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Reducing the volume, exposure and negative impacts of advertising for foods high in fat, sugar and salt to children: A systematic review of the evidence from statutory and self-regulatory actions and educational measures

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Abstract

Purpose

To identify and review evidence on 1) the effectiveness of statutory and self-regulatory actions to reduce the volume, exposure or wider impact of advertising for foods high in fat, sugar and salt (HFSS) to children, 2) the role of educational measures.

Design/methodology/approach

A systematic review of three databases (Medline, CINAHL and PsycINFO) and grey literature. Relevant evidence included studies evaluating advertising bans and restrictions, advertising literacy programmes and parental communication styles. Relevant media included TV, internet, radio, magazines and newspaper advertising. No studies were excluded based on language or publication date.

Findings

Forty-seven publications were included: 19 provided evidence for the results of statutory regulation, 25 for self-regulation, and six for educational approaches. Outcome measures varied in approach, quality and results. Findings suggested statutory regulation could reduce the volume of and children's exposure to advertising for foods HFSS, and had potential to impact more widely. Self-regulatory approaches showed varied results in reducing children's exposure. There was some limited support for educational measures.

Discussion

Consistency in measures from evaluations over time would assist the development and interpretation of the evidence base of successful actions and measures to reduce the volume, exposure and impact of advertising for foods HFSS to children.

1. Introduction

Children are exposed to advertising in a variety of media and settings, including television, radio, internet, sms messaging, billboards, and in schools and shops. Advertisers' targeting of young children is controversial because they do not have the developmental maturity to recognise the purpose of advertising or to assess advertising claims (McGinnis et al., 2006; Wilcox et al. 2004). It is only at around 12 years old that children have the cognitive skills to evaluate advertising more critically (Boush, 2001; Peterson et al., 1984). *Nevertheless, even with the development of these skills around early adolescence, evidence suggests that the persuasive intent of advertising is not understood fully until late adolescence or early adulthood (Carter et al., 2011).*

1.1 Relationship between food and beverage advertising and children's diets

A significant proportion of advertising is for foods and beverages, and these advertisements are often for products high in fat, sugar and salt (HFSS). High levels of dental caries and increases in weight have sharpened the focus at the national and supranational levels on the relationship between advertising and negative health outcomes. Extensive literature reviews have found an association between exposure to advertising for foods HFSS and poor diet and obesity (Cairns et al., 2013; Hastings et al., 2003; McGinnis et al., 2006). The authors concluded that the effects of advertising exposure on diet are not due to chance. Similar patterns of exposure and negative impact are also recognised in middle and low income countries (Hawkes, 2007). The World Health Organisation (WHO) has responded to this increasing evidence base by recommending that greater efforts be made to reduce children's exposure to advertising for foods HFSS at the national, cross-border and global level (Cairns, 2009; WHO 2013).

1.2 Solutions

To achieve a reduced volume of and exposure to advertising for foods HFSS, and to improve children's dietary habits, policies and programs have been suggested and in some countries implemented. Similar actions are in place for tobacco and alcohol advertising. Restrictions on alcohol advertising to children and young people have been implemented in many countries, however, there is disagreement over its impact (Caswell, 2012; Nelson, 2010). For tobacco advertising, Saffer and Chaloupka (2000) report that comprehensive restrictions are needed to reduce consumption, and that limited bans will have little or no effect. Studies on self-regulation by the alcohol industry suggest that these actions have little impact on reducing exposure to alcohol advertising in youth (Chung et al., 2010; Fielder et al., 2009; Jernigan, 2009). In relation to

advertising of foods HFSS, three main forms of action are most frequently put forward to limit the influence of advertising: statutory regulation, self-regulation and educational approaches.

Statutory regulation

An increasing number of statutory regulations have been implemented (see Hawkes, 2007, and Hawkes and Lobstein, 2011 for extensive reviews): bans on advertising to children under 12 or 13 years are in place in Quebec, Sweden, and Norway. In the UK, advertising for foods HFSS are prohibited during children's television programming and regulated by Ofcom. In the US there are limits on advertising more generally to children, however, these are directed towards advertisement length and misleading claims, rather than content. Overall, regulations are concentrated in high income countries (Hawkes, 2007).

Self-regulation

The food industry and industry bodies have responded to criticisms of their advertising practices by developing guidelines aimed at the reducing the volume of and limiting children's exposure to advertising for foods HFSS. The International Chamber of Commerce's (ICC) Framework for Responsible Food and Beverage Communications provides advertising recommendations. These include the promotion of healthy diets and lifestyles, clear delineations between advertising and programming, and prohibitions on manipulating children's naivety (Hawkes, 2007). Similar recommendations were made by the Confederation of the Food and Drink Industries of the EU (CIAA) (Hawkes, 2007). Commitments have been made by the International Food and Beverage Alliance to advertise only healthier products to children under 12, to stop advertising to children under 12 completely, and to limit advertising in schools (IFBA, 2014). Within Europe, signatory companies to the EU Pledge have made similar commitments (EU Pledge, 2014). In the US, leading food and beverage companies signed up to the Council of Better Business Bureaus Children's Food and Beverage Advertising Initiative (CFBAI) have pledged that half of child-targeted advertising is to be for healthier products or encouraging a healthy lifestyle. Independent monitoring of CFBAI commitments is undertaken by the Rudd Center at Yale University (Rudd Center 2010a, b, 2011, 2012a,b). Trade associations in Canada and Australia have developed similar guidelines and have received commitments from leading food companies (Potvin Kent et al., 2011a; 2011b; 2012). A major difficulty with these commitments is that companies can define which of their products are considered healthier, and that many commitments refer only to television advertising.

Educational approaches

There is also a view that educational approaches with parents and children could reduce children's exposure and other negative impacts of unhealthy food marketing. These approaches often focus around advertising literacy interventions, that is, "the skills of analyzing, evaluating, and creating persuasive messages across a variety of contexts and media" (Livingstone and Helsper, 2006:562). Children are educated about the use of advertising, its persuasive function, and the techniques used to attract children's attention. A review by Bergsma and Carney (2008) found that media literacy interventions can improve health outcomes, particularly in relation to alcohol advertising and eating disorders. Less is known about the impact of advertising literacy in relation to healthier diets. Indeed, it is possible that teaching children to pay greater attention to advertising, risks increasing advertising effects (Livingstone and Helsper, 2006; Parvanta et al., 2010). The American Psychological Association cautiously argues that there should be a focus in the 3rd to 12th grade (8-18 years) curriculum on advertising literacy. Nevertheless, they highlight that there is limited evidence that media literacy can successfully reduce the negative impact of advertising to children (Wilcox et al., 2004).

