). | conduct meta-analysis, agricultural strategies consistently reported significantly improved diet patterns and vitamin A intakes for both women and children. Although some individual studies reported significant reductions in child malnutrition, summary estimates for effects on stunting [relative risk (RR) 0.93 [95% confidence interval (CI) 0.84, 1.04]], underweight (RR 0.80 [95% CI 0.60, 1.07]) and wasting (RR 0.91 [95% CI 0.60, 1.38]) were not significant. Findings for an effect on vitamin A status, anemia and morbidity were inconsistent. Overall the evidence base for the potential of agricultural strategies to improve the nutrition and health of women and young children is largely grounded in a limited number of highly heterogeneous, quasi-experimental studies, most of which have significant methodological limitations. |
**Organic farming / diet** | Organic farming methods, though most studies limited to testing of one organic foodstuff, e.g. carrots, apples. Only two examined consumption as part of a whole diet. | NS | Organic farming has environmental (Env) and possibly health benefits (Social). It can also bring economic benefits to producers (Econ). | Note: only results from the human studies are included here. The results of the largest study suggested an association of reported consumption of strictly organic dairy products with a reduced risk of eczema in infants, but the majority of the remaining studies showed no evidence of differences in nutrition-related health outcomes that result from exposure to organic or conventionally produced foodstuffs. The published literature lacks strong evidence that organic foods are significantly more nutritious or healthier than conventional foods. However, organic produce may reduce exposure to pesticide residues (conventional produce has a 30% higher risk for pesticide contamination than...**

Dangour et al. (2010) | Organic farming methods, though most studies limited to testing of one organic foodstuff, e.g. carrots, apples. Only two examined consumption as part of a whole diet. | NS | Organic farming has environmental (Env) and possibly health benefits (Social). It can also bring economic benefits to producers (Econ). | Note: only results from the human studies are included here. The results of the largest study suggested an association of reported consumption of strictly organic dairy products with a reduced risk of eczema in infants, but the majority of the remaining studies showed no evidence of differences in nutrition-related health outcomes that result from exposure to organic or conventionally produced foodstuffs. The published literature lacks strong evidence that organic foods are significantly more nutritious or healthier than conventional foods. However, organic produce may reduce exposure to pesticide residues (conventional produce has a 30% higher risk for pesticide contamination than...**

Smith- Spangler et al. (2012) | Participants consumed: A predominately organic diet (4); A limited organic diet (2); Only certain organic foods – apples (2), carrots (1), tomatoes (1), juice and fresh produce (1) or Human studies: USA (2), Europe (11), USA & Europe (1) | NS | Organic farming has environmental (Env) and possibly health benefits (Social). It can also bring economic benefits to producers (Econ). | Note: only results from the human studies are included here. The results of the largest study suggested an association of reported consumption of strictly organic dairy products with a reduced risk of eczema in infants, but the majority of the remaining studies showed no evidence of differences in nutrition-related health outcomes that result from exposure to organic or conventionally produced foodstuffs. The published literature lacks strong evidence that organic foods are significantly more nutritious or healthier than conventional foods. However, organic produce may reduce exposure to pesticide residues (conventional produce has a 30% higher risk for pesticide contamination than...**
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<tr>
<td><strong>Reduction in meat consumption</strong></td>
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<tr>
<td>Yip et al. (2013)</td>
<td>Reduction in livestock product consumption – various scenarios modelled.</td>
<td>UK (2), UK and São Paulo city, Brazil (1), Europe (1), OECD (1)</td>
<td>Reducing meat consumption would reduce greenhouse gas emissions from livestock (Env) and improve health (Social), with potential economic impacts (Econ).</td>
<td>The estimated counterfactual scenario emission effects presented in the included studies ranged from a reduction of &lt;3–30% and reduction in the burden of disease ranged from 1 to 16%. All co-benefit studies estimated that reducing population meat consumption could reduce greenhouse gas emissions and the burden of disease. However, important attention must be paid to nutrition balance and a systematic approach in input and output attribute parameters is recommended for better model quality.</td>
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<tr>
<td><strong>Bio-fortification of maize, rice or wheat</strong></td>
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<tr>
<td>Gunaratna et al. (2010)</td>
<td>Bio-fortification with maize varieties with improved protein quality – Quality Protein Maize (9)</td>
<td>Sub-Saharan Africa, Asia, or Latin America – Ethiopia (2), Ghana (4), India (1), Mexico (1), Nicaragua (1)</td>
<td>Bio-fortification is believed to be cost-effective (Econ), improve health (Social), and more accessible to the rural poor than nutrient supplementation (Social / Econ). May have environmental effects due to higher yield (Env).</td>
<td>The results indicated that consumption of QPM instead of conventional maize leads to a 12% (95% CI: 7–18%) increase in the rate of growth in weight and a 9% (95% CI: 6–15%) increase in the rate of growth in height in infants and young children with mild to moderate undernutrition from populations in which maize is the major staple food. Participating subjects were children under five years of age, with most under 24 months at baseline. All studies were conducted in locations where children exhibited mild to moderate undernutrition.</td>
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<tr>
<td><strong>Genetically modified foods</strong></td>
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<tr>
<td>Loevinsohn</td>
<td>Biotechnology/ Genetically modified</td>
<td>India (2),</td>
<td>Genetically modified</td>
<td>No studies were found that assess the effect of</td>
</tr>
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<tr>
<td>et al. (2013)</td>
<td>Modified Organism (1) Hybrid seed (1) System of Rice Intensification (1) Irrigation and water management (1) Multiple technologies (1)</td>
<td>Peru (1), Rwanda (1) &amp; Timor Leste (1)</td>
<td>foods have potential health (Social), environment (Env) and economic (Econ) benefits.</td>
<td>genetically modified foods. One study of genetically modified cotton was included.</td>
</tr>
<tr>
<td>Solari et al. (2011)</td>
<td>Consumption of genetically modified (GM) food (3)</td>
<td>China (1), England (1) &amp; USA (1)</td>
<td>Genetically modified foods have potential health (Social), environment (Env) and economic (Econ) benefits.</td>
<td>While most of the studies reviewed found no evidence of adverse effects associated with the consumption of GM foods, some did find significant alterations at the morphological and functional levels of certain organs. The evidence is not sufficient to determine whether the consumption of GM foods has adverse effects on human health or not.</td>
</tr>
</tbody>
</table>

