

# **Food Policy Evidence Reviews**

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*These reviews presents the latest international evidence on the effectiveness of policies within the seven domains of the Food-EPI tool on population nutrition and related behaviours (consumer purchases and eating patterns).*

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Reviews extracted from unpublished Masters thesis: '*The Relative Contributions of Food Policies to Improving Population Nutrition - Weighting System For The INFORMAS Food-EPI Tool: A Delphi Study*'

Masters of Public Health, The University of Auckland, 2015

*Please acknowledge the author if using the material.*

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## **1.1. FOOD LABELLING**

### **1.1.1 Codex labels**

#### **Ingredient lists and nutrient declarations in line with Codex recommendations are present on the labels of all packaged foods**

*The evidence on the association between nutrient declarations and consumer use, understanding and dietary outcomes is summarised below. Please note that the systematic reviews have used the term ‘nutrition labels’ as opposed to ingredient lists and nutrient declarations.*

Evidence from systematic reviews indicates that most consumers claim to look at “nutrition labels” (also called the nutrition information panels or NIPs) often or at least sometimes (1, 2). Prevalence of self-reported use of nutrient declarations is generally high (e.g. 82 % in NZ, 52 % in Canada, 47 % in the European Union (EU) and 75 % in the United States (US)) (2). Although reported use of nutrient declarations is high, surveys suggest that actual use of nutrient declarations during food purchase may be much lower. For example, Cowburn and Stockley (1) noted that three studies using verbal protocol analysis (a more objective method which elicits participants’ thoughts as they are undertaking a task, e.g. on their shopping choices using nutrient declarations) suggested that consumers may simply look at the nutrition information panel but not process the information further.

A recent systematic review undertaken by Campos et al., (2), examined consumer use and understanding of nutrient declarations on pre-packaged foods, and the impact of nutrient declarations on consumer dietary habits. This review comprised 120 studies, including cross-sectional surveys (n=96), experimental studies (n=17), natural experiments (n=7) and longitudinal surveys (n=2). This systematic review did not assess the quality of the studies reviewed. Campos et al., (2) found consistent findings with an earlier systematic review examining consumer use and understanding of nutrient declarations by Cowburn and Stockley (1). A total of 103 papers were included in this review of which nine studies were judged to be of “medium-high” quality (1). Cowburn and Stockley (1), reported that 28% of studies reviewed were undertaken in realistic settings where actual food purchasing decisions were made, while 57% of the studies were cross-sectional surveys, and 14% were experimental designs.

Both systematic reviews concluded that consumers generally perceive nutrient declarations to be useful. However, consumer nutrition knowledge (of the type needed to interpret nutrient declarations), was reported to be moderate or low (1, 2). The evidence with respect to consumers' understanding of nutrient declarations is mixed. For example, three experimental studies reviewed by Campos et al., (2) that asked consumers to retrieve or manipulate information from nutrient declarations, reported that consumers had good understanding of nutrient declarations based on their performance. However, nine studies indicated that many consumers reported difficulty understanding the quantitative information presented on labels especially in regards to recommended daily amounts, per cent daily values, serving sizes or other forms of reference information on labels (2). Most consumers appeared to be able to retrieve simple information and make simple calculations and comparisons between products using numerical information, but their ability to interpret the nutrition label accurately reduced as the complexity of the tasks in the studies increased (1, 2).

The systematic reviews (1, 2) also examined the types of nutrition information sought by consumers and found that consumers were more likely to look at nutrients they wished to avoid. The most commonly sought for nutrient was fat, followed by energy content and protein. Consumers reported that they did understand the terms '*fat*', '*calories/kilocalories*', '*sugar*', '*vitamins*' and '*salt*'. However, consumers had difficulty understanding the role that these different nutrients displayed on the labels played in their diet. Both reviews (1, 2) found that the groups who were most likely to understand and use nutrient declarations included women, those on a higher income, those with a higher level of educational achievement, middle aged and younger adults, consumers with a special interest or positive attitude to diet and health, and those with a medical diagnosis. Studies that used educational interventions that targeted label knowledge and understanding was shown to have positive results in a range of sub-populations including low income groups (2).

Campos et al., (2) reported that the observational studies consistently found an association between the use of nutrient declarations and healthier diets in seven studies reviewed. In six studies, label use was associated with lower fat consumption. Several studies also found that label use was associated with consuming healthier varieties of foods, with some studies showing reduction in sodium, cholesterol and energy intakes and increase in fibre intakes. Associations between label use and healthier diets were also consistent in experimental and longitudinal studies. Campos et al., (2) also reviewed longitudinal studies in the US which evaluated the implementation of the 1990 Nutrition Labelling and Education Act (NLEA)

which required the ‘Nutrition Facts’ panel to display information on nutrients (such as calories, total and saturated fats, cholesterol, and sodium) in a standardised format on all pre-packaged foods. After the implementation of the Act in 1994 studies observed that (2):

1. A nationally representative sample survey of consumers in 1989 and 1995 showed that frequent label users in 1995 had a significantly greater probability of consuming a low-fat diet compared with both non-label users in 1995 and frequent label users in 1989 (before the implementation of the Act)
2. Low-fat and low-sodium food purchases increased significantly, although the same effect was not observed for purchases of low-energy food products and/or food products with healthier nutrients.

Campos et al., (2) concluded that the evidence reviewed showed that consumers found nutrient declarations to be a credible source of nutrition information and reported high usage of the nutrient declarations to guide their selection of foods. The authors stated that the evidence reviewed also indicated a consistent relationship between nutrition label use and healthier diets, although this causal nature may be bi-directional. Both systematic reviews concluded that there was not enough evidence to indicate that nutrient declarations use was associated with higher diet quality. Cowburn and Stockley (1) also stated that they could not conclude with any certainty that the findings from the review will reflect how consumers behave when they are actually making food purchase decisions because only about one-third of studies they reviewed took place in realistic settings. Several limitations of these reviews include: the lack of studies in non-high income Western countries; the range and variety of approaches used for measurement making comparison between studies difficult; and majority of the data were based on self-report measures which may over-estimate the use of nutrient declarations.

*Overall, the evidence from the literature indicates that consumers generally perceive nutrient declarations (nutrition labels) to be useful in guiding their food choices and the prevalence of self-reported use was generally high. However, findings might not reflect how consumers behave when they are actually making food purchase decisions in real life. Consumer nutrition knowledge was reported to be moderate or low and there is mixed evidence with respect to consumers’ understanding of nutrient declarations. There is currently insufficient evidence to indicate that providing nutrition information on packaged foods has a positive impact on diet.*

### **1.1.2 Food Claims**

**Robust, evidence-based regulatory systems are in place for approving/reviewing claims on foods, so that consumers are protected against unsubstantiated and misleading nutrition and health claims**

*The evidence on the association between health claims and nutrition claims on consumer use, understanding and purchasing behaviour is summarised below.*

A review undertaken by Williams (3) examined consumer use and understanding of health claims on foods. Studies that used surveys, interviews and focus groups showed that consumers in several countries perceived health claims to be useful. The author noted that the reason consumers liked health claims appeared to be because of general difficulties in interpreting existing nutrition information on labels. However, the extent of use of health claims is unclear. The evidence also indicated that consumers were sceptical of health claims on foods and supported health claims being regulated by government. However, consumers often assumed that health claims had already been approved by government authorities, despite explicit statements on the packages.

Williams (3) also reviewed a number of experimental studies that used mock food packages with varying labelling formats to evaluate the impact of health claims on consumers' attitudes and beliefs about the product. The most consistent finding from the studies reviewed, was that health claims increased consumers' expectations about the healthiness of products and produce more positive attitudes towards their nutritional value. A general "halo effect" is observed, which influences the beliefs about nutritional attributes unrelated to health claims. Some studies reported that the presence of a health claim was associated with a greater probability of limiting their search for information to the front panel only, although this was not consistent in all studies.

Two studies reviewed found that after the introduction of NLEA legislation, the level of misleading health claims substantially reduced. Two other studies reviewed suggested that there were increases in sales for both oats and folate-enriched breakfast cereals after claims and media coverage about the health benefits of these products. However, another study found that claims alone for new products do not increase their sales. For, example a study that was reviewed (4), examined the sales of cooking oils in New York pre and post NLEA, found that pre-NLEA, food companies actively competed with explicit health claims promoting heart health, lower saturated fat and higher monounsaturated fat choices. After, the implementation

of the NLEA, these health claims were prohibited and the study found that consumers shifted their purchases toward “nutritionally inferior” cooking oils that were high in saturated fat. The purchase of oils with monounsaturated fats increased in areas with highest levels of education suggesting that less educated consumers may have been more impacted by the change. Williams concluded that more research is needed to understand the impact on health claims and food choices (3).

A review (5) examining the use and understanding of claims in NZ and Australia, found that consumers reported high levels of awareness for endorsement programs such as the National Heart Foundation Pick the Tick program and reported an increase in using the tick to guide food selection. Findings also suggested that consumers perceived this programme to be more credible and it had a greater impact on purchases compared to written claims. However, consumers also reported difficulty interpreting the tick logo (5). For example, a study reviewed (6) showed that one third of NZ shoppers surveyed (n=1509) in 28 supermarkets, misinterpreted the meaning of the logo and believed that all tick-endorsed foods could be eaten without restriction. The authors of this review noted that these studies were carried out soon after implementation and that increased awareness and education surrounding the program may have increased consumer understanding (5). An online survey study reviewed, (n=1,044), found that, in general, high level claims (e.g. risk reduction) had the most influence on intent to purchase compared with general-level claims (nutrition content and function claims). Another study reviewed found that majority of participants (n=1940) misinterpreted nutrient claims for ‘lite’, ‘no added sugar’, 94% fat free. 77% of participants thought that ‘lite’ referred to fat; 28% thought ‘no added sugar’ meant that there was no sugar in the product at all; while only 11% and 16% correctly interpreted the ‘reduced salt’ claim and ‘94% fat free’ claim, respectively (5).

*Overall, the evidence base in this area is limited and more studies and systematic reviews are needed to establish whether an association exists between the use and understanding of health and nutrition claims and food purchases and dietary outcomes. There is some evidence that health claims are associated with a general “halo effect”, although consumers might misinterpret the meaning of the claims. This suggests that consumers might be susceptible to misleading claims.*

### **1.1.3 Front-of-Pack**

**A single, consistent, interpretive, evidence-informed front-of-pack (FOP) supplementary nutrition information system, which readily allows consumers to assess a product's healthiness, is applied to all packaged foods**

*The evidence on the association between different FOP supplementary nutrition information systems on packaged foods and consumer use, understanding, purchase and consumption is summarised below. Please note that although the systematic review summarised below, classifies systems such as the Keyhole symbol as a FOP labelling system, while the INFORMAS typology classifies it as a “health claim” (7)*

Systematic reviews (1, 2, 8) indicate that consumers want a simpler presentation of nutrition labelling information. Compared with ‘traditional’ nutrient declarations, graphics and symbols, adjectival descriptions of nutrient levels such as ‘high’ or ‘low’, and labels with minimal numerical content are more effective in helping consumers understand, interpret and apply the information provided (1, 2, 8).

A systematic review undertaken by Hersey et al., (8) examined the effects of FOP and shelf nutrition labelling systems on consumers’ use, understanding, purchase behaviour and consumption. The authors noted that “nutrient-specific FOP symbols display a few key nutrients” and gave examples such as: the Traffic Light System (TLS) used in Britain which is colour-coded and usually displays a ranking (high-green, medium-yellow, low-red) for total fat, saturated fat, sugar, sodium or salt and sometime energy; and the Guideline of Daily Amounts (GDA%) which displays the nutrients per portion and as a percentage of a person’s GDA for each nutrient. The authors defined “FOP summary systems” as those using an algorithm to provide an overall nutritional score. Some examples include: binary systems such as the Choices Programme logo or the Keyhole Symbol; graded systems such as the Guiding Starts system and NuVal system; “multiple level summary icon” as a symbol that displays a graphic rating or numerical score based on a nutritional algorithm. A total of 38 articles were examined in this systematic review, of which 20 studies used an experimental design. The results on the effects of FOP and shelf nutrition labelling system are summarised below:

- Understanding of labels**

Three out of seven studies found that consumers could easily identify healthier products using FOP labels compared with none, while the remaining studies found mixed results. Six out of 10 studies found that consumers could easily assess the level of nutrients and/or identify the

healthier product using nutrient specific systems compared with summary systems. Several studies found that consumers could identify healthier foods, rate the healthfulness of foods and have more realistic attitudes towards the healthfulness of the products using FOP labels with symbolic colour compared with no colour. Similar findings were also found for FOP labels with text. Seven out of 12 studies found that FOP labels that combined text and colour enabled consumers to accurately interpret nutrient levels, compare and rate products based on their healthiness.

