

Warwick Obesity Network

Rapid Review of the Evidence For and Against Restrictions on Food Advertising to Fight Obesity

Summary

The interdisciplinary Warwick Obesity Network conducted a rapid review of medical research published over the past 15 years on the links between advertising and obesity. A summary of key points that emerged:

- **Based on the evidence presented in this review, the Warwick Obesity Network urges the government to further restrict children’s (online and television) exposure to advertisements promoting high fat, sugar and salt (HFSS) foods. We support the implementation of a total ban for the online advertisement of HFSS products and further restrictions introduced for advertising HFSS products on TV.**
- The relationship between obesity and exposure to food advertising meets all criteria commonly used to demonstrate the presence of a causal relationship in epidemiology.
- Younger children (<8 years of age) are more susceptible to the impacts of food marketing, in terms of quantity and quality of calories consumed, than older children and adults.
- Children from socio-economically disadvantaged and ethnic minority backgrounds are disproportionately exposed to unhealthy food advertisements.
- “Advergimes” that contain food cues can increase short-term food consumption. Though the primary purpose of most advergimes is the promotion of unhealthy foods, parents and children are often unaware that advergimes are advertising tools.
- The use of a familiar cartoon character wields more powerful influence on children’s preference for less healthy foods than for fruits or vegetables.
- The introduction of further statutory regulations is widely supported by both the general public and health care professionals.
- Regulating the advertising of unhealthy foods likely represents a cost-effective intervention.
- Advertising restrictions must be accompanied by community-based interventions that address other causes of poor diet and sedentary behaviour; this is because online and TV advertisements represent one small dimension in the wider obesogenic environment.
- Voluntary bans are ineffective. Exposure to unhealthy food advertising is similar before and after the introduction of voluntary food advertisements.

Method

The team conducted a rapid review of published evidence based on an electronic search in Medline. The review covers English-language studies published from 2006 to 2020. The search included all systematic reviews that contained an advertisement element

(intervention/exposure) and captured obesity-related outcomes. Studies were screened using a pre-defined form to extract key data, such as design of included studies, sample size, analysis, population, intervention/exposure and outcomes (see Appendix 1). This review synthesises evidence from 18 systematic reviews, incorporating results of some 400 peer-reviewed studies involving more than 9,000 individuals.

Results

Relationship between advertising and food consumption. Four systematic reviews conclude that exposure to screen advertising significantly increases children's short-term consumption of unhealthy food (e.g., Boyland et al., 2016; Sadeghirad et al., 2016; Folkvord & Riet 2018; Russell et al., 2019). One systematic review and meta-analysis, collating evidence from 39 published studies, found that playing an advergame that contains food cues (e.g., placing food in a character's mouth to earn points) for 5 minutes increased short-term food consumption by 53.4 kcal compared to advergames without food cues (Russell et al., 2019). The same review found that exposure to 4.4 minutes of TV food advertisements increased short-term food consumption by 60.0 kcal compared to children exposed to non-food advertisements (Russell et al., 2019).

Food advertisements seem to have a greater impact in promoting consumption of unhealthy food compared to healthy food (Kraak & Story, 2015). For example, the use of a familiar cartoon media character has a more powerful influence on children's preference for less healthy foods than the use of the same character to on children's preference for fruit or vegetables (Kraak & Story, 2015).

Due to a lack of longitudinal evidence, it is less clear whether an acute increase in food consumption, in response to food advertising, is associated with long-term health outcomes such as obesity. However, a 2016 systematic review found that the relationship between obesity and exposure to food advertising meets all criteria commonly used to determine the presence of a causal relationships in epidemiology (Normal et al., 2016). This research was undertaken using the 'Bradford Hill Criteria', a recognised public health framework (Bradford Hill, 1965). The evidence base was particularly strong for children aged 3-12 years, with exposure to marketing across all media platforms consistently demonstrating significant, negative effects on food preferences and food consumption (Normal et al., 2016).