2. Purpose

There is lack of clarity over which actions have the potential to successfully impact this area. Hawkes argues, "despite greater efforts made to monitor regulations...there is still no concrete evidence on the effectiveness of regulation in the prevention of unhealthy diets or obesity" (2007: 1968). With this in mind, our aim was to identify and review the available evidence on 1) the effectiveness of policy actions to reduce the volume, exposure or other negative impacts of advertising for foods high in fat, sugar and salt (HFSS) to children, and 2) the role of educational measures.

3. Research Design

3.1 Search strategy

Searches were carried out in MEDLINE, CINAHL and PsycINFO from database start-dates using synonyms for advertising, food, and children (see Table 1 for a search strategy example).

Appropriate MESH terms and subject headings were used where appropriate. Grey literature included published reports by academics, government agencies, trade associations and advocacy groups, and was searched through Google. There were no restrictions on the year or language the article was published in. The reference list of full text publications was also searched for relevant titles. The search included papers published up to and including 6 March 2013.

[Table 1 about here]

3.2 Study Selection

Studies were included in the review if they met the following criteria:

- Primary research reporting on the effectiveness of policy actions (statutory or self-regulatory) intended to reduce the volume, exposure and other negative impacts of advertising for foods high in fat, sugar and salt (HFSS) to children (aged < 18 years), or the role of educational measures.
- Relevant outcome measures resulting from these actions including volume of advertising, advertising exposure, advertising patterns by nutritional content, cost-effectiveness, eating behaviour, health outcomes, and antecedents of eating behaviour.
- A comparator (studies with before/after measures, experimental and quasi-experimental designs, or comparisons).
- Advertising in traditional media (TV, radio, magazines, newspapers) and new media (internet and websites).
- Peer-reviewed and grey literature.

Studies were excluded from the analysis if they focused only on the advertising techniques that attract children, compliance with regulations, in-store/restaurant promotions, in-school marketing or product packaging. These issues are undoubtedly of importance, but are beyond the scope of the current review. Studies were also excluded if they focused only on food advertising more generally, and not advertising for foods HFSS.

SC and SM independently screened the titles and abstracts of all studies for relevance.

Disagreements were resolved through regular meetings until consensus was achieved. Full text was obtained for all identified studies and screened.

3.3 Data extraction

Data extraction included information on the study country, study design, sample, action or educational measure employed to reduce the volume, exposure or impact of advertising for foods HFSS to children, study quality, nutritional criteria used, outcome measures and whether

appropriate statistical tests had been carried out. Extracted information and overall findings are presented in tables 2-4.

3.4 Data synthesis

Due to the diversity of evidence it was not possible to synthesise results quantitatively through a meta-analysis. Instead a vote counting method was employed (Lewis and Pattanayak, 2012). For each outcome measure within each study, we recorded whether the action or educational measure had the desired impact for that outcome. If so, a positive result was recorded. For each study, we created a ratio of outcomes resulting in the desired impact against the total number of study outcomes. Where at least 50% of outcomes demonstrated the desired impact of an action or measure, studies were recorded as providing evidence for its success. Outcomes that focused only on food as a single category (and not foods HFSS) were excluded from the outcome list, as were outcomes that did not directly relate to children <18 years. A narrative review accompanies the synthesis to expand further on the extracted information.

4. Results

PRISMA guidelines were followed in reporting the results of the review (Moher et al., 2009).

4.1 Search results

From the initial search, 2351 non-duplicated titles and abstracts were identified (figure 1). From the grey literature 23 publications, and from reference list searches 13 publications, were identified. SC and SM independently examined titles and abstracts. Full text was obtained for 134 publications, and 47 studies were identified for inclusion in the analysis. Main reasons for excluding full text publications were that they did not report results from primary data, they lacked a comparator, they did not focus on mass advertising, and that they focused only on compliance or advertising techniques aimed at children.

[Figure 1 about here]

4.2 Overview of included studies

Range of actions to reduce the impact of children's exposure to advertising for foods HFSS

Nineteen studies provided evidence for statutory actions to reduce the volume, exposure or other negative impacts of advertising for foods HFSS to children (Adams et al., 2012; Cecchini et al., 2010; Chou et al., 2008; Dhar and Baylis, 2011; Dixon et al., 2007; Ferguson et al., 2012; Goldberg, 1990; Gorn and Goldberg, 1982; Haby et al., 2006; Kelly et al., 2007; Kim et al., 2012; Magnus et al., 2009; Ofcom 2006, 2008, 2010; Potvin Kent et al., 2011a, 2012; Taras and Gage, 1995; Veerman et al., 2009). Actions included total bans on all advertising, bans on advertising of foods HFSS during specific hours, length of advertisements, and advertising of healthy food products, with the aim of reducing the volume of, and children's exposure to, advertising of foods HFSS, Body Mass Index, health costs, and improving diet. Twenty-five studies reported on the impact of self-regulation by industry (AFGC, 2012; ASC, 2010; Batada and Wootan, 2009; Brindal et al., 2011; Effertz and Wilcke, 2012; EU Pledge, 2010, 2011, 2012; FTC, 2012; Hebden et al., 2011, King et al., 2011; Kolish et al., 2011; Kolish and Hernandez, 2012; Kunkel et al., 2009; Potvin Kent et al. 2011a, 2011b, 2012; Powell et al., 2010; Quilliam et al., 2011; Rudd Center, 2010a, 2010b, 2011, 2012a, 2012b; Speers et al., 2011). Actions included voluntary codes not to advertise foods HFSS during children's programming or directly to children under 12 years. These actions were aimed at reducing the volume of and children's exposure to advertising of foods HFSS, but did not explicitly focus on wider impacts. Six studies reported on educational measures to curb the influence of advertising for foods HFSS (Bickham and Slaby, 2012; Buijzen, 2009; Ferguson et al., 2012; Harris and Bargh, 2009; Hindin et al., 2004; Yu, 2011). These included media literacy interventions with parents or children, and parental communication with children relating to food advertising, and were aimed at improving diet quality, attitudes and beliefs towards food advertising. Three studies provided evidence for more than one approach (Potvin Kent et al., 2011a, 2012; Ferguson et al., 2012).

Study design

Twenty-eight studies collected data or obtained commercial monitoring data on food advertising, and used this information to assess advertising content, usually over time, to determine the success of actions (Adams et al., 2012; AFGC, 2012; ASC, 2010; Batada and Wootan, 2009; Brindal et al., 2011; Effertz and Wilcke, 2012; EU Pledge, 2010, 2011, 2012; FTC, 2012; Hebden et al., 2011; Kim et al., 2012; King et al., 2011; Kolish et al., 2011; Kolish and Hernandez, 2012; Kunkel et al., 2009; Ofcom, 2008, 2010; Potvin Kent et al., 2011b; Powell et al., 2010; Quilliam et al., 2011; Rudd Center, 2010a, 2010b, 2011, 2012a, 2012b; Speers et al., 2011; Taras and Gage, 1995). The aim of these studies was to determine whether advertising content had changed as new actions were implemented. Television advertising was the main focus of studies, often due to data constraints.