- **Use of Labels (reported use, observed and likely use)**

Five out of the 13 studies reviewed, found that over 50% of study participants reported they use or were likely to use FOP labels at least some of the time and are likely to be influenced by them. However, six studies found different results to the contrary.

- **Food purchase and purchase-related behaviour**

Four out of six studies reported that consumers were influenced to purchase products that indicated “healthy” by FOP labelling systems. Three studies found that after the introduction of multiple level summary icons, consumers purchased healthier products as a result of these icons. For example, a study (9) found that after the introduction of the Guiding Stars program in 168 US supermarkets, sales increased by 0.5% after the first year and 1.4% increase in the sales of starred foods after two years. Both results were reported as significant.

- **Consumption behaviours (likely, reported and observed consumption)**

Studies found that the evidence regarding FOP labelling was mixed in four studies. Only one study measured consumers’ actual dietary intake and found no significant differences in participants’ actual consumption for chocolate mousse cake between the FOP label (Choices Programme) and non-logo in the Dutch population (10). An experimental simulation shopping study found no significant differences between the five label schemes and no labels. In contrast, two studies found that FOP labelling had a positive impact on consumers’ diets.

The authors concluded that consumers more easily identified healthier foods using nutrient-specific schemes compared with summary systems. Furthermore, particular features on a FOP label such as text or colour also allowed consumers to easily identify healthier products (8). Studies suggest that the display of multiple-level summary icons can influence consumers to make healthier purchases. Although it should be noted that this type of study has not been

widely conducted for nutrient-specific systems and this review only identified one such study. The authors concluded that they found limited evidence to suggest that FOP labelling actually changed consumers' eating behaviours. Some limitations of this systematic review include: variability of outcome measures across studies; many studies only reporting statistically significant differences across groups; lack of studies in "real world settings" in the shopping environment; lack of studies comparing multiple-level summary icons with the TLS, limited information of other contextual information on the food product; and lack of evidence on the likelihood of substitution effects (e.g., whether consumers over-consume products displaying green lights).

Whilst there are voluntary targets for salt levels in foods in Finland, the effectiveness of Finland's salt reduction program has often attributed to the introduction of legislative requirements to label the salt content of foods in the 1980s (11). Products exceeding the specified amount of salt had to carry a high salt warning label, which resulted in food companies having to reformulate products to avoid this and some high salt products disappearing from the market altogether (11).

*Overall, the evidence indicates that consumers prefer simpler presentations of nutrition labelling information and that consumers could more easily interpret FOP labels that combined text and colour. Evidence also indicates that consumers were influenced to purchase products that were identified as "healthy" by FOP labelling systems. However, the findings on the association of FOP labelling with consumer use and with consumption behaviours were mixed. Implementation of labelling has the potential to encourage reformulation of packaged products by food companies as illustrated by the Finland case.*

#### **1.1.4 Menu Boards**

**A consistent, single, simple, clearly-visible system of labelling the menu boards of all quick service restaurants (i.e. fast food chains) is applied by the government, which allows consumers to interpret the nutrient quality and energy content of foods and meals on sale**

*The evidence on the association between menu-labelling and food purchases (calories selected from foods) and dietary outcomes (consumption of calories) is summarised below.*

An updated systematic review and meta-analysis undertaken by Sinclair et al., (12) examined the influence of menu-labelling on the selection and consumption of calories in restaurants and other food service establishments and found results that were consistent with those of an earlier systematic review by Swartz et al (13). A total of 17 studies were included in this review, with seven quasi-experimental studies and 10 experimental studies (12). Six studies were rated as high quality (3 quasi-experimental, 3 experimental). Among the five fast-foods restaurant quasi-experimental studies reviewed that assessed food purchases, only one reported a statistically significant association between the introduction of menu labelling and the selection of fewer calories at purchase. The authors (12) stated that customers purchased 14.4% fewer calories from food purchases, not beverages in this study after mandatory menu labelling was introduced in New York City. The association was shown to be stronger in locations where residents had higher incomes and more education. For cities such as Boston and Philadelphia, where there is no mandatory menu-labelling, purchases stayed constant over the study period. Two quasi-experimental studies on workplace cafeterias reported increased purchase frequency of targeted items where menu-labelling was present.

Sinclair et al., (12) conducted a meta-analysis of 13 separate menu label conditions on calories selected and the effect of 11 separate conditions on calories consumed in seven experimental studies. The results from the meta-analysis showed that:

1. The pooled mean difference for calories selected by participants was 43 fewer calories and consumed 41 fewer calories in the menu labelling group compared to control group (both results were significant).
2. The pooled mean difference for calorie selected was 31 fewer calories and consumed 13 fewer calories when calorie content labels without additional contextual or interpretive information were present in participants in the menu labelling groups compared to control groups (both results were not significant).

3. The pooled mean difference for calorie selected was 67 fewer calories and consumed 81 fewer calories when calorie content labels with additional contextual or interpretive information were present in participants in the menu labelling groups compared to control groups (both results were significant).

The authors concluded that the results of the meta-analysis of the experimental studies suggest that labelling of menus with calories alone had no effect on calories selected or consumed while there was a significant effect on reduction in calories selected and consumed when additional contextual and interpretive information was present (12).

However, Sinclair et al., (12) reported that data on calorie labels from quasi-experimental studies had little influence on calories purchased in settings where mandatory menu labelling had been implemented. Some of the limitations of the systematic review include: several studies with small sample sizes with questionable power to detect statistical differences; lack of long term impact assessment; half the quasi-experimental groups did not adjust for confounding variables and comparison groups were not sourced from the same population which could introduce bias; experimental studies did not conceal allocation or method of randomisation and tended to recruit more participants who were young or well-educated. Swartz et al., (13) also concluded from their systematic review that in both natural and experimental study settings, calorie menu labelling had no effect or only a modest effect on calorie ordering and consumption.

A recent review (14) examined the effect of calorie labelling on food purchasing and consumption. A total of 31 studies were reviewed of which 18 studies were conducted in “real world” settings, while the remaining 13 were conducted in controlled laboratory settings. The authors concluded that while there were some positive results reported from studies examining the effects of calorie labelling, overall the best designed studies (real world studies with a comparison group) showed that calorie labels did not have the desired effect in reducing total calories ordered.

Authors from reviews (12, 14) also noted that menu labels also compete with other influential factors at the point of purchase such as situational (time, convenience), personal (taste, hunger, and weight loss/gain), social (eating for pleasure and social desirability of food choices), and environmental determinants (availability, affordability, and accessibility of foods).

A recent study by Nikolaou et al., (15) assessed the long-term impact of calorie labelling using an uninterrupted time-series study design and weight changes over 36 weeks in two years, in a group 120 young adults living in a fully-catered university residential accommodation. In Year 1, subjects acted as a control group without calorie labelling and in Year 2 calorie-labelling was present prominently and consistently for 30 of the 36 weeks. The results from this study showed a mean weight increase of 3.5kg for the Year 1 control group compared with a reduction of 0.15kg in the Year 2 intervention group. The authors concluded that calorie-labelling was associated with 3.5kg less weight gain and that no other confounding variables such as environmental factors or health promotion initiatives could be identified to account for this large difference in weight changes between two years (15).

*Overall, the evidence from the literature suggests that labelling of menus with calories alone had no effect on calories selected or consumed while there was a significant effect on reduction in calories selected and consumed when additional contextual and interpretive information was present. However, more comprehensive and robust study designs, along with longitudinal studies are needed to see if menu-labelling influences purchase and consumption of healthier products, and if impact of menu-labelling persists in the long term. One recent long-term calorie labelling study shows promising results on weight changes, although more studies are needed to see if menu-labels are effective in the long run.*

## 1.2. FOOD PROMOTION

### 1.2.1 Media promotion

**Effective policies are implemented by the government to restrict exposure and power of promotion of unhealthy foods to children through all forms of media, including broadcast (TV, radio) and non-broadcast media (e.g. Internet, social media, point-of-purchase, product placement, packaging, sponsorship, outdoor advertising)**

*The international evidence on food and beverage marketing for children and its effects on food purchase, consumption, brand/category choice, food preferences, and nutrition knowledge is summarised below. The evidence for the impact of self-regulatory industry codes and statutory regulations on levels of food marketing exposure is also summarised below with some illustrative real life examples. Please note that the terms 'food marketing' and 'food promotion' are used interchangeably.*

Television advertising has been the most dominant form of advertising as reflected by the evidence base, which is mainly focused on high income Western countries (16, 17). The average child in the US views 15 television food advertisements per day. More than 98% of the television food advertisements seen by children and 89% of those seen by adolescents are for products high in fat, sugar and/or sodium (17). A study that compared television food advertising to children in 11 countries across five continents found that food advertisements composed 11% to 29% of advertisements, of which 53% to 87% of food advertisements were for unhealthy foods (18). A study comparing advertising for foods and beverages to children on free-to-air television across six cities within the Asia-Pacific region found that 27% of television advertisements were for food/beverages, and the most frequently advertised product was sugar-sweetened drinks (19). Both the studies found that rates of unhealthy foods advertising were highest during viewing times most popular with children.

However, in recent years, other forms of marketing media such as online advertisements, social media, and sponsorships through sporting events have also been receiving increasing amounts of attention (16, 17, 20). For example in the US, spending by food industries on youth directed television advertising fell by 19.5% while spending on other forms of media such as online and viral marketing increased by 50% (21). Trends in online marketing expenditure (for all goods and services including food and beverages), have shown a dramatic increase from a total of less than \$0.5bn to over \$10bn during the period of 2000-2010 in three leading European markets (France, Germany and United Kingdom (UK)) (22). Modern marketing campaigns use

an integrated approach to reinforce commercial messages across multiple platforms. Marketing strategies that have been typically found in high income countries such as the use of television advertisements, sport stars and celebrity endorsements, building brand loyalty, are now also increasingly present in low income countries (16).

The most recent systematic review undertaken by Cairns et al., (16) examined the international evidence on food and beverage marketing towards children. The authors noted that its findings are consistent with other independent, rigorous reviews conducted during the 2003-2012 period. This systematic review included a total of 99 primary articles (of which more than 75% of studies used cross sectional studies) and 16 review articles. More than 50% of articles were found from North America, followed by Europe, Australasia, Asia and other studies or reviews that focused internationally. The results on the effects of food promotion on children from this review are summarised below and the weight of evidence (quality of studies and strength of effect) as reported by the authors is written in brackets.