Vulnerability and exposure of certain children. Younger children (≤ 8 years of age) are more susceptible to the impacts of food marketing, in terms of quantity and quality of calories consumed, than older children and adults (Boyland et al., 2016; Sadeghirad et al., 2016).

There is also strong and consistent evidence, from a 2020 systematic review collating evidence from 25 studies, that children from socio-economically disadvantaged and ethnic minority backgrounds are disproportionately exposed to advertisements promoting high fat, sugar and salt (HFSS) foods (Backholder et al., 2020). Children in lower-income households are more exposed because they spend more time than their higher-income peers watching TV and playing online games. There are also regional differences in food access, with lower-income neighbourhoods often having worse access to healthy and nutritious food outlets and a greater prevalence of outdoor advertising of HFSS foods and drinks (Backholder et al., 2020).

Children who are overweight or obese are also more vulnerable to the influence of marketing; following exposure to food advertisements, these children consume an average of 45.6 kcal more than children of healthy weight (Russell et al., 2019).

It has been hypothesised that children are particularly vulnerable to the effects of marketing as they are unable to understand its selling or persuasive intent. In fact, a systematic review examining food promotions in Australia found that 75%-100% of 6-year-olds fail to comprehend the basic purpose of food advertisements (Carter 2006).

While the mechanisms by which food advertising affects eating behaviour is beyond the scope of this review, it appears that food advertisements activate a certain region of children's brains: the ventromedial prefrontal cortices (vmPFC), which play a role in decision-making, reward valuation and self-control (Bruce et al., 2016). This activation results in more rapid food decisions and a tendency to favour taste over nutrition (Bruce et al., 2016).

Prevalence of HFSS advertising. Food advertising in the UK is dominated by foods that are high in fat, salt and sugar (Boyland & Halford, 2013; Sonntag et al., 2015; Azar et al., 2018). An examination of children's TV advertisements broadcast in the UK found that 62.5% of broadcasts were for food items, out of which 73.4% to 95.3% were related to HFSS foods (Azar et al., 2018). Less information is available on duration of or exposure to advergames; however, Sonntag et al. (2015) found that the primary purpose of most advergames is the promotion of unhealthy foods. As advergames do not typically include age restrictions, it is likely that children are accessing advergames that are not age appropriate. Parents and children are often unaware that advergames have a marketing element; they instead mistake these advertising vehicles for generic online games (Folkvord & Riet, 2018).

Despite current regulations, children in the UK continue to be exposed to a high volume of TV and online adverts promoting HFSS food (Boyland & Halford, 2013; Folkvord & Riet, 2018). The introduction of further statutory regulations is widely supported by both the general public and health care professionals (Lobstein et al., 2020).

Policy considerations. Further regulation is a potentially cost-effective option. A systematic review of 30 studies, examining the cost-effectiveness of 13 different policy options to reduce HFSS food consumption in children, found restrictions of online and TV advertisements to be the most cost-effective policy option (Lobstein et al., 2020).

It must be noted that online and TV advertisements represent one small dimension in the wider obesogenic environment. The food industry targets children in multiple ways, including the use of appealing product packaging, priority positioning of HFSS products in supermarkets, and an abundance of unhealthy food options in public places (Paes et al., 2015; Elliot & Truman, 2020). A 2015 review of 36 studies found that HFSS food products are overwhelming advertised to children, using various strategies, while healthy foods high in fibre, vitamins and minerals are rarely promoted by the food industry (Sonntag et al., 2015). Food advertisement restrictions are also unlikely to be effective in reducing the rising levels of childhood obesity unless they are supported by community-based interventions that address other causes of poor diet and sedentary behaviour (Weihrauch-Blüher et al., 2018).

Finally, voluntary codes are unlikely to be sufficient in reducing the advertising of unhealthy foods. Exposure to HFSS food advertising has been shown to be similar in countries before

and after the introduction of voluntary food advertisement restrictions (Galbraith-Emami et al., 2013). Industry-sponsored reports typically overestimate the effect of voluntary bans – a striking contrast with the findings of independent reports that show no impact (Galbraith-Emami et al., 2013).