Seven modelling studies extrapolated existing data to assess whether regulatory actions would be effective in reducing the volume and wider impacts of advertising for foods HFSS to children (Cecchini et al., 2010; Chou et al., 2008; Haby et al., 2006; Kelly et al., 2007; Magnus et al., 2009; Ofcom, 2006; Veerman et al., 2009). Three studies used cross-sectional survey designs (Buijzen, 2009; Harris and Bargh, 2009; Yu, 2011), and nine studies used experimental or quasi-experimental designs (Bickham and Slaby, 2012; Dhar and Baylis, 2011; Dixon et al., 2007; Ferguson et al., 2012; Goldberg, 1990; Gorn and Goldberg, 1982; Hindin et al., 2004; Potvin Kent et al., 2011a, 2012).

4.3 Strengths and weaknesses of studies

No suitable quality assessment tool was available due to the varied study designs included in the review. Instead, key areas important in quality assessment across study designs were identified, with assessment particularly focused on how data had been sampled and collected, nutrient criteria used, sampling of study participants, reporting of statistical analyses and study funding. Quality assessment results are reported by study design.

Advertising content

The main strength of many studies investigating advertising content was in the way they collected and sampled data. Studies by the Rudd Center (2010a, 2010b, 2011, 2012a, 2012b) and Powell et al. (2010) examined data covering a full year. This was also true of both Ofcom studies (2008; 2010), and the FTC's (2012) study. EU Pledge (2010, 2011, 2012) studies also used data from a full year, however, they compared data from different EU countries over the three years, limiting the ability to monitor change over time. The remaining studies investigated more specific time points. Some studies provided detail on why they had sampled data in this way, for example, including a mix of weekdays and weekends and avoiding holiday periods (Effertz and Wilcke, 2012; Hebden et al., 2011; Kim et al., 2012; Potvin Kent et al., 2011b; Taras and Gage, 1995). The nutrient criteria used to analyse advertising content was considered especially important in relation to assessing the strength of a study's findings. The majority of studies used a validated tool, or one used in previous studies. Five studies were limited to broad product categories such as 'candy' or 'cereal' (FTC, 2012; Rudd Center, 2010, 2010b, 2011, 2012a). Six studies used food companies' own nutrient criteria to assess advertising content (ASC, 2010; EU Pledge, 2010, 2011, 2012; Kolish et al., 2011; Kolish and Hernandez, 2012). A weakness of some studies was that they failed to provide enough information about the statistical techniques used, or they reported only descriptive statistics (ASC, 2010; Batada and Wootan, 2009; Brindal et al., 2011; EU Pledge, 2010,

2011, 2012; FTC, 2012; Kolish et al., 2011; Kolish and Hernandez, 2012; Rudd Center, 2010a, 2010b, 2011, 2012a, 2012b; Taras and Gage, 1995). It was therefore difficult to assess whether results reflected statistically significant changes in outcomes, or were the result of chance. Studies were funded by a range of organisations including national research funders (Adams et al., 2012; Potvin Kent et al., 2011b), health advocacy groups (Batada and Wootan, 2009; Kunkel et al., 2009), charities (Powell et al., 2010; Rudd Center, 2010a, 2010b, 2011, 2012a, 2012b; Speers et al., 2011), government departments and organisations (Brindal et al., 2011; FTC, 2012; King et al., 2011; Kim et al., 2012; Ofcom 2008, 2010) and industry (AFGC, 2012; ASC, 2010; Kolish et al., 2011; Kolish and Hernandez, 2012). A small number of studies did not declare funding (Effertz and Wilcke, 2012; Hebden et al., 2011; Quilliam et al., 2011; Taras and Gage, 1995).

Modelling

Modelling studies were assessed by the data sources used, whether cost-effectiveness was examined, the time period modelled, statistical analysis and funding. All but one study drew from national and international surveys to model regulatory outcomes. Kelly et al. (2007) instead extrapolated data from a single week to model four regulatory outcomes. The study looked at the volume and pattern of advertising rather than cost effectiveness. Veerman et al. (2009) did not examine cost-effectiveness also. Three studies modelled long-term outcomes with Cecchini et al. (2010) examining a period of 100 years, whilst Haby et al. (2006) and Magnus et al. (2009) investigated Disability Adjusted Life Years (DALYs) over a child's lifetime. Kelly et al.'s (2007) study only provided descriptive results rather than comprehensive models (Cecchini et al., 2010; Chou et al., 2008; Haby et al., 2006; Magnus et al., 2009; Ofcom, 2006; Veerman et al., 2009). Studies were funded by national research funders (Chou et al., 2008; Veerman et al., 2009), government departments and agencies (Haby et al., 2006, Kelly et al., 2007; Magnus et al., 2009; Ofcom, 2009), and supranational organisations (Cecchini et al., 2010).

Cross-sectional

Cross-sectional studies were assessed based on the study samples used, measures, statistical analysis and funding. Samples were small and non-random, however, Buijzen (2009) tried to ensure that a mix of social groups was represented. Survey measures were partially rather than fully validated (Buijzen 2009; Harris and Bargh, 2009; Yu, 2011). Statistical analyses were described in detail, however, it was unclear whether demographic variables had been controlled for (Buijzen, 2009; Harris and Bargh, 2009; Yu, 2011). No funding was declared for two studies

(Buijzen, 2009; Yu, 2011), whilst the third was funded by a government department (Harris and Bargh, 2009).

Experimental and quasi-experimental

Studies using an experimental design were assessed according to sampling, follow-up period, validity of measures, statistical analyses and study funding. Sample sizes ranged from n=35 (Hindin et al., 2004) to n=9177 (Dhar and Baylis, 2011). Dhar and Baylis's (2011) study had a large number of participants, nevertheless, up-to-date data was unavailable, which may limit the applicability of the findings. It was in this study only, however, that we were able to determine whether measures were validated in the form they were operationalized. In Potvin Kent's (2011a, 2012) studies, validated nutrient criteria were used to assess advertising. In the three controlled experimental studies, follow-up periods were short, with post intervention measures collected only (Dixon et al., 2007; Ferguson et al., 2012; Gorn and Goldberg, 1982). Statistical analyses were described in detail and carried out appropriately in all studies, but there were no tests to assess whether randomisation had been successful (Dixon et al., 2007; Ferguson et al., 2012; Gorn and Goldberg, 1982). In Hindin et al.'s (2004) study, participants acted as their own controls, and in Bickham and Slaby's (2012) study, schools were assigned to intervention and control based on when they were introducing a media literacy program. Studies were funded by industry (Dixon et al., 2007), national research funders (Gorn and Goldberg, 1982; Potvin Kent et al., 2011a, 2012), charity and government funding (Bickham and Slaby, 2012; Goldberg, 1990), or did not declare any funding source (Ferguson et al., 2012; Hindin et al., 2004).