- **Food purchase and purchase-related behaviour**

Statistically significant results were found between marketing and food purchase behaviour in seven out of the eight studies reviewed, showing evidence that the nutritional quality of foods marketed correlated with nutritional quality of food purchases and/or requests. (**STRONG**)

- **Consumption behaviours**

Positive associations between food promotion and consumption behaviour such as increased snacking, higher energy intake and less healthful food choices were found in 14 out of 18 studies reviewed. However, only six studies found a significant effect. The authors concluded that the evidence on the specificity and universality of the effect is mixed. (**MODEST**)

- **Food preferences**

Nine out of 16 experimental studies and one of two cross-sectional studies reported significant changes in food preferences as a result of marketing exposure. A number of studies found evidence for the changes towards high fat, salt or sugar foods in response to television advertising and promoted branded foods. (**MODEST**)

- **Nutrition knowledge**

Exposure to promotions of low nutrition foods was found to be correlated with poor nutrition knowledge in four studies considered to be of medium or high quality, while four other studies using less detailed outcome measures reported no association. (**MODEST**)

- **Brand and category choice** (such as choosing fast-food brands e.g. McDonalds)

Four out of six studies reviewed found evidence for brand level effects and marketing exposure. Six studies found evidence on category level effects on marketing exposure, while three reported inconclusive results and two reporting no association. (**STRONG**)

- **Relative to other factors**

Food promotion can act as a significant independent determinant relative to other factors (such as parental and peer influences, television viewing behaviour) of children's food behaviours and health status as reported in eight studies. (**MODEST**)

The most convincing studies in real-world settings show that the ban on television advertising aimed at children under the age of 13 on French-speaking television networks in Quebec, Canada reduced the quantity of children's cereals in the homes of French-speaking children but not for English-speaking children who continued to be exposed to the same amount of television advertising from food advertisements through US television stations (17, 20, 22). Research also indicates that the ban had also significantly reduced the amount of fast-food consumption by French-speaking families with children compared with English speaking families with children. However, no such differences were found in Ontario for families with or without children or between French- and English-speaking families where there was no such ban (17, 20).

A systematic review (22) examining initiatives to limit unhealthy food promotions to children identified 21 articles, four industry reports and seven industry-sponsored reports. This review found that surveys reported in peer-reviewed scientific journals provide evidence of continuing high levels of promotion for less healthier foods, with high levels of exposure for children (22). The authors also found that there were only small or no reductions in exposure in recent years as a result of the introduction of self-regulatory codes (voluntary pledges by food and beverage companies). However, statutory regulations as seen in Quebec, Canada and the UK were found to result in meaningful reductions in children's exposure. In contrast, reports sponsored by the

industry reviewed in this article, indicate high levels of adherence to their voluntary pledges, and these reports indicated substantial reduction in the promotion of unhealthy foods and children's exposure. However, the authors stated that a variety of other authoritative sources indicated weak or no reductions, or insufficient evidence to conclude that self-regulatory has led to such reductions. These industry codes are limited in impact because of the narrow range of media covered, weak definitions of marketing in these codes (i.e. different audience and nutrient profiling definitions), the absence of many large food companies in these voluntary schemes and the lack of enforceability or penalties for failure, suggest that voluntary pledges may not be sufficiently comprehensive to reduce children's exposure to promotion of unhealthy food products unless combined with enforceable statutory measures (22).

*The evidence base indicates that there is a strong association between food promotion and food purchasing behaviour and brand loyalty. Effects of marketing on consumption behaviours, food preferences, nutrition knowledge, and other factors were assessed to be modest. Evidence also suggests that voluntary pledges by the food industry are not effective in reducing children's exposure to the promotion of unhealthy food products unless combined with enforceable statutory measures.*

### **1.2.2 Settings promotion**

**Effective policies are implemented by the government to ensure that unhealthy foods are not commercially promoted to children in settings where children gather (e.g. preschools, schools, sport and cultural events)**

*The evidence on the availability and marketing of unhealthy foods in settings where children gather (sports settings and schools) is summarised below. Please note that the terms 'food marketing' and 'food promotion' are interchangeably used.*

A systematic review by Carter et al., (23) examined the availability and marketing of food and beverages to children through sports settings. This review included a total of 14 articles, with two identified as research reports. Eight were cross-sectional surveys and the majority of articles (n=10) were from Australia. This review found that majority of studies reported that energy-dense and nutrient poor foods and beverages were provided at sporting venues and sports club. Sponsorship of junior sport by food and beverage companies was dominated by unhealthy foods (23). Studies reviewed also suggested that health promotion initiatives (such as funding and introduction of healthy foods) have resulted in improvements to the quality of food and beverages available. However, the authors noted that there was a limited amount of

literature exploring sport settings. Many of the studies reviewed had methodological limitations such as a reliance on self-report measures; no objective measures being used to identify the availability of food and beverages; and no comprehensive description of foods available at clubs or stadia. Few studies evaluated the impact of interventions. The authors concluded that little is known about how sports sponsorship and related food marketing in sports settings affects children and those more comprehensive studies are needed to identify the nature, extent and impact of food sponsorship and marketing in sports settings.

Corporate-sponsored endeavours such as incentive programs that reward students for achievement; exclusive agreements that place brand names on vending machines, cups, cans, and scoreboards; naming rights agreements; free supplemental educational materials or software; and direct advertising are some of the ways that promotion of unhealthy foods enters schools (24, 25). Molnar et al., (24) found that 59.4% of primary schools in the US engage in at least one fundraising activity, exclusive agreement or incentive program with a corporation that sells foods high in fats or sodium or foods with minimum nutrient value. The authors also suggest, if extrapolated, the results indicate that between 16.4 million and 19.6 million of America's 30.1 million primary school children are exposed to marketing of these unhealthy food items (24).

**Some examples of in-school marketing from the US are (25):** (*No evidence on the impact of these marketing schemes was found*)

4. **Corporate sponsored news program:** Channel One is shown in nearly twelve thousand schools to almost eight million students. In exchange for free video equipment, the schools agree to show a Channel One program every day to their students, consisting of ten minutes of news and approximately two minutes of commercials which are dominated by food advertising (Pepsi, Mountain Dew, Snickers, and Kellogg's Pop Tarts)
5. **Vending machines:** Many school districts sign pouring rights contracts with Coca-Cola or Pepsico. These contracts give beverage companies exclusive rights to sell their products at school events and place vending machines on school property. The amount of money a school receives is often tied to the sale of beverages, thus giving schools an incentive to encourage the consumption of soft drinks
6. **Incentive programs:** For example, Pizza Hut's Book-It program offers free pizzas to students who read a certain number of books.

7. **Direct Advertising on school space:** Advertising frequently appears on interior and exterior school walls, gymnasiums, scoreboards, and at school athletic events. Much of this advertising is for soft drinks and snack foods.
8. **Educational-sponsored programs:** Coca-Cola partners with “Reading Is Fundamental” and also provides elementary schools with a reading program called The Coca-Cola Story Chasers Mobile. McDonalds sends mascot Ronald McDonald into schools to promote, among other things, literacy, character education and first aid.

*Evidence from the literature indicates that energy-dense and nutrient poor foods and beverages are provided at sporting venues and sports clubs and that sponsorship of junior sport by food and beverage companies are dominated by unhealthy foods. Health promotion initiatives such as funding and introduction of healthy foods have resulted in improvements to the quality of food and beverages available in sports settings. However, in general, there is a lack of evidence on the extent, nature and impact of sports sponsorship on children. In schools in the USA, there is some evidence indicating that unhealthy food products are promoted by companies. However, the evidence on the impact of marketing on settings where children gather and its influence on children's nutrition is absent.*

## 1.3. FOOD PRICES

### 1.3.1 Taxes healthy foods

#### Taxes on healthy foods are minimised to encourage healthy food choices where possible (e.g. low or no sales tax, excise, value-added or import duties on fruit and vegetables)

*The evidence on the association between minimising taxes on healthy foods (shown through studies that use monetary subsidies for healthier foods) with purchasing behaviour and dietary outcomes is summarised below. Price elasticity (PE) refers to “the percentage change in quantity demanded (consumption or purchases) of a good resulting from a 1% change in the own-price of the good”(26). Demand is said to be ‘Price inelastic’ if it is less than 1 and ‘price elastic’ if it is more than 1. In the example provided by Powell et al, (26) “an inelastic PE of demand for soft drinks of –0.8 implies that the consumption of soft drinks will fall by 8% if the price of soft drinks rises by 10%”.*

A recent systematic review (27) examining the effectiveness of monetary subsidies (price discounts and vouchers) in promoting healthier food purchases (measured through sales and voucher redemption) and consumption (measured through self-reports) in field interventions found, in all but one study, that subsidies on healthier foods significantly increased the purchase and consumption of promoted products. The review examined 24 studies on 20 field interventions, with nine studies using RCTs, eight studies using pre-post tests and three were cohort studies. The authors suggested that a 10% price discount or a \$US 7.50 voucher could serve as an estimate for the minimal level needed to set subsidies in order to induce a meaningful increase in healthier food purchases or consumption (27). Two studies that measured the dose response relationship of different subsidy levels on food purchases and fruits and vegetables (F&V) intake found that price reductions of 10%, 25% and 50% on low-fat snacks sold in school and worksite vending machines were associated with an increase in sales by 9%, 39% and 93 %, respectively while 10% and 25% discounts on healthier food purchases were associated with an increase in daily F&V intake by 0.38 and 0.64 servings, respectively. Findings from seven interventions which included a follow-up period to assess changes in dietary behaviour after the withdrawal of incentives were mixed. Four found no extended effect at follow up, while three found sustained improvement after the intervention period (two studies at six months, one study at five weeks). The authors also stated that the current evidence could be compromised by several study limitations such as small and convenience samples which may limit the generalizability of results; short intervention and follow up periods do not

allow for long-term impact assessment and the absence of measurement of overall diet/energy intake (27).

Another recent systematic review undertaken by Thow et al, (28) reviewed seven studies that assessed food subsidies for targeted foods (i.e. healthy food categories or F&Vs) with consumption (randomised control trial (RCT) (n=1), survey-based (n=1), modelling studies (n=5)). These studies reported subsidies ranging from 1.8% to 50%, and all found an increase in consumption of targeted foods. For example, a RCT study in NZ supermarkets showed that a subsidy of 12.5% (for healthier food products) increased healthy food purchases by 10% with little or no effect on unhealthy nutrient consumption. Four studies, that modelled F&V subsidies of about 10%, showed a 5% increase in consumption. However, the effect of subsidies on total calorie intake remains unclear with three studies reporting a small reduction (1%) while six studies reported increases in total calorie intake by 1-17% but also increases of healthy food consumption, with subsidies of 10-30%. The authors concluded that there was strong evidence from robust modelling studies and one RCT in supporting the association between subsidies and change in consumption (28). However, there was also some evidence suggesting that subsidies could increase overall calorie consumption.

A systematic review by Powell et al., (26) found that consumption of F&V was price inelastic in five out of the seven studies reviewed: Mean PEs for fruit was -0.49 and -0.48 for vegetables, suggesting that subsidising F&V by 20% would increase consumption by 10%. It should be noted that this review only used data from the US, and PE may differ by country (26).

One international initiative for GST exemption for fresh fruit and vegetables currently exists in Australia. A recent letter to the editor by Veerman & Cobiac (29, 30) calculated that adding GST to fruits and vegetables could result in a loss of about 100 000 healthy life-years over the lifetime (for the 2003 Australian adult population) due to an additional 90 000 cases of Ischaemic Heart Disease, stroke and cancer.

*Overall, the quality of evidence available is strong due to the majority of studies using RCTs, field interventions and robust modelling study designs. The evidence from the literature indicates that there is an association between subsidies on healthier foods and increased purchase and consumption of promoted healthier products. It could be surmised from these results that minimising taxes on healthy foods would lead to similar results for food purchasing behaviour and dietary outcomes. However, some studies also reported an*

*increase in overall calorie consumption and thus more longitudinal studies are needed to see if purchase and consumption of healthier products, persist in the long term.*

### **1.3.2 Taxes unhealthy foods**

**Taxes on unhealthy foods (e.g. sugar-sweetened beverages (SSB), foods high in nutrients of concern) are in place to discourage unhealthy food choices where possible, and these taxes are reinvested to improve population health**

*The evidence on the association between taxes on unhealthy foods with purchasing behaviour and dietary outcomes is summarised below.*

All 16 studies systematically reviewed by Thow et al. (28) that modelled the effect of sugar-sweetened beverage (SSB) taxes (ranging from 5-30%) on consumption, showed a reduction in consumption of SSB ranging between 5 to 48%. Of these 16 studies, four that modelled substitution effects in response to taxes between 5-20%, showed a reduction in calorie intake from these beverages by 10-48% in adults and 5-8% in children, with increase in consumption of other beverages such as milk, low-calorie beverages, tea and coffee (28). Three of these studies showed an overall reduction in calorie consumption from all beverages as a result of these taxes. However, one of the studies reviewed both by Thow et al., (28) and Powell et al., (26) estimated that children substitute whole milk for soft drinks thus showing no or only a small reduction in overall calorie intake and no effect on weight outcomes in children and adolescents (26, 28, 31). Six modelling studies which did not consider substitution effects also found significant reductions of 10-25% in consumption of SSB in response to taxes of 10-30% (28).