### Agriculture policies

**Dangour et al. (2013b)**

- Output price policies – subsidized price of agricultural outputs (2); Public food distribution system policies – food subsidy programs (2).

**McCorriston et al. (2013)**

- Agriculture trade liberalization intervention / policy, including: export subsidies, tariffs (import or export), quotas, trade-restricting taxes, trade-restricting laws, import subsidies, other non-tariff barriers, and trade agreements (numbers of each not given).

These policies affect the price of food (Econ) and possibly food consumption, nutrition and disease (Social).

Most food-insecure segments of the population are also the poorest, as poverty limits their purchasing power to access food on the market. Trade reform can also affect poverty (Econ) and hence by extension has a bearing on food security (Econ, Social). There is currently no direct evidence that agricultural policies that directly influence the price of food affect rates of undernutrition. However, there is a small effect on overnutrition, including a reduction in adult weight and risks of nutrition-related chronic disease.

The evidence indicates no consistent outcome, as 13 studies suggested that agricultural trade reform has led to an improvement in food security, while 10 studies reported a decline. The remaining 11 studies indicated a more mixed outcome. Part of the reason for the lack of clear evidence is that agricultural trade liberalization is often introduced alongside other reforms at the macroeconomic or sector level. These wider reforms can also impact on food security metrics, making it difficult to isolate any link with agricultural trade liberalization from other influences.
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<td><strong>Taxes and Subsidies</strong></td>
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<tr>
<td>Eyles et al. (2012)</td>
<td>Food taxes (17, 15) Subsidies (6, 3) Combinations of food taxes and subsidies (7, 4)</td>
<td>OECD countries</td>
<td>Food taxes raise revenue for governments (Econ). Pricing strategies (food taxes and subsidies) influence food choice and potentially health (Social).</td>
<td>Based on modelling studies, taxes on carbonated drinks and saturated fat and subsidies on fruits and vegetables would be associated with beneficial dietary change, with the potential for improved health. Higher quality studies suggested unintended compensatory purchasing that could result in overall effects being counter to health. Higher quality studies estimated that dairy/saturated fat taxes may increase mortality from CVD and CHD (n=1 study), and less healthy/junk food taxes may increase overall mortality (n=1 study) and mortality from stroke and CVD (n=2 studies). Most (11/14) studies assessing absolute impacts for lower socio-economic groups estimated that effects on food and nutrient consumption, and health and disease, would be pro-health. Relative impacts may also be greater for lower income groups, and thus food taxes and subsidies have the potential to be pro-equity. The limited existing evidence suggests that small taxes or subsidies are not likely to produce significant changes in BMI or obesity prevalence but that nontrivial pricing interventions may have some measurable effects on Americans’ weight outcomes, particularly for children and adolescents, low-SES populations, and those most at risk for overweight.</td>
</tr>
<tr>
<td><strong>Note:</strong> the first number in each of the brackets above refers to studies that assessed the impact of food pricing on diet (n=30) and the second to studies that assessed the impact on health and disease outcomes (n=19). Not that some studies assessed taxes, subsidies, and/or combinations of taxes and subsidies and as such have been included in more than one category above.</td>
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<tr>
<td>Powell and Chaloupka (2009)</td>
<td>Prices of: - Fruits and vegetables, and fast food (3) - Sugar, potatoes and whole milk (2 papers but 1 study with different analyses) - Meat, fruits and vegetables, dairy, and fast food (2 papers but same authors and with overlap in data used). - Full-service restaurants, fast food restaurants, and food at home (1)</td>
<td>USA (7 studies, 9 papers)</td>
<td>Food pricing policies impact on revenue (Econ), influence food choice and potentially health (Social).</td>
<td></td>
</tr>
<tr>
<td><strong>Note:</strong> that there are significant limitations with the included studies, as well as with the conduct of this systematic review.</td>
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<tr>
<td>Tax on soft drink and snacks (1) Tax on sugar-sweetened beverages (5) Prices of: - Fast food and fruit and vegetables (8) - Fast food (4) - Soft drink and fruit and vegetables (1) - Fruit and vegetables (1) - Carbonated beverages, fruit drinks, green vegetables (1)</td>
<td>USA (20)</td>
<td>Food pricing policies impact on revenue (Econ), influence food choice and potentially health (Social).</td>
<td>Overall, the evidence on the extent to which changes in food or beverage prices may significantly impact weight outcomes remains mixed. The studies that linked soda taxes to weight outcomes showed minimal impacts on weight; however, they were based on existing state-level sales taxes that were relatively low. Higher fast-food prices were associated with lower weight outcomes particularly among adolescents, suggesting that raising prices would potentially impact weight outcomes. Lower fruit and vegetable prices were generally found to be associated with lower body weight outcomes among both low-income children and adults, suggesting that subsidies that would reduce the cost of fruits and vegetables for lower-socioeconomic populations may be effective in reducing obesity.</td>
</tr>
</tbody>
</table>

| Food taxes, including on soft drink, snack food, “unhealthy food” and/or nutrient content, e.g. fat (17) Fruit and vegetable subsidies (2) Combinations of food taxes and subsidies (5) | USA, Ireland, Scotland, UK, Egypt, Denmark, Norway, Sweden, France | Food taxes raise revenue for governments (Econ). Pricing strategies (food taxes and subsidies) influence food choice and potentially health (Social). | In general, taxes and subsidies influenced consumption in the desired direction, with larger taxes being associated with more significant changes in consumption, body weight and disease incidence. However, studies that focused on a single target food or nutrient may 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. Almost all studies were conducted in high-income countries. |

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Econ – Economic; Env – Environment; GM – genetically modified; NS – not specified; P&S – Peace & Security; QPM – Quality Protein Maize; UK – United Kingdom; USA – United States of America.

*a* A **cash crop** is an agricultural crop which is grown for sale to return a profit.

*b* This number was revised down from the 10 cited in the journal paper following correspondence with the lead author (Dr Amy Webb-Girard) due to discrepancies in the number of studies.
### Additional File 3. Characteristics of included economic evaluations

Note: Two tables are included in this file in order to show all relevant details – Tables A3a and A3b.