4.4 Study findings

Actions and educational measures to reduce the volume, exposure and impact of advertising for foods HFSS to children were split into three main types: statutory, self-regulatory and educational. Findings are discussed for each type.

Statutory actions

Three study types were identified that evaluated statutory actions: real world studies, modelling studies, and controlled experiments (Table 2).

[Table 2 about here]

Real world studies - Nine studies reported results relating to real world examples of statutory regulation (Adams et al., 2012; Dhar and Baylis, 2011; Goldberg, 1990; Kim et al., 2012; Ofcom, 2008, 2010; Potvin Kent et al., 2011a, 2012; Taras and Gage, 1995). Three studies reported on UK regulations (Adams et al., 2012; Ofcom, 2008, 2010), four from Quebec/Canada (Dhar and Baylis, 2011; Goldberg, 1990; Potvin Kent et al., 2011a, 2012), one from the US (Taras and Gage, 1995) and one from South Korea (Kim et al., 2012). The results from seven out of nine studies indicated that statutory regulation had produced successful outcomes in relation to volume of, or exposure to, advertising for foods HFSS and purchasing of these foods. However, four studies reported only descriptive statistics, rather than testing whether there had been statistically significant changes (Ofcom 2008, 2010; Potvin Kent et al. 2011a; Taras and Gage 1995). Adams et al. (2012) reported that Ofcom regulations had not had the desired impact of reducing children's advertising exposure. Regulations were rarely breached during children's television programming, however, a greater percentage of advertisements were for foods HFSS, and the odds of children viewing them were not reduced. Table 2 highlights that in some studies there was variation in findings for whether outcomes reflected the desired impact of regulations. Taras and Gage (1995) found that after the Children's Television Act limited the advertisement length during children's programming, US children saw more but shorter advertisements, and less for some foods HFSS but more for others. Potvin Kent et al. (2011a, 2012) found that Quebec French-speaking children were exposed to a less negative food advertising environment than English-speaking children; however, Quebec French-speaking children were still exposed to high levels of advertising for foods HFSS despite a ban on advertising to children under 13 years.

Modelling studies – Seven studies modelled the effect of various regulatory scenarios (Cecchini et al., 2010; Chou et al., 2008; Haby et al., 2006; Kelly et al., 2007; Magnus et al., 2009; Ofcom, 2006; Veerman et al., 2009). Three studies used data from Australia (Haby et al., 2006; Kelly et al., 2007; Magnus et al., 2009), two from the US (Chou et al., 2008; Veerman et al., 2009), one from the UK (Ofcom, 2006), and one examined data from a range of countries (Cecchini et al., 2010). The results all predicted that regulation would reduce the negative impacts of advertising for foods HFSS to children, including reducing BMI, overweight and consumption of these foods. Kelly et al.'s (2007) study was the only one to report descriptive statistics, rather than statistically significant results.

Experiments – Three studies used a controlled experimental design (Dixon et al., 2007; Ferguson et al., 2012; Gorn and Goldberg, 1982). Studies were carried out in Australia (Dixon et al., 2007), the

US (Ferguson et al., 2012) and Quebec (Gorn and Goldberg, 1982). Results from two studies indicated that changing the advertising environment encouraged healthier food choices (Ferguson et al., 2012; Gorn and Goldberg, 1982). For the majority of outcomes measured, Dixon et al. (2007) found that regulation of advertising for foods HFSS did not have the desired impact on liking of and attitudes towards healthy and unhealthy food. All studies reported statistically significant results.

Self-regulatory actions

Studies evaluating the results of self-regulatory actions were split into two categories: those carried out by food industry representatives, and those by academics, government or advocacy organisations. The majority of studies investigated advertising content to evaluate the impact of regulations, and all were based on real world examples (Table 3).

[Table 3 about here]

Studies by academics/governments/advocacy groups representatives - Eighteen studies were carried out by these groups (Batada and Wootan, 2009; Brindal et al., 2011; Effertz and Wilcke, 2012; FTC, 2012; Hebden et al., 2011; King et al., 2011; Kunkel et al., 2009; Potvin Kent et al., 2011a, 2011b, 2012; Powell et al., 2010; Quilliam et al., 2011; Rudd Center 2010a, 2010b, 2011, 2012a, 2012b; Speers et al., 2011). Eleven studies were from the US (Batada and Wootan, 2009; Kunkel et al., 2009; Powell et al., 2010; Quilliam et al., 2011; Rudd Center, 2010a, 2010b, 2011, 2012a, 2012b; Speers et al., 2011), three from Australia (Brindal et al. 2011; Hebden et al., 2011; King et al., 2011), three from Canada (Potvin Kent et al., 2011a, 2011b, 2012), and one from Germany. Seven out of the 18 studies indicated that self-regulation had reduced the volume of, exposure to and expenditure on advertising for foods HFSS for the majority of outcome measures (Batada and Wootan, 2009; FTC, 2012; Hebden et al., 2011; King et al., 2011; Powell et al., 2010; Rudd Center 2010b, Speers et al., 2011). The remaining studies reported that self-regulation did not have the desired impact on the majority of outcome measures (Brindal et al., 2011; Effertz and Wilcke, 2012; Kunkel et al., 2009; Potvin Kent et al., 2011a, 2011b, 2012; Quilliam et al., 2011; Rudd Center 2010a, 2011, 2012a, 2012b). Twelve studies reported descriptive statistics only (Brindal et al., 2011; Batada and Wootan, 2009; FTC, 2012; Kunkel et al., 2009; Potvin Kent et al., 2011a, 2011b; Powell et al., 2010; Rudd Center 2010a,b; 2011; 2012a,b).

Studies by food industry representatives - Seven studies were carried out by food industry representatives, and each found that self-regulation had the desired impact for all of the outcomes

reported (ASC, 2010; AFGC, 2012; EU Pledge, 2010, 2011, 2012; Kolish et al., 2011, Kolish and Hernandez, 2012). All but one study reported descriptive statistics only (AFGC, 2012): this study was also the only one to use objective criteria to define nutritional values. Studies included data from Canada (ASC, 2010), Australia (AFGC, 2012), the US (Kolish et al. 2011; Kolish and Hernandez, 2012), and three studies examined advertising in a number of EU countries (EU Pledge, 2010, 2011, 2012).