Three modelling studies reviewed by Thow et al., (28) examined existing state-based soft-drink taxes in the US and found little difference in consumption of soft-drinks between states with small taxes ( $\approx 5\%$  tax) and states without taxes. Six modelling studies reviewed, assessed taxes on individual nutrients (fat, sugar, salt). Four modelling studies on fat-based nutrient taxes showed that relatively small taxes on fat (5-17.5%) can reduce intake of fat and/or saturated fat by 0-3%. Two modelling studies showed that consumers in the US will substitute full-fat milk with low-fat milk in response to a tax on fat. However, one study indicated that a targeted fat tax might have unintended consequences such as increasing salt intake and decreasing F&V intake. Two modelling studies on sugar taxes suggested that these taxes would reduce consumption of sugar and sweets by 23% in Finland (response to a tax of 1€/kg on sugar), and aggregate added sugar intakes of 8% in the US (response to a tax of \$0.003/gram).

All but one of eight studies reviewed by Thow et al., (28) examining taxes ranging from 10-50%, based on nutrient profiling scores, reported reductions in purchases (30%) and consumption (6.5% total calories). For example, one study in the US, showed that a 25% tax on ‘red-labelled’ foods (based on nutritional profiling) significantly reduced the consumption of unhealthy foods among obese and non-obese participants by 40% and 10% respectively (28). Five survey-based studies reported that a 25-50% tax on “high calorie for nutrient foods” applied in these studies, showed a 30% reduction of purchase of target foods and 6.5-8% on overall calorie consumption (28).

Powell et al., (26) suggested that SSBs are PE and that a tax that raises prices by 20% would reduce SSB consumption by 24% (elasticity of -1.21). However, the authors concluded that overall, the evidence on the extent to which changes in food or beverage prices may significantly impact weight outcomes remains mixed. Studies linking existing soda sales taxes to weight outcomes showed only very minimal impact on weight outcomes which is consistent with Thow et al.’s findings (26, 28).

A systematic review conducted by Maniadakis et al., (32) concluded that the evidence on the effectiveness of taxes on SSB and foods high-in-fat to reduce obesity-related outcomes was not consistent. Fifty five studies were included in this review, with 22 demand studies, 11 longitudinal studies, 11 cross-sectional, six modelling, four experimental, and one cohort study. Nine demand studies indicated that the PE for demand of beverages ranged between -0.5 to -1.6 depending on beverage considered.

The systematic review (32) found that there was evidence linking the effect of price and tax increase on consumption. However, any reductions in weight and energy intake from foods/beverage taxes or price changes were small or statistically insignificant (32). It was found from 11 studies that a 10% increase in prices reduced energy intake by a maximum of 50 calories per day or 1.5 pounds a year which the authors suggested cannot be considered significant in these studies. It was suggested by the authors that, although there may be a decrease in the purchase of the “taxed food”, consumers may end up consuming the same or even more from other substituted food and drinks, as identified by six studies in this review (32). The authors have also stated that careful consideration should be given to studies that have transformed consumption figures to energy and weight outcomes using extrapolation models. Other limitations include estimation of calorie intake and energy intake; studies undertaken in specific setting are difficult to extrapolate to other population contexts.

A systematic review undertaken by Eyles et al., (33) examined the association between food pricing strategies with food consumption and NCDs from published mathematical modelling studies of food pricing interventions. Thirty two studies met the inclusion criteria and only seven studies were considered to be “moderately high quality” while the rest (n=25) were of low quality. The majority of studies reviewed suggested that impacts of food/SSB taxes would have the potential to improve population food consumption (i.e. lowering consumption of taxed foods) (33). The 16 simulation modelling studies that examined the association between food taxes and their impact on health and NCDs found that majority of studies suggested that the impact of food/nutrient taxes have the potential to change population health outcomes. However, the authors also found that three moderately high quality studies one of which estimated that a dairy/saturated fat tax may increase mortality from CVD and coronary heart disease (CHD), and less healthy/junk food taxes may increase overall mortality (in one study), and mortality from stroke and CVD (in two studies). The potential adverse health consequences estimated as a response to these taxes is due to compensatory purchasing via cross-Pes (i.e. substituting for another food item which may be just as bad as the taxed good). The authors suggest the need for studies to include better assessments of possible compensatory purchasing and population health outcomes and the potential effects of fiscal policy on long-term health and NCD-related deaths (33).

Many studies have noted that such food and beverage taxes would be regressive, with the financial burden falling predominantly on the lowest income groups who spend the largest proportion of their total budget on food (26, 32, 33). However, 11 out of 14 studies reviewed by Eyles et al., (33) estimated these food taxes would result in greater health benefits for lower socio-economic compared with higher socio-economic groups, and thus have the potential to reduce health inequalities.

Currently, there are no formal robust evaluations identified in the literature for recent health food tax policies such as the Denmark “fat tax”, ‘Public Health Food Tax (NETA)’ on packaged foods introduced in Hungary in 2011, and a tax on sweets in Finland in 2012. An econometric analysis of the Danish fat tax undertaken by Jensen and Smed (34) using longitudinal individual consumer panel data, adjusted for seasonal effects, suggested that the introduction of the tax has shown a 10-15% decrease in consumption for fats (such as butter, blends, margarine and oils) compared with intake levels before the introduction of the tax – at least in the short run. However, media reports on the Danish tax indicated increased levels of cross-border purchases in Germany and Sweden with one report suggesting that 48% of Danish people made these

trips valued at \$1.8 billion in 2012 (35, 36). This may have not changed or may have increased consumption of products in high saturated fat from cross-border purchases.

An analysis of the 1980s Irish tax on soft drinks, found that the 10% price increase reduced consumption by 11% (37). However, health impacts were not evaluated (37). Preliminary results assessing the effects of the Mexican soda tax, which took effect on January 2014 (one peso per litre excise tax on SSBs), showed that there was approximately a 10 percent decline in purchases of taxed beverages in the first quarter of 2014 compared to the first quarter of 2013 (38). The data used came from a commercial panel of consumers, which contained information on purchases of beverages from households living in cities with population of at least 30,000.

One of the conclusions of a health and financial impact assessment report presented to the media and public on April 2013 suggested that the adoption of the Public Health Food Tax (NETA) in Hungary in 2011 has had a positive impact on food consumption patterns (39). A Finnish media report on the other hand suggest that the initial drop in consumption pattern for sweets did not continue, with retailers reporting that sweet sales returned to previous levels, suggesting that this tax may only have had a short-term impact on demand (40). However, given that these are sourced from media reports, the information may not be credible.

*Overall, the quality of evidence available is moderate with the majority of studies using modelling study designs. The evidence from the literature suggests that there is an association between taxing unhealthy foods and reductions in consumption of the taxed foods. However, the evidence on the extent to which foods/beverage taxes affect weight outcomes remains mixed and reductions were considered to be only small or statistically insignificant in studies. Potential adverse health consequences as a result of compensatory purchasing via Cross-PE could also occur as suggested by some studies. There are currently no formal robust evaluations identified in the literature to assess the impact of ‘real-world’ policy taxes on population nutrition. However, some illustrative examples of short term impact of “real-world” policy taxes showed an association with decreased purchase and consumption of the taxed goods.*

### **1.3.3 Food subsidies**

**The intent of existing subsidies on foods, including infrastructure funding support (e.g. research and development, supporting markets or transport systems), is to favour healthy rather than unhealthy foods**

*The evidence on the impact of existing subsidies using illustrative examples is summarised below.*

The selective granting of domestic support measures significantly influences investment decisions by domestic and foreign companies, and the production, price, availability, and consumption of specific foods (41). In the Pacific Island region, there is increased support for production of export crops, which has resulted in a shift in agricultural land use away from traditional crops (particularly staple grains) towards ‘cash crops’ typically grown for export (such as refined cereals and vegetable oils) (42). The US Farm Bill, the primary instrument through which domestic support is granted to the US agricultural sector, found that domestic support to corn and soybeans has driven down the price of these products while the prices of fruits and vegetables, grown without such subsidies, have steadily increased (41).

Hawkes et al., (43) examined agricultural policies with obesity and NCDs. The authors concluded that there has been a paradigm and policy shift towards more liberalisation of agriculture markets which has increased specialisation of productions and as a result changing the ability of and incentivizing producers to supply some foods relative to the other (43). An illustrative example given, is that of vegetable oils, whereby policy reforms have resulted in soybean and palm oil being the lowest cost vegetable oil in the global market. Following the economic theory of “substitution effect” (lower prices leads consumers to shift from purchasing the more expensive product towards the less expensive substitute), relative price differentials may influence purchasing behaviour. For example, in India, the more expensive domestically produced rapeseed, groundnut and cotton seed oils have been substituted for less expensive soybean and palm oil, which makes up a significant portion of all vegetable oils consumed in India. Agricultural policies have also affected farmgate prices, changing the incentives of Food Consuming Industries (FCIs) to use some ingredients relative to others and thereby affecting both nutritional quality and content of foods available to consumer. For example, when high-fructose corn syrup (HFCS) became cheaper than sugar in the 1980s in the US as a direct result of farm policies, the Coca Cola Company substituted HFCS for sugar and increased the ratio of percentage of HFCS from 50% to 75% in 1984, saving them \$25million annually.

However, the authors conclude that the impact of these agricultural policies is less clear for consumers and their health, as price changes have affected both healthy and unhealthy food production (43). Farmgate prices may not necessarily be passed down to the final retail price and thus may or may not affect consumer affordability. Hawkes et al., (43) suggest that the key implication to be considered is not just whether the ingredients produced by agriculture are healthy or not, rather the actions of the supply chain such as how ingredients are substituted, transformed and marketed relative to each other. For example, “healthy” soybean oil can be transformed to trans-fat, or fruit can be used as ingredient in processed foods (such as fruit juice) with far higher calorie content. The authors conclude that policies intervening in agricultural policy would only be effective if supply chain dynamics (transformation, substitution, and marketing) are also taken into account (e.g. encouraging the production of healthy foods may not necessarily increase the supply in the marketplace but may be transformed into a processed food containing that ingredient (43).

Singapore introduced the “Healthier Hawker Program” to encourage hawkers to use healthier ingredients in prepared foods (44). The government provides funding to manufacturers to develop healthier ingredients and facilitates the supply of these ingredients to hawkers at competitive prices through shared marketing and delivery services developed by leveraging on productivity schemes offered to small and medium enterprises. The Health Promotion Board works through centralized kitchens that supply volume catering and food court chains to incorporate procurement of healthier ingredients for hawkers (44). Participation in this program ranges between 35% to 90% in different hawker centres and shops. Suppliers of the healthier ingredients have reported an average 30% increase in the volume of ingredients ordered (44).

*The emergence of this research area is relatively new, and thus evidence on the impact of existing subsidies for healthy foods is largely absent. However, the illustrative examples suggests there might be an association between providing subsidies on foods, including infrastructure funding support (e.g. research and development, supporting markets or transport systems), and the types of foods produced by agriculture and food consuming industries , which in turn affects both nutritional quality and content of foods available to consumers.*

### **1.3.4 Income Support**

#### **The government ensures that food-related income support programs are for healthy foods**

*The evidence on the association between food-related income support programs with purchasing behaviour and dietary outcomes is summarised below.*

A systematic review with meta-regression undertaken by Green et al., (45) found that food price and affordability affects food security at all income levels. They identified 136 studies reporting 3495 own price food elasticity estimates from 162 countries, with almost half from low-income countries. Meta-regression models showed that demand for all food groups was more responsive to changes in price in lower income than higher income countries, indicating that increases in food prices are likely to have a disproportionately greater impact on food consumption in low income countries. The highest predicted PE were found for meat (-0.78), fish (-0.80), dairy (-0.78), and other food (-0.95) in low income countries, whereas the lowest were found for cereals (-0.43) and fats and oils (-0.42) in high income countries. Food prices also had a stronger impact for low income households within the same country (45).