#### Table A3a. Characteristics of included economic evaluations – methods & results – sorted by intervention type

<table>
<thead>
<tr>
<th>Economic evaluation</th>
<th>Intervention, Source of effectiveness data, &amp; Setting</th>
<th>Methods – Population, Comparator, Outcomes, Costs included,</th>
<th>Methods – Type of study, Model, Reference Year, Perspective, Time horizon, Discounting, Funding source</th>
<th>Result, incremental cost-effectiveness ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bio-fortification of maize, rice or wheat</strong></td>
<td><strong>Intervention:</strong> Bio-fortification of rice and wheat with zinc – optimistic and pessimistic scenarios for zinc content and coverage. <strong>Source of effectiveness data:</strong> Projected increases in zinc content and potential coverage rates were estimated by plant breeders and other experts. <strong>Setting:</strong> India</td>
<td><strong>Population</strong> – Infants (below 1 year of age) and children (1–5 years of age); India. <strong>Comparator</strong> – Alternative micronutrient interventions and international reference standards <strong>Benefits</strong> – DALYs (due to reductions in diarrhea, stunting, pneumonia and mortality) <strong>Costs</strong> – Basic R&amp;D, country-specific activities (adaptive breeding, dissemination, extension) and maintenance breeding.</td>
<td><strong>Type of study</strong> – Cost-utility analysis <strong>Model</strong> – NS, used a model based on DALYs <strong>Ref. Year</strong> – 2004 <strong>Perspective</strong> – NS <strong>Time horizon</strong> – 30 years <strong>Discounting</strong> – 3% on costs and health benefits <strong>Funding source</strong> – German Research Foundation</td>
<td>The cost for saving one DALY amounts to $US 0.73-7.31, which is very cost-effective by standards of the World Bank and the World Health Organization, and is lower than that of most other micronutrient interventions.</td>
</tr>
<tr>
<td>Stein et al. (2007)</td>
<td><strong>Intervention:</strong> Transgenic bio-fortification of rice with enhanced provitamin A, zinc, iron and folate concentrations (multi-biofortification). <strong>Source of effectiveness data:</strong> Projected increases in micronutrient content were estimated based on previous literature and input of scientists involved in bio-fortification</td>
<td><strong>Population</strong> – Whole population; China. <strong>Comparator</strong> – Status quo (current practice) <strong>Benefits</strong> – DALYs <strong>Costs</strong> – Basic R&amp;D, country-specific activities (adaptive breeding, regulatory requirements), social marketing and maintenance breeding.</td>
<td><strong>Type of study</strong> – Cost-utility analysis <strong>Model</strong> – NS, used the DALY framework <strong>Ref. Year</strong> – NS, costs and benefits calculated for 2002-2032 <strong>Perspective</strong> – NS <strong>Time horizon</strong> – 30 years</td>
<td>Under optimistic assumptions, the cost per DALY saved would be around US$ 2; it would stay below US$ 10 even under pessimistic assumptions. The total cost of developing and implementing multi-biofortified rice in China is...</td>
</tr>
<tr>
<td>Economic evaluation</td>
<td>Intervention, Source of effectiveness data, &amp; Setting</td>
<td>Methods – Population, Comparator, Outcomes, Costs included,</td>
<td>Methods – Type of study, Model, Reference Year, Perspective, Time horizon, Discounting, Funding source</td>
<td>Result, incremental cost-effectiveness ratio</td>
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<tr>
<td></td>
<td>projects.</td>
<td></td>
<td>Discounting – 3% on costs and health benefits</td>
<td>approximately US$ 85.4 million.</td>
</tr>
<tr>
<td><strong>Setting:</strong> China</td>
<td></td>
<td></td>
<td>Funding source – NS</td>
<td>Effective and cost-saving (dominant)</td>
</tr>
<tr>
<td><strong>Taxes and subsidies</strong></td>
<td></td>
<td></td>
<td>Type of study – Cost-utility analysis[^b^]</td>
<td>Intervention costs ≤ $US0.02 per head in LMIC; $US0.11 per head in England</td>
</tr>
<tr>
<td>Cecchini et al. (2010)</td>
<td>Intervention[^a^]: Fiscal measures (taxes or subsidies) that increase the price of unhealthy food content (fat) or reduce the price of healthy foods rich in fiber (fruits and vegetables)</td>
<td>Population – Whole of population, 0-100 years</td>
<td>Model – Micro-simulation model developed by WHO and OECD (CDP model)</td>
<td></td>
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<tr>
<td></td>
<td>Source of effectiveness data: Demand elasticities from French Government report that reviewed results from 9 studies.</td>