Educational actions

Six studies looked at the impact of educational measures with parents or children with the aim of reducing exposure or other negative impacts of advertising for foods HFSS to children (Bickham and Slaby, 2012; Buijzen, 2009; Ferguson et al., 2012; Harris and Bargh, 2009; Hindin et al., 2004; Yu, 2011) (Table 4). Studies reported that these measures had the desired impact for all but one outcome, and all studies reported statistically significant outcomes. One study focused on educating children about advertising directly (Bickham and Slaby, 2012), and found that a media literacy program improved children's beliefs regarding food advertising and had a small influence on their desires. Three studies were cross-sectional (Buijzen, 2009; Harris and Bargh, 2009; Yu, 2011), with one investigating the association between parental communication styles and their regulation of advertising (Buijzen, 2009). Harris and Bargh (2009) asked college students to describe retrospectively their parents' regulatory styles and their current enjoyment of different foods. Yu (2011) asked parents and children to report on interactions when watching television together to assess the relationship between this and children's attitudes towards food advertising and obesity levels. All three studies found that parental communication styles were associated with child-related advertising variables. In a controlled experiment, Ferguson et al. (2012) found that parental encouragement slightly reduced the negative influence of advertising for food HFSS. The final study focused on a media literacy intervention for Head Start parents (Hindin et al., 2004). It found that parents were more likely to use techniques to reduce the negative influence of unhealthy food advertising after participating in the program. There was little evidence to support that this improved children's diets or other health outcomes.

[Table 4 about here]

5. Discussion

5.1 Summary of main findings

We reviewed the available evidence on the results of actions and measures to reduce the volume, exposure and other negative impacts of advertising for foods HFSS to children. Evidence was not definitive, however, seven out of nine studies supported the use of statutory actions. Dhar and Baylis (2011) and Goldberg's (1990) studies are important as they provide evidence of success in Quebec after the banning of all advertising to children under 13. Both studies by Potvin Kent et al. (2011a, 2012) also supported this as French-speaking children in Quebec experienced a less harmful advertising environment than English-speaking children. Nevertheless, the studies also highlighted that children in Quebec are still exposed to advertisements for foods HFSS. Each modelling study reported regulation as having the desired impact on outcomes, however impacts were predicted to take some time to be realised. Cecchini et al. (2010) found that although advertising regulations had the most positive impact on health compared with a number of initiatives, these results were only seen after 40 or 50 years. Two controlled experiments (Ferguson et al., 2012; Gorn and Goldberg, 1982) showed the potential of improving healthy choices when healthy foods are advertised in the same way as foods HFSS.

Adams et al.'s (2012) study contradicted the results from the Ofcom reports (2008; 2010) on the impact of UK regulations. They argue that their results are more robust due to their use of product specific data to assess nutritional quality. They found that after the introduction of actions limiting advertising for foods HFSS during children's programming that the proportion of these advertisements had increased. The study authors' concluded, however, that this indicated that greater regulation was necessary outside of traditional children's programming, a view supported by leading public health bodies (Academy of Medical Royal Colleges, 2013; National Institute for Health and Clinical Excellence, 2010).

There was some evidence to support greater parental education. Five studies (Buijzen, 2009; Ferguson et al., 2012; Harris and Bargh, 2009; Hindin et al., 2004; Yu, 2011) indicated parental style could have a positive impact on changing behaviour or attitudes. The studies were small in scale, however, ranging from 35 to 234 participants. The cross-sectional studies (Buijzen, 2009; Harris and Bargh, 2009; Yu, 2011) only measured associations between variables and we cannot be sure that they reflect direct causation. Outcomes from these studies varied widely from attitudes to food choices, therefore, their ability to provide robust evidence for the success of educational measures is limited. A single study assessed the effectiveness of advertising literacy programs aimed at children (Bickham and Slaby, 2012). It showed some evidence of desired impact with regard to food advertising beliefs and desire to eat cereal, but little information on actual behaviour.

Rozendaal et al. (2012) have argued that advertising literacy is unlikely to reduce harm from advertising as conceptual understanding of persuasive intent does not necessarily reduce its influence. The results from the review highlight that there is still very little evidence that advertising literacy can be used as a successful measure against advertising for foods HFSS.

The results from the studies examining self-regulation were varied, and it is difficult to draw firm conclusions regarding the impact of these actions. There were clear differences in the results from studies funded by industry and those funded from national research funders, government and advocacy groups. Studies funded by industry were positive about the success of the initiatives. Nevertheless, six out of seven studies did not use an independently defined measure of nutritional quality (ASC, 2010; EU Pledge, 2010, 2011, 2012; Kolish et al., 2011; Kolish and Hernandez, 2012). Batada and Wootan (2009) found that measures of nutritional quality used by industry are often inadequate, with 59% of industry-approved products HFSS when independent criteria are used. In the US, the CFBAI attempted to counter this critique by introducing standard nutrient criteria in December 2013. Seven studies from academics/government/advocacy organizations reported the successful implementation of self-regulatory actions, however, 11 studies contradicted these findings. Frequently, the successful impact was reported for one group of outcomes, for example a particular age group of children, however, not for other outcomes.

5.2 Strengths and Limitations

The main strength of the review is that it brings together the disparate literature on actions to reduce the impact of children's exposure to advertising for foods HFSS, providing an overview for a range of outcomes. It complements Galbraith-Emami and Lobstein's (2013) review on the impact of statutory and self-regulatory initiatives on reducing children's exposure to advertising for foods HFSS. This review supports their findings of divergence in the results from peer-reviewed papers and industry-funded reports. However, it expands on this work by also including educational measures, and includes a wider range of outcome measures, which serve to highlight the complexity and the gaps in the research evidence in this area of regulatory policy.

Additional strengths were that no date or language restrictions were put on searches, increasing the possibility of including a wider range of findings. Nevertheless, although the review did not exclude studies based on language, the search was conducted in English only, limiting the returned results.

The main limitation of the review was the complexity of drawing together the findings from a large volume of reports of varying quality. In addition, the extensive range of outcome measures did not lend itself to a meta-analysis, and a vote counting method was used. This provided a limited overview of reported findings, and at times obscured the mixed impact of actions. It also provided little information on the magnitude of effects. Synthesising findings was also complicated by the many different nutrient criteria used to determine the healthfulness of foods, and lack of analysis within the studies beyond reporting descriptive statistics.

The studies focused on television advertising and provided little evidence for the results of actions applying to non-broadcast advertising. This perhaps reflects the lack of actions addressing other media more generally (Hawkes, 2007). Modelling studies focused on banning television advertising, but they did not take into account the likelihood that advertising would switch to different media if regulations were in effect. They also assumed full compliance with regulations. Lewin et al. (2006) have highlighted the methods used by major food companies online to attract children to their brands, and the FTC (2012) report found that advertising to youth through new media had increased by 50% from 2006 to 2009.