Powell et al., (26) found that lower F&V prices were consistently associated with lower weight outcomes among both low-income children and adults. The Supplemental Nutrition Assistance Program (SNAP), which is the largest of the federal nutrition-assistance programs in the US, provides beneficiaries with food assistance to buy nutritious foods while the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides nutritious foods and nutrition education for low-income women, infants, and children aged below five years (46). A systematic review (46) examining the effect of food subsidy programs on the health and nutritional status of disadvantaged families in high income countries identified 16 articles that met the inclusion criteria, with four RCTS, seven pre-post-test studies, and three interrupted time series analyses of routine data studies. However, nine studies were assessed to have moderate to high risk of bias. This review found 10-20% increases in targeted nutrients and foods consumed by female participants (mainly in pregnant women), as a result of these food subsidy programs (46). Four studies (3 RCTS, 1 pre-post-test) found significant increases in the measures of F&V intake. The authors also noted that there was limited high quality evidence assessing the impact of food subsidies on health and nutrition and most of the evidence in the review came from the WIC program in the US (from nine studies) (46). Other limitations include, self-report measures used to assess intake, studies focused mainly on

women and lack of longitudinal studies to assess sustainable impacts of dietary behaviour from the subsidy programmes (46).

Some studies have shown that SNAP participants had poorer health nutrient intake status than their income-eligible non-participant counterparts (47, 48). It was found that compared with non-participants, SNAP participants consumed less than the recommended amount of fruit and vegetables, 39% fewer whole grains, 44% more fruit juice, 56% more potatoes, 46% more red meat, and in women, 61% more SSBs (47). In another nationally representative survey of the US population, adjusted analyses revealed that SNAP participants had lower dietary quality scores overall and lower scores for F&V compared to non-SNAP participants (48).

The UK Healthy Start food voucher programme introduced in 2006, provides vouchers which can be exchanged for fresh or frozen fruit and vegetables, plain cows' milk or infant formula, and coupons for free vitamin supplements to low income pregnant women and families with children (up to the age of four) (49). A multi-method study conducted in England found that women reported that food vouchers increased the quantity and range of fruit and vegetables eaten by them and their children (49). This was said to have improved the quality of family diets while receiving food vouchers and that this would establish good habits for the future. Factors that could compromise the impact of these vouchers include erosion of voucher value relative to the rising cost of food, lack of access to registered retailers and barriers registering for the programme (49).

*The evidence from the literature suggests that, for all food groups, demand was more responsive to changes in price in lower income households compared with high households and in lower-income countries compared with higher income countries. However, the evidence on the association of targeted government subsidies for healthy foods and consumption suggests there might be a positive relationship but the association remains unclear due to the limited number of high quality studies and lack of longitudinal studies to assess the dietary behaviours of participants in the long term. The majority of studies are US-based, and therefore might not be generalizable to other countries, as populations and subsidy programs are highly context dependent.*

## **1.4. FOOD PROVISION**

### **1.4.1 School food**

**The government ensures that there are clear, consistent policies (including nutrition standards) implemented in schools and early childhood education services for food service activities (canteens, food at events, fundraising, promotions, vending machines etc.) to provide and promote healthy food choices**

*The evidence on the association between government/state policies and/or interventions implemented in schools and early childhood services for food service activities and purchasing behaviour and dietary outcomes of children/students is summarised below.*

*Evidence on educational interventions and some multi-component interventions were excluded from the summary as they were not directly related to governmental food service policies in school and early childhood education service settings. Some examples of “real-life” national and state based policies from the UK and US are examined. Please note:*

*“Competitive Food and Beverages” (CFBs) refer to energy-dense snack food and beverages sold as competition to US federal school meals, sold in schools a la carte in the cafeteria, vending machines, school stores, snack bars, in-school fundraisers; and given as rewards for good behaviour/performance in primary schools.*

A recent systematic review undertaken by Driessen et al., (50) examined the effect of interventions aiming to change the school food environment, and food purchasing, consumption behaviour and body weight. Interventions on changing the school food environment were considered in isolation, excluding any other intervention such as physical activity, education or other obesity-based preventions. A total of 18 articles were included in this review (of which three papers reported on the same study), with 11 studies identified as natural experiments which reported the effect of state or national level policies and change in school environment. Many were recent papers, with ten being published since 2010. The majority of studies were conducted in the US (n=14). Eleven studies were assessed as weak, five as moderate and two studies as strong.

Of the 18 articles, 17 found a significant positive outcome for BMI (or change in BMI) or the healthiness of food sold or consumed (50). Two studies measured BMI as their primary outcome measure, with one study reporting a significant decline in the rate of overweight prevalence four years post the implementation of the policies (51). The second cohort study found that students from states with new laws or where laws were considered to be strong at

baseline had lower increases in BMI compared with students from states with no laws at baseline or at follow-up (52). However, careful consideration should be given to the interpretation of these findings, as changes in BMI could potentially be due to other factors. Two other studies did not find a significant effect for BMI.

Fifteen articles reported a significant intervention effect on purchasing behaviour or dietary outcomes (50). The majority of studies involved changes to the availability of foods provided at the canteen or snack bar, of which seven were the result of change in national or state policy, while six were the result of scientific method of the study. Results for eight of these studies showed changes in the diet or food purchases of the students in the expected direction while four found less conclusive evidence. One study found that the implementation of a competitive school-based food policy was associated with a decline in consumption of school pastries, juice but not chips, candy, energy drinks or sweet drinks (not further defined) (53). Another study examining the effect of state policy on removing chips, candy, SSBs, and desserts from the snack bar found that students consumed fewer soft drinks and more milk, and reduced their consumption of chips and candy as part of the national school lunch programme. Consumption was assessed by self-reported food frequency questionnaires (54). However, compensatory purchasing from the vending machines increased the consumption of these types of products, which meant that overall consumption did not change in this study (54). Driessen et al., (50) concluded that school-based food environment interventions can have a positive impact on children's' eating behaviours. As most studies were natural experiments, high quality intervention study designs are needed to provide more conclusive evidence. However, even though the design of studies may not be of high quality, the natural experiments examining state and national level policies provide evidence suggesting that these policies can change school food environments and subsequently food purchases and consumption by students (50).

A systematic review undertaken by Chriqui et al., (55) examined the effect of US state laws and/or school district policies restricting the sale of CFBs on student consumption, BMI and weight outcomes and the availability of CFBs in school. A total of 24 studies were included in this review, with 20 cross-sectional, three longitudinal and one combination study. The majority of studies (n=16) examined both pre/post policy changes, while the rest (n=8) examined post-policy changes only and studies were assessed according to the primary direction of the relationship between the policy(ies) and outcome(s) of interest. Fifteen out of the 24 studies showed that state laws/district policies influenced outcomes in the expected direction, while nine studies reported mixed or non-significant findings.

Seven bivariate and six multivariate studies examined the relationship between the CFBs policies and in-school availability of and/or access to CFBs (55). All multivariate studies and five bivariate studies reported an association between the policies and availability/accessibility of CFBs in the expected direction. Four multivariate studies however, reported mixed findings on the association for the BMI outcome. Three bivariate studies found an association between the policies and consumption, purchasing and dietary intake in the expected direction while three additional studies reported mixed or non-significant findings. Two multivariate studies showed reductions in calories consumed and reductions in energy density consumed from foods/beverages. The authors suggest that more robust study designs examining pre-post policy influences longitudinally are needed to assess long term outcome measures such as BMI, weight outcomes and overall consumption (55).

A systematic review (56) on the effectiveness of interventions to promote F&V consumption in children in schools showed that 22 out of the 30 studies reviewed reported a significant effect on F&V intake at follow up, with the effect ranging from increases of 0.14 to 0.99 servings a day. Provision of free or subsidised F&V were part of 10 studies, of which five were from national programmes in England, Norway and Netherlands. Evaluation of two national schemes the England School Fruit and Vegetable Scheme programme and the Norwegian School Fruit Programme which provided free or subsidised F&V showed statistically significant increases in consumption during the scheme. The Norwegian programme also showed sustained effects on F&V intake after the scheme finished, with an increase F&V intake of 30-35 g/day (56). Evaluation of the Netherlands programme found that children with non-western ethnicity (intervention group) reported significantly higher intake of vegetables, while children with western ethnicity reported significantly higher fruit intake measured by child-reported intakes. However, no significant effect on intake was observed based on parent reports. The authors stated that there was variability with F&V intake measurement and reporting across studies (56). Other issues such as recall bias, social desirability and observer bias can be an issue affecting reliable data collection with children. Twenty three studies identified in this review had used a multi-component approach which is not discussed here.

A systematic review and meta-analysis (57) examining the effectiveness of primary school interventions to promote F&V consumption found that computer-based interventions were more effective in increasing the consumption of F&V, while free/subsidised F&V interventions and multicomponent (targeting school education/curriculum components/parents) did not achieve statistically significant results.

Several examples of school-based policies for food service activities to provide and promote healthy food choices are summarised below:

### **United Kingdom**

Food Based Standards (FBS) and Nutrient-Based Standards (NBS) for school lunches that required catering in all primary schools to be fully compliant to these standards were introduced in England in 2008 (58-60). The 13 FBS were intended to increase access to healthier foods such as fruit and vegetables (F&V) while limiting access to less healthy foods such as confectionery. The 14 NBS were introduced to complement the FBS and to ensure that the food contained an appropriate amount of energy (kJ and kCal) and adequate iron (Fe) and that the food was low in fat, sugar and sodium (Na).

Haroun et al., (60) assessed the impact of these standards and found that, schools provided significantly more F&V, water and juices, salads, fruit-based deserts and less foods cooked in fats, confectionery, less sauces and ketchup after the introduction of FBS. Compared with 2005, 21.8% more pupils chose water, 14.7% chose more vegetables and salad, 6.5% chose more fruit, and these results were shown to be statistically significant. School pupils were also making healthier choices by choosing an average of 2.2 portions of F&V. However, about 30-40% of these portions were wasted, although this level of wastage was also seen in 2005. The energy content of the average school lunch was higher than the recommended NBS and relatively few schools provided meals with energy levels within the limit. The sodium content of an average meal was also higher than the standard, with only 19% of schools meeting the standard. However it was reported that the sodium content of meals chosen and eaten by pupils was roughly one third lower than 2005. However, the iron and zinc content of an average meal was much lower than the recommended standard.

In contrast, Upton et al (58) found that pupils in the West Midland and Worcestershire regions of England were not consuming adequate portions of F&V at lunchtime after the introduction of FBS. Only a third of pupils consumed fruit and only 3% consumed at least one portion of fruit as part of their school meal. Although the percentage of pupils consuming vegetables was higher (77%), only 6% consumed at least one portion during lunchtime. Spence et al, (59) examined the effect of the policy on the nutritional content of foods at lunchtime and diet of children aged 4-7 years, using 12 cross-sectional surveys of 12 primary schools in North East England, pre and post policy. Findings from this study demonstrated that there was a statistically significant reduction in children's mean daily percent energy intake from fat,

saturated fat and non-milk extrinsic sugar (NMES). Statistically significant reductions in mean daily intake of sodium and increased intake of nutrients (such as calcium, vitamin A and folate) were found. The study also found that children who ate a school lunch had a lower percentage of energy derived from total fat and saturated fat but an increased intake of carbohydrate, protein, vitamin C, and folate. The authors concluded that the school food policy standards were associated with significant improvements in the nutritional content of school lunches and this was reflected in the children's diet (59). However, the authors also noted that the energy intakes from saturated fat and NMES, and absolute intakes of sodium and NMES of all school children remained above the Dietary Reference Value (59).