<td>Comparator – No prevention or treatment only</td>
<td>Ref. Year – 2005</td>
<td></td>
</tr>
<tr>
<td><strong>Setting:</strong> LMIC - Brazil, China, India, Mexico, Russia, and South Africa; plus England.</td>
<td>Benefits – DALYs</td>
<td>Perspective – NS</td>
<td>Time horizon – Lifetime of cohort (100 years)</td>
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<td></td>
<td>Costs – basic administration, planning, monitoring and enforcement at the national level. Potential revenues from the tax, as well as expenditures originating from the subsidy, are not accounted for in the analysis, as they represent transfers rather than costs.</td>
<td>Discounting – 3% on costs and health benefits</td>
<td>Discounting – 3% on costs and health benefits</td>
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<tr>
<td></td>
<td></td>
<td>Funding source – Contributions of OECD member countries and a grant from the European Commission</td>
<td>Funding source –</td>
<td></td>
</tr>
<tr>
<td>Dallongeville et al. (2011)</td>
<td>Intervention[^2^]: Fiscal measures (taxes or subsidies) including: 1) 3.4% reduction in VAT, and 2) €100/year/person fruit &amp; vegetable stamp policy designed for low-income consumers</td>
<td>Population – Whole of population plus those in the first decile of income (low income), age NS</td>
<td>Type of study – Cost-effectiveness analysis</td>
<td>Average cost-effectiveness ratio: The costs/LYS are €100,000 for VAT reduction and €474,000 for the food stamp policy.</td>
</tr>
<tr>
<td></td>
<td>Source of effectiveness data: Income elasticity and price</td>
<td>Comparator – Current practice</td>
<td>Model – Economic model of the fruit and vegetables market, incorporating supply and demand.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Benefits – number of deaths avoided (DA) and life-years saved (LYS)</td>
<td>Ref. Year – 2006</td>
<td>Ref. Year – 2006</td>
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<tr>
<td>Economic evaluation</td>
<td>Intervention, Source of effectiveness data, &amp; Setting</td>
<td>Methods – Population, Comparator, Outcomes, Costs included,</td>
<td>Methods – Type of study, Model, Reference Year, Perspective, Time horizon, Discounting, Funding source</td>
<td>Result, incremental cost-effectiveness ratio</td>
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</table>
|                      | elasticity of demand were from French studies; the price elasticity of supply was from a UK study. | **Costs** – The direct costs included those of decreases in government revenue due to 1) decreases in VAT on fruit and vegetables and 2) the costs of subsidizing fruit and vegetable consumption. | **Perspective** – NS  
**Time horizon** – NS  
**Discounting** – NS  
**Funding source** – NS | 1,032).  
The food stamp policy reduces health inequalities between low-income consumers and others, whereas the VAT reduction can increase them. |
| Sacks et al. (2011) | **Intervention**: d Fiscal measure (tax) – 10% tax on unhealthy food (biscuits, cakes, pastries, pies, snack foods, confectionery and soft drinks)  
**Source of effectiveness data**: In the absence of direct evidence of effect on BMI and health outcomes, a logic pathway was used. At each stage of the logic pathway, the best available evidence was used, in some cases supplemented with reasoned assumptions. Food consumption: Australian 1995 National Nutrition Survey, Own-price and cross-price elasticities: UK National Food Survey  
**Setting**: Australia | **Population** – Adults, ≥20 years  
**Comparator** – Current practice  
**Benefits** – DALYs  
**Costs** – Implementation of the legislation (including costs related to legislative activities, and administration and enforcement of laws once passed for a period of 10 years, costs to food industry for changing food labels)  
**Type of study** – Cost-utility analysis  
**Model** – Used multistate life table Markov model  
**Ref. Year** – 2003  
**Perspective** – Health sector perspective (with some industry costs included)  
**Time horizon** – Lifetime of cohort (remaining lifetime of cohorts – ages grouped by 5 years)  
**Discounting** – 3% on costs and health benefits  
**Funding source** – Australian National Health and Medical Research Council | Effective and cost-saving (dominant)  
Reduced mean weight 1.6 kg (95% UI: 1.5; 1.7); DALYs averted 559,000 (95% UI: 459500; 676,000).  
Cost outlay was $AUD18 million (95% UI: 14.4; 21.6). |
| **Strategies to combat acidification and ozone** | **Intervention**: Strategies to | **Population** – NS  
**Type of study** – Cost-benefit | Net benefits for all |