Studies were drawn mainly from industrialised nations which may limit the applicability of the findings. There is concern about the rise of advertising to children in newly industrialised nations (Hawkes, 2007). Pérez-Salgado et al. (2010) found that food advertisements in Mexico City were most prominent during children's programming, that advertised foods tended to be for sugary foods and drinks, and that the nutritional quality of food advertising was poorer during this programming than others.

5.3 Conclusion

This review collated evidence to aid decision-making on actions and measures to reduce the volume, exposure and negative impact of advertising for foods HFSS to children. The findings indicate the potential for statutory regulation. There is limited support for educational measures with parents and children. Overall, the review highlights the lack of consistency of outcome measures, nutrient criteria and time-scales within the evidence. Further evaluation is required where statutory legislation is in place, and independent assessment of industry self-regulation is also necessary. In addition, educational studies could be more robust in their design. Leadership from government and other actors could provide an opportunity for robust standards to be set in terms of monitoring and compliance. Useful standardised outcomes could include consumption behaviour,

health outcomes, advertising exposure, advertising expenditure and valid nutrient criteria. Particularly important is the recognition that change may be long-term and cumulative. While no single intervention can be expected to have a large impact on a child's risk of overweight, at least in the short term, reducing the volume of, and children's exposure to, advertising of foods HFSS is a policy that can be justified as a precautionary measure, and one which serves to help change the social norms around dietary behaviour and appropriate nutrition for children. In the future, researchers should aim to generate evidence on the longer term impacts of interventions and their wider potential to change health behaviour in order to ensure that policymakers can be more confident in the decisions that they take.

6. Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

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Table 1 – Medline Search Strategy

1	media literacy.mp. or marketing/ or advertising as topic/ or advert\$.ab,ti. or
2	marketing.ab,ti. or commercials.ab,ti.
3	exp Child/ or Child, Preschool/ or Adolescent/ or child\$.mp. or adolescent\$.mp. or exp
4	Parents/ or exp Parenting/ or exp Parent-Child Relations/ or young people.mp. or exp Young Adult/ or teenage\$.mp. or pupil\$.ti,ab. or teacher\$.ti,ab. exp Food/ or food\$.ab,ti. or Diet/ or diet\$.ab,ti. or snack\$.ab,ti. or nutrition\$.ab,ti. or beverage\$.ab,ti. or beverages/ or carbonated beverages/ or eating.ab,ti. or Food Industry/ or exp Food Habits/ 1 and 2 and 3

Table 2 – Statutory regulation

Study	Study type	Method	Example outcome measures	Nutrient criteria	Desired impact: outcomes ratio
Real world					
Adams et al. 2012 UK	Analysis of advertising content	Secondary data from one week before Ofcom regulations to reduce ad exposure of children <16 years and from one week after restrictions.	Exposure: proportion of viewed food ads for foods HFSS	UK Nutrient Profiling Model	0/2* (x)
Dhar and Baylis 2011 Quebec	Quasi-experiment	Estimated fast food expenditure & consumption in Quebec where advertising is banned to children <13 yrs. Compared French- and English-speaking areas using national survey data.	Fast food purchasing propensity, expenditure & calories consumed	'Meals at fast food restaurants'	2/2* (✓)
Goldberg 1990 Quebec	Quasi-experiment	Investigated difference between French-speaking (n=331) and English-speaking homes (n=144) in children's cereals purchasing after ban on advertising to children <13 yrs implemented. English-speaking children exposed to US TV.	Children's cereals purchased	High sugar cereals	1/1* (✓)
Kim et al. 2013 South Korea	Analysis of advertising content	Assessed companies' TV food advertising practices on 5 channels over 4 months before (2009) and after scheduled restrictions (2010) (no ads for food HFSS during children's programming or between 5-7pm).	Exposure: gross ratings points Ad budgets Number of ads	Korean Food & Drug Administration (KFDA)	10/11* (✓)
Ofcom 2008 UK	Analysis of advertising content	Used primary & commercial monitoring data to track changes in children's exposure to advertising for foods HFSS after Ofcom regulations introduced.	Exposure: impacts Ad spots by airtime category and channel groups.	UK Nutrient Profiling Model	54/86 (✓)
Ofcom 2010 UK	Analysis of advertising content	Used primary & commercial monitoring data to track changes in children's exposure to advertising for foods HFSS after Ofcom regulations introduced.	Exposure: impacts	UK Nutrient Profiling Model	60/107 (✓)

Potvin Kent et al. 2011a Canada	Quasi-experiment	TV viewing of 428 10-12 year olds living in Ontario (voluntary regulation) and Quebec (ban on advertising to children <13 yrs) assessed using 7 day diaries. Content analysis of ad categories & techniques during programming.	Number of ads per product category	Food categories (Gantz et al. 2007)	31/39 (✓)
Potvin Kent et al. 2012 Canada	Quasi-experiment	TV viewing of 428 10-12 year olds living in Ontario (voluntary regulation) and Quebec (ban on advertising to children <13 yrs) assessed using 7 day diaries. Content analysis of healthfulness of ads during programming.	Number of ads per product category	Food categories (Powell et al. 2007) & UK Nutrient Profiling Model	14/24* (✓)
Taras and Gage 1995 US	Analysis of advertising content	Compared ad data from earlier studies to 1 week of TV advertising during children's programming on 7 channels after Children's Television Act limited commercial ads.	Number and types of ads	Nutrient classification system by Taras et al. (1989)	4/9 (x)
Modelling Cecchini et al. 2010 Brazil, China, England, India, Mexico, Russia, South Africa	Modelling of regulatory scenarios	Long term (100 year) microsimulation model examining impact of various interventions, including regulation of food advertising to children, on disease. Country specific risk factors included eg children's television viewing levels. Used data from Chou et al. 2008, Ofcom 2008 and national & international surveys.	BMI DALYs	Used data from Chou et al. (2008) & Ofcom (2008).	32/33* (✓)
Chou et al. 2008 US	Modelling of regulatory scenarios	Data from national population surveys and fast food advertising data to model ban on fast food restaurant advertising or eliminating tax deductibility for companies on this advertising.	Reduction in overweight	Fast food advertising defined by commercial monitoring data	8/8* (✓)
Haby et al. 2006 Australia	Modelling regulatory scenarios	Data from Gorn and Golberg (1982) and national cohort data used to model cost savings and BMI reduction from reduced advertising of food HFSS.	BMI DALYs	Australian Guide to Healthy Eating: core vs. non-core	4/4* (✓)