### **United States**

The State of Maine in the US, implemented a state-wide nutrition policy to ban "foods of minimal nutritional value" (FMNV) in public high schools that participated in federally funded meal programs. Following the introduction of the policy, it was shown that the availability of soda in student vending machines decreased significantly, with 11 schools showing no availability of sodas in any student food venue (61). However no significant changes were found for other sugar-sweetened beverages and junk food. It was also observed that soda advertisements were common on school grounds (61). Many schools also allowed exceptions to the policy by allowing the sale of FMNV to staff and public on school grounds (61).

Evaluation of the California's State-wide School Nutrition Standards for food and beverages that compete with reimbursable school meals in California showed that the availability of the nutrition-standard compliant foods and beverages increased, while the availability non-compliant foods such as sugar-sweetened beverages, regular chips and candy decreased (62). A survey of 7<sup>th</sup> and 9<sup>th</sup> graders from the 'Health Eating, Healthy Communities' study (facilitated by research-trained staff onsite) reported significant decrease in the consumption of soda and significant increase in the consumption of water after legislation (62). However, the study also found significant decreases in the consumption of vegetables (not including fried potatoes). There was a trend of decreased student consumption of candy, chips and sport drinks at school while increased consumption of milk and fruit. However, these changes were not statistically significant. Although schools greatly increased their rates of compliance with the nutrition standards, not all achieved 100% compliance during the period studied, nor did they greatly reduce the number of CFB offerings (62).

*Overall, the evidence (the majority of which were from natural experiments) suggests that there is an association between the implementation of state/national policies and changes in the school food environment and on food consumption and purchasing behaviour of students, in the expected direction. Studies also showed that the availability of less healthy foods decreased after the implementation of policies. However, studies also showed that rates of compliance by schools were not 100% and less healthy foods were still available in school settings. Evidence on the provision of free/subsidised F&V and F&V intake were mixed as some studies showed increased F&V intake and sustained impacts in the long term, while others did not report significant findings. Findings were also mixed for the association between the implementation of these state/national policies and BMI.*

#### **1.4.2 Public Sector Food**

**The government ensures that there are clear, consistent policies in other public sector settings for food service activities (canteens, food at events, fundraising, promotions, vending machines, public procurement standards etc.) to provide and promote healthy food choices**

*The evidence on the effectiveness of procurement policies in public sector settings and the availability, purchase and consumption of healthy foods by consumers is summarised below.*

A review (63) examining the impact of procurement policies on food purchases, consumption and behaviours found that five studies and a comprehensive review showed improvements in dietary quality, food provision or awareness of the program in intervention groups. In Ireland, one of two public sector hospitals implemented a catering initiative designed to provide nutritious foods while reducing sugar, sodium and fat intakes in their canteen and the other hospital acted as a control (64). A total of 100 participants aged between 18-64 (50 intervention: 50 non-intervention) who consumed at least one main meal from the hospital staff canteen daily, were asked to complete an anonymous 24 hour dietary recall questionnaire. The study found that mean intakes of total sugars, fat, saturated fat and salt were significantly lower in the intervention hospital, with 72% of respondents complying with the recommended under-3 daily servings of foods high in fat and sugar compared with 42% in the control group. Also, 43% of respondents exceeded recommended daily salt intake in the intervention group, compared with 57% in the control. In Seattle, US, homebound, 100 low-income seniors receiving 'Meals on Wheels' over four months were delivered healthy food baskets with F&V while 52 low-income homebound seniors who lived outside the project service area were

recruited to serve as control respondents (65). The study found that seniors receiving baskets increased their F&V intake (>5 servings/day) by 17% compared to baseline, with the intervention group consuming 1.04 more servings than the control group.

*Many public sector settings currently do not have nutritional policies or programmes in place and there are very few evaluations undertaken in settings that do have policies in place (66). As such, there is an absence of evidence to evaluate their impact on population nutrition. However, some intervention studies have shown that procurement policies for healthy foods can have a positive impact on food purchases, dietary outcome and availability but more studies are needed to provide conclusive evidence.*

### **1.4.3 Support Systems**

**The government ensures that there are good support and training systems to help schools and other public sector organisations and their caterers meet the healthy food service policies and guidelines**

*Evidence on the effect of good support and training systems in schools and in other public health organisations on nutrition knowledge, food purchases and dietary outcomes is summarised below.*

#### **School settings**

A whole school approach using the health promoting schools (HPS) model integrates nutrition education, partnerships between the school, families and community to promote school-based health policies (67). A systematic review (67) on effectiveness of health-promoting schools approach in promoting school-based nutrition found that this approach can increase students' consumption of high-fibre foods, healthier snacks, water, milk and F&V. A total of 19 studies were included, three of which were interventions on nutrition policy only, six on nutrition education only and 10 studies on a comprehensive HPS approach. Five of the 19 studies reviewed were assessed as methodologically strong. The HPS model used in schools was shown to have reduced students' "breakfast skipping" behaviour as well as reducing their intakes of low nutrient energy-dense foods, fatty and cream foods and sweet drinks consumption. It was also shown to have increased intakes of high-fibre foods and healthier snacks in two studies and consumption of water, milk, fruit and vegetables in six studies. All but two of the reviewed studies reported a significant increase in students' nutrition knowledge

after the intervention (67). However, the link between knowledge gain and behaviour change after implementation remains unclear.

Multicomponent interventions are similar to HPS, combining changes in school food services (such as improving availability of F&V) with an educational component, and at least some parental involvement to increase F&V intake. Twenty three studies of multicomponent interventions within the systematic review mentioned above (56), showed increases in F&V intake. However, only one of seven studies that measured BMI, found a positive impact on BMI and F&V intake. For example, the APPLE Program in NZ found significantly lower BMI in children in the intervention schools compared with the control schools (68). Significant increases in fruit intake (by 0.8 servings during a 3 day intake) were also observed compared to the control schools, although no significant differences were found for vegetable intake. The authors stated that it is difficult to separate the effects of multiple intervention components and determine which components contribute to effectiveness.

### **Workplaces**

The ‘Danish ‘6 a day’ Work-site Canteen Model Study’ provided catering staff with an eight hour training session for preparation of dishes and the buffet using F&V, goal setting for canteen staff and managers (average grams of F&V consumed per customer per meal), along with providing support for implementation and further development of strategies at five worksite canteens (a military base, an electronic component distributor, a bank, a town hall and a waste-handling facility) (69). Results from this study demonstrated that all five canteens significantly increased the daily amounts of F&V served. There were significant increases in the total consumption of F&V from baseline to end-point at three months, by 70g per customer on average (113g/meal). Follow up after a year showed that the canteens either maintained or significantly increased consumption of F&V, the average increase being 95 g (181g/meal) per customer compared with baseline. Analysis of this worksite study five years after baseline found that the average F&V consumption increased by 95 g (208g/day) per customer per day was achieved from baseline with four sites showing significant increases (70).

The Heartbeat Award (HBA) scheme established in England in 1990, awarded HBAs to catering establishments fulfilling the following criteria: at least one-third of the dishes on the menu were ‘healthy choices’; at least one-third of the eating area was non-smoking; at least 30% of food handling staff had received training on hygiene; and the premises complied with food hygiene regulations. Evaluation of four HBA workplaces compared with two comparison

workplaces on changes of employee eating habits following implementation of the HBA scheme found that overall the intervention had a positive impact on consumption of four of the 20 foods assessed, resulting in a significant increase in fruit consumption and use of lower fat milks, and a significant reduction in consumption of sweet puddings and fried foods (71).

*The evidence from the literature indicates that the “health promoting schools” approach and multi-component interventions are associated with increased F&V intake. However, the association with factors such as knowledge gain, behaviour change, and dietary outcomes remains unclear. There is an absence of evidence regarding support and training systems in other public sector settings. The two studies summarised above, show a positive impact of catering initiatives, however more evidence is needed to provide conclusive evidence.*

#### **1.4.4 Private Sector Food**

##### **Government actively encourages and supports private companies to provide and promote healthy foods and meals in their workplaces**

*The evidence on the association between workplace interventions on dietary outcomes (consumption and BMI) is summarised below.*

A systematic review (72) on the effectiveness of workplace interventions found that of the six studies reviewed, four reported small but statistically significant increases in F&V consumption. Three of these studies involved changes in workplace environment, menu planning, media campaigns, and motivation strategies, while one study used fresh fruit deliveries as the intervention. However, the maximum increase in F&V intake was 1 ½ servings per day. Three studies examined changes in fat intake with only one study reporting statistically significant decrease in the percentage of energy obtained from total fat and polyunsaturated fat in the intervention group compared with the control group. This study also reported a statistically significant reduction in overall energy intake and statistically significant increases in protein and carbohydrate intake. However, it also reported a statistically significant increase in BMI levels of the intervention group. The authors concluded that there was limited ability to draw conclusions on the effectiveness of workplace interventions due to heterogeneity of interventions and outcomes and the low quality of the studies reviewed (72). It is also unclear whether the modest dietary improvements can be sustained in the long term as the studies’ follow-up timeframes were relatively short (72).

Ni Mhurchu et al, (73) systematically reviewed the effects of worksite health promotion on employee diets and found that worksite health promotion programmes were associated with modest improvements in dietary intake. Out of the 16 studies reviewed, eight were focused on nutrition education while the remainder were focused on the worksite environment either alone or in combination with nutritional education. In two of the reviewed RCTs, the average daily combined F&V intake increased from +3% to +16% in intervention groups compared with -2% to +4% in control groups. Five RCTs reported average daily reductions (total fat as percentage of energy) of -2.2% to -9.1% in intervention groups compared with +1.3% to -1.8% in control groups. Studies that evaluated the effectiveness of worksite environmental interventions either alone or in combination with nutritional education found generally positive dietary outcomes, however effect sizes were small (73).

The findings from both reviews examining worksite/workplace interventions on dietary outcomes (consumption and changes in BMI) have been mixed due to limited evidence and a lack of high quality studies to reliably determine effectiveness of such interventions (72, 73). Studies were assessed to be methodologically weak due to unmatched control groups and reporting biases that arise from self-reported dietary measures (72, 73).

*Overall, the evidence from the literature indicates that findings on the association between workplace environment interventions and consumption are mixed due to heterogeneity of interventions and outcome measures and the lack of high quality studies to reliably determine effectiveness of such interventions. More longitudinal studies are needed to ascertain whether dietary improvements can be sustained in the long term.*

## **1.5. FOOD TRADE & INVESTMENT**

### **1.5.1 Trade Agreements**

**The direct and indirect impacts of international trade and investment agreements on food environments and population nutrition and health are assessed and considered**

*The evidence of the impact of international trade and investment agreements on food environments and population nutrition is sparse and therefore only illustrative examples are presented. A brief introduction on trade liberalisation and foreign direct investments (FDI) from Friel et al's (41) overview is also summarised below since this is a new area of investigation.*

Trade liberalisation and FDI through multilateral, regional and bilateral agreements has brought about three important changes to food systems (41):

9. opening of domestic markets towards international food trade and FDI;
10. subsequent entry of transnational food corporations and their global market expansion;
11. global food advertising

These three changes have ability to alter the structure and nature of food systems, and in turn, the availability, nutritional quality, accessibility, price and promotion of foods, consequently shaping food preferences and diet-related health (41).

A review undertaken by Friel et al., to examine the links between trade agreements and food environments from an obesity/NCD perspective identified nine studies (41). Findings from the review indicate that the liberalisation of trade in goods (import and export flows) has been consistently shown to increase total food imports, particularly import volumes of animal products and highly processed foods in low and middle-income countries (LMICs). The authors also suggest that trade has the potential to benefit the nutritional status of the populations by improving food availability, accessibility and affordability but the impact of trade liberalisation policies are strongly influenced by regional, national and local contexts. Exacerbation of inequalities within regions, countries and social groups have resulted from trade liberalisation policies including development of new dietary habits and significant contributions to the global burden of under-nutrition, obesity and NCDs.