Krewitt
### Economic evaluation

**Intervention, Source of effectiveness data, & Setting**

(1999) combat acidification and ozone in Europe, including:
1) 50% Gap closure between the level of ecosystem protection in 1990 and the target of 100% ecosystem protection by 2010; 2) Joint optimization; and 3) Maximum feasible reduction.

**Source of effectiveness data:** Effectiveness of measures to achieve the targets under each of the three scenarios were not specified.

**Setting:** Europe

### Methods – Population, Comparator, Outcomes, Costs included

**Comparator** – Current Reduction Plan

**Benefits** – Avoided damage costs ($) due to reduced adverse effects on human health (mortality and morbidity), crop production and building materials. All impacts valued in $US 1990 using the approach of willingness-to-pay for improved environmental quality.

**Costs** – Emission control costs ($) required to implement the strategies.

### Methods – Type of study, Model, Reference Year, Perspective, Time horizon, Discounting, Funding source

**Model** – Used an impact assessment model (EcoSense), which uses relevant input data from the whole of Europe.


**Perspective** – NS

**Time horizon** – NS

**Discounting** – 0% on health and environmental benefits

**Funding source** – Partly funded by the European Commission under the JOULE Program.

### Result, incremental cost-effectiveness ratio

The estimated cost-effectiveness ratio (CER) for biocontrol in Nigerian maize ranged from 5.10 to 24.8 (‘very cost-effective’); and for the post-harvest intervention package in Guinean groundnuts ranged from 0.21 to 2.08 (‘not cost-effective’ to ‘very cost-effective’).