Kelly et al. 2007 Australia	Modelling regulatory scenarios	Extrapolating data from ads on 3 TV channels over 1 week. 4 regulatory models applied: 1) Prohibit during children's peak viewing. 2) Limit during children's peak viewing. 3) Prohibit non-core ads during 7.00-20.30. 4) Prohibit non-core ads during children's peak viewing.	Number and % reduction of core and non-core food ads.	Australian Guide to Healthy Eating: core vs. non-core	8/16 (✓)
Magnus et al. 2009 Australia	Modelling of regulatory scenarios	Used data from Gorn and Golberg (1982) and national cohort data to model cost savings and associated health benefit of removing ads for foods HFSS during peak viewing time for 5-14 year olds.	Consumption of Energy Dense Nutrient Poor foods Sugar sweetened beverage consumption BMI DALYs	Australian Guide to Healthy Eating: core vs. non-core	24/24* (✓)
Ofcom 2006 UK	Modelling regulatory scenarios	Used commercial monitoring data to model the effect of 5 regulatory packages on impacts (1 viewer watching 1 ad) of TV ads for foods HFSS. P1 Timing restrictions on specific food and drink products P2 Timing restrictions on all food and drink products P3 Volume based restrictions P4 Industry proposed hybrid of packages 2 & 3, allowing brand advertising. P5 Pre-9pm ban	Exposure: Impacts QALYs VOLs	UK Nutrient Profiling Model	76/80* (✓)
Veerman et al. 2009 US	Modelling of regulatory scenarios	Simulation model – input based on NHANES 2003-4 data, CD-2000 BMI cut offs, literature, Delphi study estimates. Reducing TV food ad exposure to zero.	Daily energy consumption BMI Overweight/obesity	Data from Bolton (1983) & Delphi estimates	14/14* (✓)
Experiments					
Dixon et al. 2007 Australia	Controlled experiment	919 10-11 year old primary school children assigned to four models for TV food ads: 1) Junk food only 2) Junk and healthy foods	Liking, attitudes and perceived healthfulness Perceptions of overall diet beliefs for healthy and junk foods	Australian Guide to Healthy Eating: core vs. non-core	4/13* (x)

		3) Healthy food only 4) No food ads			
Ferguson et al. 2012 US	Controlled experiment	75 3-8 year old children randomised to a McDonald's ad for either a healthy or non healthy product, and either parental encouragement or a neutral response.	Children's food choice	Apple vs. French fries	1/1* (✓)
Gorn and Goldberg 1982 Quebec	Controlled experiment	288 Canadian children at summer camp. 14 days of ads. Four conditions for TV ads: 1) Candy ads 2) No ads 3) Fruit ads 4) Public Service Announcements	Children's snack & beverage choices Attitudes towards snack & beverages provided in the following year.	Candy ads	2/4* (✓)

* - statistical results reported beyond descriptives. (✓) - majority of outcomes had desired impact. (x) - minority of outcomes had desired impact. BMI – Body Mass Index. DALYs – Disability Adjusted Life Years. Pa – Per annum. QALYs – Quality Adjusted Life Years. VOL – Value of Life.

Table 3 – Self-regulation

Study	Study type	Method	Example outcome measures	Nutrient criteria	Desired impact: outcomes ratio
Non-industry					
Brindal et al. 2011 Australia (Adelaide)	Analysis of advertising content	Evaluates success of AFGC and QSRI initiatives not to advertise during children/family TV programming. Commercial monitoring data for South Australia collected from different time points.	Exposure: Impacts Number, frequency, % core & non-core food ads.	AGHE: core vs. non-core	334/748 (x)
Batada and Wootan 2009 US	Analysis of advertising content	Evaluated CFBAI initiative by examining products approved by companies, and 28 hours of ads from the Nickelodeon TV channel in 2005 and 2009.	Number of fast food ads % company ads for foods HFSS	Adapted from NANA Model School Wellness Policies	17/24 (✓)
Effertz and Wilcke 2012 Germany	Analysis of advertising content	Recorded ads for 2 weekend and 2 weekdays from Oct 2007– Mar 2008, and 1 weekday and 1 weekend day in 2010 – before/after EU Pledge. Examined children’s peak viewing times on 3 channels.	Proportion ads for core & non-core foods	AGHE: core vs. non-core	0/3* (x)
Federal Trade Commission 2012 US	Advertising expenditure & analysis of advertising content	Data from 48 companies on youth marketing expenditure from 2006 (before CFBAI initiative) and 2009. Data obtained through compulsory process orders. Also used national surveys to examine consumption.	Marketing expenditure Nutrients in foods marketed Nutrient consumption	Dietary Guidelines for Americans	471/928 (✓)
Hebden et al. 2011a Australia	Analysis of advertising content	Evaluated impact of QSRI on fast food advertising. Evaluated ads on 3 TV channels over 4 days in May 2009 and April 2010.	Frequency & proportion of core and non-core food ads	AGHE: core vs. non-core	4/7* (✓)
King et al. 2011 Australia (Sydney)	Analysis of advertising content	Analysis of samples of TV advertising on Free-to-air channels by signatories and non-signatories to AFGC initiative in 2006, 2007, 2009.	Proportion of core and non-core food ads	AGHE: core vs. non-core	4/6* (✓)
Kunkel et al. 2009	Analysis of advertising	Evaluated TV advertising to children after companies signed up to CFBAI. 2009 sample – 70.5 hours of	Number of Go-Slow-Whoa food ads	US Dept. of Health & Human Services,	5/15 (x)

US	content	children's programming across 7 networks.		Go-Slow-Whoa food rating system	
Potvin Kent et al. 2011a Canada	Quasi-experiment	TV viewing of 428 10-12 year olds living in Ontario (voluntary regulation) and Quebec (ban on advertising to children <13) assessed using 7 day diaries. Content analysis of ad categories & techniques during programming.	Number & % of ads, & seconds per product category	Food categories (Gantz et al. 2007)	8/39 (x)
Potvin Kent et al. 2011b Canada	Analysis of advertising content	Compared TV advertising during children's preferred viewing of 17 corporations participating in CAI and 35 not.	Number of ads per product category	UK Nutrient Profiling Model	0/11 (x)
Potvin Kent et al. 2012 Canada	Quasi-experiment	Programming of 10-12 year olds living in Ontario (voluntary regulation) and Quebec (ban on advertising to children <13) assessed using 7 day diaries. Content analysis undertaken for ads during this programming.	Number of ads per product category	Food categories (Powell et al. 2007) & UK Nutrient Profiling Model	9/23* (x)
Powell et al. 2010 US	Analysis of advertising content	Used commercial data from 2003, 2005 and 2007 to determine whether children's exposure to TV food advertising had changed after introduction of CFBAI.	Exposure by product category, brand, age & ethnicity	Product categories	73/135 (x)
Quilliam et al. 2011 US	Analysis of advertising content	Analysis of food company websites with games based on CFBAI signatory status. 166 games analysed.	Types of games and nutritional value of food advertised through games	IOM school food guidelines	2/5* (x)
Rudd Center 2010a United States	Analysis of advertising content and sales data	Overview of children and adolescents' exposure to fast food TV advertising in line with CFBAI pledges. Compared data from 2003 to 2009. Commercial monitoring data.	Advertising expenditure Exposure: GPRs by product category & age	Commercial data product categories UK Nutrient Profiling Model	16/73 (x)
Rudd Center 2010b US	Analysis of advertising content	Overview of children and adolescents' exposure to food and beverage TV advertising by category of food in line with CFBAI pledges from 2002 to 2008. Commercial monitoring data.	Exposure: GPRs by product category, age & ethnicity	Commercial data product categories	58/65 (✓)