In the Pacific region traditional diets were based on local starchy staples, fish, seafood, coconuts and other fruit (42). However, increasing import volumes of vegetable oils, margarine, butter, meat and chickens and canned meat, have resulted in large shift in consumption of these products, promoting increases in saturated fat and sugar intakes. Between 1963 and 2000, total fat supply increased in some Pacific Island countries by as much as 80% (41).

In Mexico, following the signing of North American Free Trade Agreement (NAFTA), imports of animal feed grains, soybeans, sugars derived from corn (including high fructose corn syrup), processed ‘ready-to-eat’ snack foods, dairy and meat products from the United States into Mexico increased (74).

In Central American countries, following the signing of Central America-Dominican Republic Free Trade Agreement, the reduction and/or elimination of tariff and non-tariff barriers on poultry, pork meat, processed meats, dairy products, some other processed products and ingredients, increased the availability and lowered the retail prices of these products (41, 75).

Foreign Direct Investment (FDI) is a key strategy used by Transnational Food Corporations to extend their supply chains (production, processing, distribution and marketing, placing control over all parts of the global supply chain into developing countries (41). FDI stimulates competition and alters the food supply as a whole, creates a cultural identity for new foods and introduces new ways to sell and promote them. Liberalizing trade in services and investment also facilitates the transnational growth and reach of advertising services, which can affect how consumers, including children, perceive choices they make about food consumption(41). Indirect consequences of liberalisation of investment and trade in services has opened up countries to investments, production, processing, retailing and advertising, and there is strong evidence linking inward FDI and expansion of highly processed food chains, and retail sales and consumption of these products in LMICs.

In Mexico, inward FDI by US-based food and drink manufacturing companies, and domestic meat production in Mexico, was found to have increased significantly in the two decades after signing NAFTA (41, 74). In Central America, it is expected that increased production of processed foods by US companies based in Central America, as well as by domestic companies (due to a more competitive market environment) as a result of CAFTA (41, 75). Investment in Fiji by Transnational Food Companies has also increased availability and consumption of processed foods (42).

*The emergence of this research area is relatively new, and thus evidence on the impact of trade and investment agreements on population nutrition is largely absent. There is currently no systematic review available, and the evidence in this summary has heavily relied on the review by Friel et al. However, the illustrative examples show some evidence on the association between international trade and investment agreements and the food supply, whereby increased import volumes of animal products and highly processed foods have been observed in LMICs. The examples also have shown that FDIs increase the availability and production for unhealthy foods, which in turn has influenced consumption patterns.*

### **1.5.2 Regulatory Capacity**

#### **The government adopts measures to manage investment and protect their regulatory capacity with respect to public health nutrition**

*Evidence on the impact of trade and investment agreements and government's ability to protect their regulatory capacity with respect to public health nutrition using illustrative examples, is summarised below.*

Trade liberalisation has also been shown to constrain or undermine the policy space and institutional capacity of some countries from implementing policies to increase the healthiness of their national food environments. For example, in 2006, when Thailand proposed on public health grounds the introduction of a front of-pack traffic light labelling system on snack food products (many of which had been introduced into the country by US-owned Transnational Food Companies), the US and other countries claimed that the introduction, contravened the agreement on Technical Barriers to Trade (41). The Thai government abandoned the traffic light system and implemented a monochrome Guideline Daily Amounts label, a decision widely regarded as reflecting the interests of the food industry, not the interests of public health nutrition (41).

Pacific Islands have also used trade-related policies to reduce the supply of unhealthy imported food products. For example:

Fiji banned the supply of mutton flaps under the Trading Standards Act in 2000 (42). The ban resulted in a drastic reduction in the import of mutton flaps (42). However, imports of flaps can still occur in part because it can still be imported for other uses and processing. There has been no assessment of the health impacts of this ban. New Zealand is a large exporter of mutton flaps to the Pacific region and it threatened to pursue sanctions at the World Trade Organisation

(WTO) when Fiji implemented a ban on importation of mutton flaps. However, the ban remains in force and no formal actions against it have been taken at the WTO (42).

Samoa banned the importation of turkey tails in 2007 (42). This ban was largely driven by health concerns and perceptions of low quality products being imported into Samoa. Assessment of consumer response to the ban indicated that health campaigns had been effective in raising the awareness of turkey tail fat content and the risk of high-fat diets (42). Findings from an impact assessment indicated that while some consumers switched to other high fat meats, a third of consumers made healthier changes (42). However, during discussions of Samoa's accession to the WTO, this ban was raised with objections, stating that the import ban on turkey tails was unique and therefore discriminatory, as there are other foods high in fat and processed being imported into Samoa. As part of the accession agreement Samoa agreed to remove the import ban and replaced it with a temporary sales ban which allows for importation for private consumption (42). Since import bans are specifically proscribed by the WTO trading rules, it is unlikely that Samoa could have maintained its ban, although Samoa did successfully negotiate scope for alternative measures (42).

*The emergence of this research area is relatively new, and thus evidence on the impact of trade and investment agreements and government's ability to protect their regulatory capacity with respect to public health nutrition is largely absent. Several illustrative examples have shown that trade liberalisation has constrained or undermined the institutional capacity of some countries from implementing policies to increase the healthiness of their national food environments.*

## **1.6. FOOD RETAIL**

### **1.6.1 Zoning Laws**

**Zoning laws and policies are robust enough and are being used, where needed, by local governments to place limits on the density or placement of quick serve restaurants or other outlets selling mainly unhealthy foods in communities**

*The evidence on the association between community food environments (type, availability and accessibility of food outlets) with purchasing behaviour and dietary outcomes is summarised below. Within this context 'Availability' is defined as the 'adequacy of the supply of food' (76) and 'Accessibility' is defined as the location of the food supply and the ease of getting to that location (determined by distance, travel time and costs, public transportation networks, private vehicle ownership, etc.) (76).*

### **Food Purchasing Behaviour**

A recent review (76) examining the association between the community food environment and food purchasing behaviour found that three of the seven reviewed studies identified a significant positive association between the density of food outlets (fast food, convenience stores) and increased frequency of food purchases from these stores. Two of four studies found significant positive association between the proximity to food outlets (fast food, small stores, supermarkets) and increased frequency of food purchases from these outlets (76). One of two studies that examined environments around homes and schools found significant associations between density of fast food outlets around both homes and schools and fast food purchasing frequency, but only significant associations between proximity of fast food outlets and increased purchasing for fast food outlets around homes. One of these studies measured both absolute density of healthy food outlets and density relative to the density of healthier food outlets. This study found a stronger positive association between the relative density of healthy food outlets and healthy purchasing behaviour than for absolute density. Ni Mhurchu et al., (76) suggested that it seems important to not only focus on how much healthy food is available in the community environment, but also its availability relative to unhealthy food.

### **Dietary outcomes (consumption of foods and/or nutrients) and BMI**

Caspi et al., (77) undertook a systematic review to evaluate the relationship between the food environment and diet. The review included 38 studies of which the majority were cross-sectional studies, while three were natural experiments or interventions that compared pre- and

post-test dietary measures. Methods of exposure assessment used were Geographical Information Systems (GIS), surveys, food store audits. Studies measured “perceived availability” by a unique set of items to measure agreement (e.g. a large selection of low-fat foods is available in my neighbourhood). Six out of seven studies that used measures of “perceived” availability of food and food stores were consistent in showing a positive relationship with dietary outcomes. For example, a US based study found that participants who lived in areas with higher self-reported and informant-reported (aggregated survey responses) ‘perceived availability’ (exposure) of fast food near their homes had 27% and 61% higher odds, respectively, of consuming fast food near their home than those who lived in areas with lower reported exposure. Another study found that women, who had greater “perceived availability” of healthy foods, were more likely to consume high amount of F&V. However, studies that used GIS-based methods to objectively measure the type of store present in neighbourhoods or density of stores were mixed, with only 13 out of 21 studies showing a significant association between geographic availability of food stores and dietary outcomes (77).

Thirteen studies reviewed by Caspi et al., (77) assessing food accessibility using GIS found an inconsistent relationship with dietary outcomes, with seven reporting no association. For example, one study reported that higher vegetable consumption was found in participants that lived farther away from a fast food outlet, but also living farther away from a supermarket. However, another study found that those who reported to have easy access to a supermarket consumed on average 86 more grams per day of fruit than those who had poorer access to supermarkets. Four out of six studies that measured this relationship using survey-based questions to assess perceptions of food store accessibility also showed no significant relationship. The authors stated that the evidence was weakest for studies of fast food consumption, with four out of eight studies showing positive associations with availability and accessibility of fast food outlets (77). The authors concluded that overall, the studies reviewed found moderate evidence on the association between food environment and diet (77). Although the majority of studies used in the literature reviewed used GIS-based measures, these studies have not been consistently associated with diet, with the authors offering an explanation that GIS-based measures alone may not be able to capture non-geographic dimensions of access.

A further 19 studies, published after March 2011, that investigated the relationship between community food environments and dietary intake were reviewed by Ni Mhurchu (76). Most were cross-sectional studies except for two longitudinal and an ecological study. Both longitudinal and ecological studies found significant associations between the availability of

retail food outlets and diet. Two studies reviewed that used natural experiments conducted in the UK, explored the effects of opening a new supermarket on dietary behaviour, and found that one study showed no change in F&V consumption between intervention and control groups, while the other reported that F&V consumption increased among residents who switched stores, who lived closest to the new store, and had the lowest consumption at baseline. However, there was no overall increase in F&V consumption. Twenty four studies showed a significant positive association between food outlet availability and dietary outcomes in the expected direction, while 13 out of 22 studies examining the proximity of food stores in relation to diet did not find an association. The authors concluded that evidence suggests an association between community food environment and dietary habits (food purchases and dietary intake) as the majority of studies reported at least one significant finding but not all observed relationships were considered to be nutritionally significant (76).

A systematic review (78) investigating the relationship between community food environment and dietary intake in children found moderately strong evidence on the relationship between the community environment and dietary intake in children up to 18 years of age. Twenty six studies were identified with most being cross-sectional in design, except for two that were longitudinal studies. Twenty-two studies showed at least one positive association between the food environment exposure and dietary outcomes (including F&V intake, fast food consumption, SSB intake, dietary quality indices, as well as consumption of other food groups and macronutrients and energy) (78). Findings from studies that employed GIS-based measures which often measure accessibility (operationalised as distance to nearest food outlets), were less consistent while studies that used self-reported measures of availability were more consistently associated with dietary outcomes. Food store audit studies showed an association between the type of availability of food outlets such as supermarkets, and fast food outlets and consumption of F&V, fast food intake or total energy intake, respectively. The authors noted that the studies used a range of approaches for measuring the community food environment and diet which made comparing studies difficult (78).

A systematic review (79) of fast food access studies examined associations between fast food access with obesity (measured by BMI and dietary intake). Findings were mixed from 15 out of 40 studies that examined the association between BMI and the fast food environment, with eight studies not finding any significant associations. Seven studies found that higher obesity prevalence was associated with living in areas with higher access to fast food restaurants. Six studies examining the relationship between fast food access and dietary intake reported mixed

findings. The authors stated that all 40 studies were cross-sectional in nature except for one and there was a lack of consensus on the definition of fast food used in the studies (79).