### Aflatoxin control strategies in maize and groundnuts

**Interventions:** Two potential aflatoxin control strategies: (1) pre-harvest biocontrol, using atoxigenic strains of *Aspergillus flavus* competitively to exclude toxigenic strains from colonizing maize in Nigeria; and (2) post-harvest interventions in a package to reduce aflatoxin accumulation in groundnuts in Guinea.

**Population** – Whole of population of Nigeria and Guinea, respectively.

**Comparator** – NS (No intervention)

**Benefits** – DALYs (due to reduction in aflatoxin-induced hepatocellular carcinoma cases) multiplied by gross domestic product

**Type of study** – Cost-utility analysis

**Model** – NS, Used a combination of health-economic formulae and quantitative cancer risk assessment

**Ref. Year** – 2009

**Perspective** – NS

Benefits are not evenly distributed throughout Europe.
<table>
<thead>
<tr>
<th>Economic evaluation</th>
<th>Intervention, Source of effectiveness data, &amp; Setting</th>
<th>Methods – Population, Comparator, Outcomes, Costs included</th>
<th>Methods – Type of study, Model, Reference Year, Perspective, Time horizon, Discounting, Funding source</th>
<th>Result, incremental cost-effectiveness ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Source of effectiveness data: 1) Personal communication (R Bandyopadhyay, International Institute of Tropical Agriculture, Ibadan, Nigeria) 2) Community-based controlled trial in West Africa</td>
<td>Costs – 1) Biocontrol costs from production to use; 2) Intervention package cost.</td>
<td>Time horizon – 5 years Discounting – 3% on benefits Funding source – US Department of Agriculture Special Cooperative Agreement and a National Institutes of Health Early Career Award</td>
<td>effective).</td>
</tr>
</tbody>
</table>

CDP – chronic disease prevention; DALYs – Disability-adjusted life years saved; LMIC – low / middle-income countries; NS – not specified; OECD – Organization for Economic Co-operation and Development; UI – Uncertainty Interval; WHO – World Health Organization;

a Cost-utility analysis is a special form of cost-effectiveness analysis where consequences are measured in terms of preference-based measures of health, such as quality adjusted life years (QALYs) or disability adjusted life years (DALYs). The advantage of cost-utility analysis over cost-effectiveness analysis is that it allows the comparison of alternative interventions that have very different health benefits (e.g. interventions for heart disease vs interventions for mental health).

b As well as these fiscal measures, this study also examined a range of population-based interventions for obesity, including school-based health promotion, work site health promotion, mass media campaigns, counselling of individuals at risk in primary care, regulation of food advertising to children, and compulsory food labelling. A combination of a mass media campaign, fiscal measures, food advertising regulation, and food labelling was also considered.

c In addition to the two interventions reported here, this study also examined a €10M information campaign.

d This study also examined traffic-light nutrition labelling.

e According to World Health Organization guidelines for cost-effectiveness, an intervention with a cost-effectiveness ratio (CER) > 1 can be considered ‘very cost-effective’; an intervention with a CER > 0.33 is considered ‘cost-effective’; and an intervention with a CER < 0.33 ‘not cost-effective’ (WHO 2001). The CER is the per-capita GDP multiplied by total DALYs saved divided by the cost of the intervention.
Table A3b. Characteristics of included economic evaluations – commentary – sorted by intervention type