Rudd Center 2011 US	Analysis of advertising content	Overview of children and adolescents' exposure to food and beverage TV advertising by category of food in line with CFBAI pledges since 2008. Commercial monitoring data.	Exposure: GPRs by product category & age	Commercial data categories	17/66 (x)
Rudd Center 2012a US	Analysis of advertising content	Overview of children and adolescents' exposure to food and beverage TV advertising by category of food in line with CFBAI pledges. Commercial monitoring data.	Exposure: GPRs by product category & age	Commercial data categories	37/84 (x)
Rudd Center 2012b US	Analysis of advertising content	Overview of cereal advertising in line with CFBAI pledges (TV and online). Compared results from 2009 with 2012. Evaluated nutrient profile of 261 cereals. Commercial monitoring data.	Advertising expenditure Exposure: GPRs by product category & age	Commercial data categories	75/239 (x)
Speers et al. 2011 US	Analysis of advertising content	Children & adolescents exposure to brand appearances during prime-time programming by CFBAI signatory and non-signatory companies. Commercial monitoring data.	Exposure: number of ads viewed by audiences	Categories used by Powell et al. 2007	20/28* (✓)
Industry					
Advertising Standards Canada 2010 Canada	Analysis of advertising content	Comparison of 2 months of TV advertising to children < 12 from 2004 and 2 months from 2009. Before and after CAI which restricts advertising to children <12 years.	Percentage 'better-for-you' products	Canadian Children's Food & Beverage Advertising Initiative analysis	4/4 (✓)
Australian Food & Grocery Council 2012 Australia	Analysis of advertising content	Analysis of TV food ads during children's programming by RCMI signatory companies from 14 days in March 2010 and 2011.	Proportion of non-core food ads	AGHE: core vs. non-core	2/2* (✓)
EU Pledge 2010 EU	Analysis of advertising content	Analysis of whether pledges not to advertise unhealthy food to children <12 years has improved TV advertising landscape in 6 countries – Greece,	Exposure: Impacts	Pledge signatories' nutritional criteria	6/6 (✓)

		Hungary, Netherlands, Poland, Portugal & Spain. Commercial monitoring data.			
EU Pledge 2011 EU	Analysis of advertising content	Analysis of whether pledges not to advertise unhealthy food to children <12 years has improved TV advertising landscape in 7 countries – France, Ireland, Netherlands, Poland, Portugal, Romania, Slovenia. Commercial monitoring data.	Exposure: Impacts	Pledge signatories' nutritional criteria	9/9 (✓)
EU Pledge 2012 EU	Analysis of advertising content	Analysis of whether pledges not to advertise unhealthy food to children <12 years has improved TV advertising landscape in 5 countries – Germany, Hungary, Italy, Poland, Portugal. Commercial monitoring data.	Exposure: Impacts	Pledge signatories' nutritional criteria	16/16 (✓)
Kolish et al. 2011 United States	Analysis of advertising content	Inhouse analysis of impact of voluntary regulation on practices of CFBAI participants. 38.5 hours of children's programming from May-June 2010.	% products with shortfall ingredient present.	CFBAI Category-Specific Uniform Nutrition Criteria	1/1 (✓)
Kolish & Hernandez 2012 United States		Inhouse analysis of impact of voluntary regulation on practices of CFBAI participants. Reviewed 31 hours of ads during Nickelodeon programs during March 2012.	% products with shortfall ingredient present.	CFBAI Category-Specific Uniform Nutrition Criteria	2/2 (✓)

* - statistical results reported beyond descriptives. (✓) - majority of outcomes had desired impact. (x) - minority of outcomes had desired impact. AFGC – Australian Food and Grocery Confederation; CAI – Canadian Children's Food and Beverage Initiative. CFBAI – Children's Food and Beverage Advertising Initiative. QSRI – Quick Service Restaurant Initiative. RMCI - Responsible Marketing to Children Initiative. AGHE – Australian Guide to Healthy Eating.

Table 4 – Educational approaches

Study	Study type	Method	Example outcome measures	Nutrient criteria	Desired impact: outcomes ratio
Buijzen 2009 Netherlands	Cross-sectional diary-survey	234 parents of 4-12 year olds asked about advertising related communication style & commercial monitoring data for study period.	Number of advertised energy dense food products or beverages consumed in average day.	'Energy dense food', but undefined	2/2* (✓)
Harris and Bargh 2009 US	Cross-sectional survey	Asked 193 college students to reflect on their parents' restrictions on their TV viewing when they were young.	Enjoyment of taste of healthy and unhealthy foods. Consuming a healthy or unhealthy diet.	'Healthy', 'unhealthy' and 'somewhat healthy' foods.	3/4* (✓)
Yu 2011 US	Cross-sectional survey	224 parent-child (7-12 years) dyads answered questions on attitudes towards TV snack/fast food advertising.	Attitudes towards advertising Obesity levels	No definition provided	2/2* (✓)
Bickham and Slaby 2012 US	Controlled experiment	375 5 th -grade students assigned to media literacy program or control group.	Food advertising beliefs Desire to eat cereal Healthy snack consumption	Undefined	6/6* (✓)
Ferguson et al. 2012 US	Controlled experiment	75 3-8 year old children randomised to a McDonald's TV ad for either a healthy or non healthy product, and either parental encouragement or a neutral response.	Children's food choice	Apple vs. French fries	1/1* (✓)
Hindin et al. 2004 US	Pretest-posttest, comparison-condition intervention	35 Head Start parents taking part in media literacy intervention to educate them about effects of TV ads on children's food choices. Participants acted as own controls.	Parental understanding of TV advertising, values, outcome expectations, self-efficacy, TV mediation behaviours and attitudes towards discussing TV advertising with their children.	N/A	6/6* (✓)

* - statistical results reported beyond descriptives. (✓) - majority of outcomes had desired impact. (x) - minority of outcomes had desired impact.

Figure 1 – Flow diagram