A systematic review (80) on the influence of food environments around schools (which included food stores and catering but excluded food provision within the school building) on obesity-related outcomes found very little evidence of an association between the community food environment surrounding schools on food purchases and consumption, but some evidence of an association with body weight in 20 of the 30 papers identified. However, the authors suggest that the association of body weight with the food retail environment may be a result of residual confounding. Of the 72 associations reported in 20 studies, 43 showed a positive relationship between body weight and exposure, and 19 associations were reported to be significant and in the expected direction after adjustments were made. These included positive associations between exposure to fast food outlets and BMI, and the proportion of overweight or obese students. Positive associations were also observed between the presence of ‘unhealthy outlets’ (such as convenience stores and takeaways) and increased adiposity among girls who walk or cycle to school and proportion of overweight students. It should be noted that the majority of studies reviewed were cross-sectional except for two longitudinal studies. Findings from ten studies that measured the associations between food outlets and consumption of foods high in fat, sugar or salt, were mixed, and not all associations were in the expected direction, with some studies reporting increased consumption in relation to grocery stores. Similarly, mixed findings were reported from four studies that measured the association between food outlets and consumption of F&V intake, and not all associations were in the expected direction. For example, one study observed positive association between the presence of fast food outlets and vegetable consumption among adolescents.

*Overall, there is some evidence to indicate an association between the community food environment and food purchasing behaviour. However, findings in studies examining the association of dietary outcomes using objective measures of store presence, density or store variety were mixed and not all reported associations in the expected direction. Evidence examining BMI and exposure to different food outlets was also mixed, and not all reported associations were in the expected direction. There was very little evidence of an association between the community food environment surrounding schools and food purchases or consumption by children/adolescents. Although the majority of studies reviewed used GIS-based measures, the results of these studies did not consistently show an association with*

*diet. The authors of systematic reviews concluded that GIS-based measures alone may not be able to capture non-geographic dimensions of access.*

### **1.6.2 In-store Food**

#### **There are existing support systems to encourage food stores to promote the in-store availability of healthy foods and to limit the in-store availability of unhealthy foods**

*The evidence on the association between consumer food environments (the availability and placement of products available within stores) with purchasing behaviour and dietary outcomes is summarised below.*

#### **Food Purchasing Behaviour**

A systematic review undertaken by Gittelsohn et al, (81) examined the impact of stocking (increasing availability) and promotional interventions in small stores on food availability and dietary behaviours that influence chronic disease risk. This review identified 16 trials that included pre- to post-intervention evaluations, of which five trials used RCTs. Intervention strategies in all 16 trials focused on increasing stocking of healthy foods in stores. Overall, the availability of promoted healthy foods in-store increased in all trials. However some trials varied in terms of foods promoted (for example some promoted low fat snacks, while five trials promoted fresh produce). Although, trials did not measure the impact on the quantity of foods stocked, five trials did report that there was an increase in the number of fresh produce varieties. In studies, that collected sales data, significant increases in sales were found for promoted health foods, with sales increasing in the range of 25% to 50%. One trial measured post-intervention data and this study reported that the increases in stocking of healthy foods and sales of promoted foods were maintained at six months post-intervention. Nine of 10 trials reported significant increases in purchasing frequency of at least one promoted food, while seven reported increased purchasing by weight of promoted foods (F&V, low-fat milk, high fibre cereals and water). Increases in food and health-related knowledge were also observed in seven trials.

An integrative review undertaken by Glanz et al., (82) (using a multi-disciplinary search to review journal articles, review articles, industry reports and online sources published between 1995 to 2010) examined in-store food marketing strategies (type of products, placement) and the influence of these strategies on consumer food-purchasing behaviours. Findings from this review suggested that in-store placement of products, using for example the prominence of

locations (e.g. end of aisle placements) and the amount of shelf-space influenced food-purchasing behaviour in nine studies. This review also found that “aisle management” (defined as proximity of food categories to one another) can influence cross-category purchases, when both are placed on “facing aisles” or “end of displays” in four studies. For the types, variety and amount of products stocked, the authors of the review concluded that, to date, there is insufficient evidence available to suggest that increasing access to healthy food products in stores increases consumption of healthier foods (82). Authors suggested that interventions may have greater impact if they focus on altering the placement and promotion of less healthy foods, instead of just increasing access to healthier options (82).

Ni Mhurchu et al., (76) also reviewed marketing studies examining the relationship between food availability in-store and food purchasing behaviours. Four of these studies examined how changes in product shelf space allocation impacted on sales and all studies reported increases in sales from increased shelf allocation of specific products. For example, a study reviewed found that increasing shelf space allocated to F&V by 100% resulted in increases in sales of 29 to 59%.

### **Dietary outcomes (consumption of foods)**

A systematic review (83) examining the influence of the consumer food environment on dietary patterns and weight status found mixed results for the association between availability of F&V in-store and consumption/intake. The authors suggested that systematic measurement of factors determining the availability of food within stores and store types is needed. Understanding the context such as neighbourhood characteristics is also relevant for understanding the complexities of the consumer food environment within different store settings, and the authors suggest further interventions and longitudinal studies examining these associations are needed (83).

Six out of nine studies reviewed by Caspi et al., (77) that used food store audit measures showed that availability and variety of healthier products (F&V, low-fat milk) in-store found a positive association with healthier diets. The authors noted that the studies used a range of approaches for measuring the consumer retail food environment and diet which made comparing studies difficult (78). Similarly, Ni Mhurchu et al, (76) concluded that the variety and complexity of methods used to assess the availability of foods in-store makes it difficult to draw strong conclusions about the association between the in-store food environment and dietary outcomes.

*Overall, the evidence in the literature suggests that there is an association between the in-store consumer retail environment and food purchasing behaviour. Increased fresh produce and/or healthier food product availability, placement of products in-store and shelf space allocated to products were particularly influential in consumer food purchasing behaviour. However, findings in studies examining the association of dietary outcomes and in-store food measures were mixed which could be due to the variability and complexity of measures used to assess outcomes. Further interventions which also include understanding the context such as neighbourhood characteristics and longitudinal studies examining these associations are needed.*

## **1.7. FOOD COMPOSITION**

### **1.7.1 Composition targets**

**Food composition targets/standards have been established by the government for the content of the nutrients of concern in certain foods or food groups if they are major contributors to population intakes of these nutrients of concern (trans fats and added sugars in processed foods, salt in bread, saturated fat in commercial frying fats)**

*The evidence on the association of changing food reformulation and dietary outcomes is summarised below. Please note that the summary is written in the context of reducing obesity and diet-related NCDs, and therefore not focused on addressing under-nutrition and micro-nutrient deficiencies.*

#### **Trans fatty acids**

Downs et al., (84) systematically reviewed evidence on the effectiveness of policies, (including self-regulation), aimed at reducing industrially produced trans fatty acids (TFAs) in food. A total of 26 studies were included in this review, of which five involved voluntary self-regulation; eight, labelling alone; four, labelling and voluntary limits; five, local bans and four, national bans. Ten studies included examined the reformulation of food products before and after the TFA policy intervention. All policy interventions were associated with a reduction in the availability of TFAs. The review found that national bans were most effective at eliminating TFAs from the food supply along with local bans which were successful in removing TFAs from fried foods. Mandatory TFA labelling and voluntary TFA limits on the other hand, had a varying degree of success, which largely depended on food category. Two of the studies reviewed showed that in the United States, mandatory TFA labelling in some cities was associated with a 58% reduction in TFA levels in blood plasma while voluntary self-regulation of TFA levels in the Netherlands was associated with a 20% reduction in dietary intake. None of the studies reviewed, had measured impact of national/local bans on population intake levels (84).

Mandatory TFA labelling was observed to be not as effective as national and local bans due to several limitations of labelling policies such as lack of consumer awareness of TFAs, not being able to interpret TFA information correctly (84). Voluntary labelling of TFAs on the other hand, had lower effect of reducing TFA. For example, New York city tried to reduce TFAs in restaurant foods through voluntary regulation but the use of hydrogenated vegetable oils as a frying fats did not decrease until the city placed a ban for TFAs in restaurants (84). Studies

also showed that, for most products reformulated, saturated fatty acid levels did not increase as the TFA level decreased. However, after the intervention, the level of saturated fatty acids was shown to be higher in specific foods, such as bakery products and popcorn. Studies also found that mono- and polyunsaturated fatty acid levels generally increased with product reformulation while total fat levels remained relatively constant, with a decrease in the combined level of TFAs and saturated fatty acids. The authors also stated that political awareness and commitment were important for the success of many of the policy interventions aimed at reducing TFAs in the food supply (84).

### **Salt reduction**

One of the most successful salt reduction initiatives in the world is the UK Food Standards Agency's (FSA) salt reduction programme (85). The evaluation of this programme (from industry's self-reporting framework and monitoring of commercial label data) undertaken between 2003 and 2010 indicated that substantial reductions of up to 70% of sodium content in some foods had been achieved through reformulation (85). Results from the consumer campaign evaluation showed increased consumer awareness, whereby 43% of adults in 2009 claimed to have made extra effort to reduce salt from their diet compared with only 34% of adults in 2004 prior to the campaign (85). The change in population's average salt intake was monitored using urinary sodium excretion data collected from surveys that were representative of the UK population. From 2000-2001, salt intake in adults was estimated to be 9.5 g while in 2005–2006, average intake among adults had decreased by 0.5 g/day to 9.0 g/day (85). In 2008, the average adult population salt intake was estimated to be 8.6g/day. The 0.9 g/day reduction in salt intakes in the UK population is assumed to be the direct result of efforts across the manufacturing, retail and (more recently) food service sectors to reformulate products, coupled with changes in consumers' dietary practices (85).

More recent articles analysing the impact of the UK's FSA salt reduction programme have found that, between 2006 and 2011 there was an overall mean reduction in crude sodium content of UK foods of 26 mg/100 which is equivalent to a 7% reduction (356 mg/100 g to 330 mg/100 g) (86). This reduction has been reflected by a decrease in average population salt consumption from urinary sodium excretion surveys (~15% (9.5 g to 8.1 g per day) over the 10 years to 2011 and 8 to 10% during 2006-2011 (87). The success of this initiative, whilst based on voluntary agreements, is attributed to sustained strong government leadership and

pressure, reinforced by robust monitoring mechanisms, and undertaking consumer awareness campaigns by working alongside non-governmental organisations (11, 85).

In a recent article documenting the global overview of progress of salt reduction initiatives found that (11):

- 80% of countries surveyed (59 countries) that have national strategies to reduce salt now include programs to work with the food industry.
- 38 countries have established product-specific targets for salt level in foods. Most of these targets are voluntary except for nine countries which have established legislation (7 for bread or for bread and other food categories)
- 17 countries that have set targets for salt levels for particular food category/categories have reported reductions – majority through bread (Malaysia negotiated the reductions through industry meetings but also reported reductions). 68% of the reported reductions were based on chemical analysis except for Australia, Italy and Malaysia which used industry self-reports and Australia, Canada and UK which were based on product surveys.
- Mostly the targets were voluntary, although three countries (Netherlands, Belgium and Argentina) reported reductions in salt levels in breads as a result of mandatory targets.
- Reductions ranged from 6% (Belgium) to 38% (Chile) in breads with the UK, Canada, NZ and Ireland all also reporting between 20% and 30% reductions in breads. For other product categories, reductions ranged from 5% (cornflakes, US) to 81% (frozen peas, US).

### **Other initiatives**

A government-led intervention in Mauritius to replace palm oil with soybean oil as the common cooking oil saw a 3.5% decrease in energy intake from saturated fat, a 5.5% increase from polyunsaturated fat and a 0.79–0.82 mmol/L reduction in average adult total cholesterol concentrations between 1987 and 1992 (88).

Other examples include, the Australian Heart Foundation's and the NZ Heart Foundation's respective Tick Endorsement Programs both of which have demonstrated reduction of sodium from commonly consumed products such as bread, with a 235 and 33 tonne reduction of salt in the food supply in a one-year period in Australia and NZ respectively (89, 90).

No current initiatives and/or policies exist by governments to reduce “added sugars” and saturated fat from the composition of processed foods have been documented and/or evaluated.

*Overall, the evidence from the literature indicates that food composition for nutrients of concern can be changed as shown through salt reduction initiatives worldwide and national bans on TFA resulting in lower levels of these nutrients of concern in foods supplied and consumed. Positive outcomes may result from the introduction of targets and initiatives aimed at reducing levels of "added sugars" and saturated fat in processed foods, if the implementation of the initiatives mirrors that used in salt and trans-fat reduction campaigns.*

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