<table>
<thead>
<tr>
<th>Economic evaluation</th>
<th>Link with sustainable development / dimensions of integrated framework</th>
<th>Strengths &amp; Limitations</th>
<th>Critical success factors / Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio-fortification of maize, rice or wheat</td>
<td>Bio-fortification is believed to increase yield (Econ) and micronutrient content and thus, potentially improve health (Social). Also, because stable foods predominate in the diets of the poor, this strategy implicitly targets low-income households, for which it is also more affordable than nutrient supplementation (Social / Econ).</td>
<td>A significant limitation is the lack of effectiveness data for zinc bio-fortification. Another limitation is the use of household-level rather than individual-level food intake data. Consequently, the use of adult equivalent weights to attribute a share of the household’s overall consumption to each household member only approximates actual individual intakes, and may significantly overestimate infant intakes.</td>
<td>As with all interventions, impact depends on coverage and the further the program is from urban centers and the more it targets people at the margin of society, the more difficult and expensive it is to increase coverage – this is an advantage of bio-fortification. While the biggest burden of zinc deficiency is borne by infants, the biggest health gain through bio-fortification occurs among children aged 1–5 years. Given the higher natural zinc content in existing wheat varieties and the lower potential increases in bio-fortified wheat compared with rice, the impact of wheat bio-fortification is lower than the impact of rice bio-fortification. While iron and zinc bio-fortification is possible with conventional breeding methods, pro-vitamin A and folate bio-fortification in rice requires transgenic approaches. Despite the support of the Chinese government, there may potentially be problems of public acceptance with transgenic rice. Moreover, pro-vitamin A bio-fortification in particular is associated with a yellowish color, which may also entail skepticism among rice producers and consumers, if not accompanied by special awareness-building and marketing efforts.</td>
</tr>
<tr>
<td>Steur et al. (2012)</td>
<td>Bio-fortification is believed to increase micronutrient content and thus, potentially improve health (Social). Also, because stable foods predominate in the diets of the poor, this strategy implicitly targets low-income, rural households, for which it is also more affordable than nutrient supplementation (Social / Econ).</td>
<td>An optimistic and pessimistic scenario was modelled due to uncertainty about effectiveness. It was assumed that the effects for each individual micronutrient can simply be added due to lack of knowledge on micronutrient interactions – but these could lead to double-counting (and overestimation) or there could be a synergistic effect, which would lead to underestimation. Limitations include the data used in the DALY framework – the data used in the scenario calculations build on several assumptions. While we have made great effort to use the most realistic data and assumptions, some degree of uncertainty remains, which needs to be kept in mind. Second, our approach relies on average micronutrient intake and food consumption data for the target</td>
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<tr>
<td>Economic evaluation</td>
<td>Link with sustainable development / dimensions of integrated framework</td>
<td>Strengths &amp; Limitations</td>
<td>Critical success factors / Comments</td>
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<tr>
<td>Taxes and subsidies</td>
<td>Food pricing policies impact on revenue (Econ), influence food choice and potentially health (Social).</td>
<td>groups considered. To capture distributional effects, disaggregated household or individual level data would be preferable, but unfortunately such data are not available for China on a nationally representative basis. The CDP model developed for this study is a simplified representation of the complex reality and is heavily constrained by the availability of national (or subnational) data for the many required input parameters. A key limitation is that information about the long-term effects of interventions is almost nonexistent, so authors assumed that effects disappear once exposure to an intervention ends. One of the key strengths is that it allows combination of multiple and heterogeneous sources of data, thus overcoming the limitations of individual sources. Probabilistic uncertainty analysis confirmed the cost-effectiveness of the intervention against country-specific thresholds for cost-effectiveness. Although the CDP model was designed to assess the distributional effects of prevention strategies, we were unable to undertake such assessment in this analysis because of data limitations. CRD commentary – The analysis was conducted in low- and middle-income countries, as well as in the UK, and the results might be transferable to other countries with similar income and epidemiological characteristics. The cost-effectiveness approach was conventional and the results appear to be robust, but the data sources and some methods were not clearly presented.</td>
<td>The advantage of fiscal measures (along with regulatory measures that improve nutritional information content or restrict the marketing of unhealthy food products) is their greater coverage in the population—i.e. more people are exposed to their positive effects—and the fairly low cost of their implementation. Price interventions and regulation – biggest health gains in shortest timeframe. Fiscal measures are consistently cost saving in LMIC and generate largest (or second largest) health effects at 20 and 50 years.</td>
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<tr>
<th>Economic evaluation</th>
<th>Link with sustainable development / dimensions of integrated framework</th>
<th>Strengths &amp; Limitations</th>
<th>Critical success factors / Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dallongeville et al. (2011)</td>
<td>Food pricing policies impact on revenue (Econ), influence food choice and potentially health (Social).</td>
<td>CRD commentary - The study had a number of methodological limitations. The key methods were not well reported and the authors did not perform an incremental cost-effectiveness analysis. These points (i) targeted and non-targeted policies to promote F&amp;V intake have a modest impact on consumption and as a result on health gains, (ii) non-targeted</td>
<td></td>
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</table>

22
<table>
<thead>
<tr>
<th>Economic evaluation</th>
<th>Link with sustainable development / dimensions of integrated framework</th>
<th>Strengths &amp; Limitations</th>
<th>Critical success factors / Comments</th>
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<tbody>
<tr>
<td>make it difficult to determine if the results are reliable and if the conclusions are appropriate. Authors note – methods rely on restrictive assumptions, which would influence results.</td>
<td>interventions through price modifications appear to be more cost-effective than targeted actions through subsidizing the consumption of the most disfavored subpopulations and (iii) owing to their lower cost, information campaigns are more cost-effective, despite lower deaths avoided than VAT reduction. LYS are larger with VAT reduction than F&amp;V stamps policies, (ii) information campaigns are the most cost-effective and (iii) market forces can limit the impacts of public health policies designed to favour F&amp;V consumption increase</td>
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</tr>
<tr>
<td>Sacks et al. (2011)</td>
<td>Food pricing policies impact on revenue (Econ), influence food choice and potentially health (Social).</td>
<td>The key strengths of this study are that it combines technical analysis (using the best available evidence) with other considerations of importance to decision makers, utilizes extensive uncertainty analysis, and employs assumptions which are both transparent and conservative. The limitations of this study are predominantly around the quality of the evidence supporting the effect of the interventions. The direct evidence supporting the likely impact of the interventions on consumer behavior is relatively weak. To counter this uncertainty, the assumptions underpinning the estimates of the change in food consumption resulting from the intervention were conservative, and several different scenarios of intervention effect were examined.</td>
<td>The intervention impacts on the total adult population. As a consequence, the DALYs saved and cost offsets are generally significantly higher than for interventions which only impact on a proportion of the population. Even if the effect of the intervention was assumed to decay progressively down to no effect after 10 years, and if the effect of the price elasticities was 20 times less than what was estimated, the intervention would remain dominant (when cost offsets are included). There is weak evidence indicating specifically how this intervention will influence consumer behavior and its overall impact on diet and diet-related disease. The intervention is likely to be regressive; however, the health benefits of the tax are also likely to be relatively greater in lower income groups. The</td>
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### Economic evaluation

<table>
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<tr>
<th>Economic evaluation</th>
<th>Link with sustainable development / dimensions of integrated framework</th>
<th>Strengths &amp; Limitations</th>
<th>Critical success factors / Comments</th>
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</thead>
<tbody>
<tr>
<td>Strategies to combat acidification and ozone</td>
<td>Strategies to combat acidification and ozone have both environmental (Env) and health (Social) benefits. The analysis also shows economic (Econ) benefits.</td>
<td>Uncertainty arises due to the need for better information on the effects of particles on human health (e.g. is it number, mass concentration, or their chemical composition that is the driving force?); effects of nitrate aerosols on health; and the best approach to valuation of mortality. The overall effect of significant variation in the approach for valuation of mortality was found to be insignificant in terms of whether benefits would exceed costs. It did however affect cost-benefit ratios. The impact categories that are included in the analysis (except for ecosystem damage that could not be quantified) include the most important sources of environmental damage costs. However, total benefits may be underestimated due to the exclusion of a large number of effects.</td>
<td>specific way in which the tax would be operationalized in the Australian context is uncertain, and there may be concerns about the feasibility of this type of tax on food products. The largest reductions in damage are found in the countries with the largest populations – France, Germany, Italy, Spain, and the UK. Avoided damages also tend to be larger in central states, because of the reduction in emissions in neighboring areas. The countries where net losses or only small benefits are predicted are those on the fringe of the European Union - particularly Ireland.</td>
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### Critical success factors / Comments
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<tr>
<th>Economic evaluation</th>
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<th>Critical success factors / Comments</th>
</tr>
</thead>
</table>
| (Wu and Khlangwiset (2010)) | Aflatoxin (a toxin of fungal origin) reduces the market value of affected commodities (e.g. maize, peanuts) (Econ) and, if consumed, has health impacts (e.g. causing aflatoxin-induced hepatocellular carcinoma or liver cancer) (Social) | The cost-effectiveness ratios are underestimated in this study because the only end-point measured was a reduction in aflatoxin-induced liver cancer (aflatoxin-induced immunotoxicity or growth retardation in early life were not included due to insufficient information). Moreover, improving food quality can also result in improved market outcomes, which were not included in this study. The assumption that there was a linear dose–response relationship between the amount of aflatoxin reduction afforded by each intervention and the reduction of aflatoxin-induced liver cancer cases in the population is a limitation of the study. Though used in previous risk assessments, the true relationship between aflatoxin exposure and liver cancer may possibly be non-linear at lower doses. | There is a potential risk of invasive aspergillosis from *A. flavus* exposure among immunocompromised individuals, thus, it is important to ensure that the biocontrol material is applied in such a way as to minimize direct inhalation of spores. The feasibility of interventions to reduce aflatoxin from a global perspective must also be addressed by answering questions such as:  
- What would be the delivery mechanism of the intervention?  
- Can the intervention be manufactured locally, or must it be imported?  
- Can farmers or consumers afford the up-front costs, and if not, who will pay for the intervention? etc. |

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*CRD – Centre for Reviews and Dissemination, UK; LMIC – low / middle-income countries; NS – not specified;*