Recommendations

On the basis of this review of current evidence, we urge the government to implement further restrictions that would limit children’s exposure to both television and on-line advertising for HFSS foods. Specifically, we believe there is evidence to support a total ban for the online advertisement of HFSS products to children and further restrictions introduced for advertising HFSS products on TV.

About the Warwick Obesity Network

The Warwick Obesity Network is an interdisciplinary team of academics and clinicians at the University of Warwick who working on obesity interventions. The network aims to mobilise current academic knowledge to inform policies that can address the global obesity epidemic. The team brings together expertise in medicine, public health, economics, psychology, behavioural science, and dietetics and nutrition. Members of the team are Dr Thijs van Rens (principal investigator, Department of Economics), Dr Lena Alkhudairy (Warwick Medical School), Dr Thomas Barber (Warwick Medical School, UHCW NHS Trust), Dr Paul Coleman (Warwick Medical School), Dr Petra Hanson (Warwick Medical School, UHCW NHS Trust), Dr Redzo Mujcic (Warwick Business School), Dr Oyinlola Oyebode (Warwick Medical School), and Dr Lukasz Walasek (Department of Psychology).

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This policy brief summarises findings of a rapid evidence review conducted for the UK Government consultation on total restriction of online advertising for products high in fat, sugar and salt (HFSS).

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Appendix 1: Data extraction

Paper No.	Lead author	Title	Year published	Date range	Meta-analysis included?/YN	Rational for the study	Population	Intervention or exposures	Comparison or control groups	Number of studies included	Participants (n)	Study designs included	Outcomes of interest	Gaps in the evidence	Quality of evidence / bias
1	Zobstein	Costs, equity and acceptability of three policies to prevent obesity: A narrative review to support policy development	2020	incipitation to June 2020	no	narrative review examines three issues of costs, equity and acceptability in relation to marketing	children less than 18 years	Regulatory interventions to restrict the exposure of children to commercial messages for foods and non-alcoholic beverages or to reduce the strength or impact of those messages (on TV)	none as not looking at the effects of advertising	30	not stated	systematic reviews, reports from government and industry	Likely to be very highly cost-effective (shown in the longer term, with a lack of analysis for the shorter term) - the use of regulations to reduce children's exposure to promotional marketing of less healthy foods and beverages is stated to be the single most cost-effective measure analysed by the OECD authors. 'partial bans have generally resulted in a shift of marketing spend and sales rather than a reduction'. This implies that the costs borne by advertising agencies and by commercial media if food and beverage advertising is restricted will also be offset by other sources of advertising revenue. 2. Acceptability: moderately to strongly supported by the public, strongly supported by health professionals and civil societies groups and moderately to strongly opposed by commercial interests (unless voluntary). 3. Moderately (beneficial) to health equity. Interventions to reduce TV advertising should have greater impact in lower SES groups, as both exposure and responsiveness to advertising of unhealthy foods are highest in lower SES groups. However data lacking.	Digital marketing channels are largely unexplored in terms of children's exposure. Differentiated across household income, parental education or ethnic group.	This is only a narrative review. Even though data was extracted by two researchers, it included a variety of reports which were non-scientific studies. However, search strategy was good so likely captured relevant articles.
2	Starkholder	Differential exposure to, and potential impact of, unhealthy food advertising to children by socio-economic and ethnic groups: A systematic review of the evidence	2020	2007- November 2020	no	examines the differential potential exposure and impact of unhealthy food advertising to children according to socio-economic position (SEP) and/or ethnicity	children less than 18 years	14 focused on exposure to unhealthy food advertising via television, 9 via outdoor mediums and 2 via multiple mediums	some studies included did not have control group (all studies were graded based on quality)	21	not provided in all studies, no info about total participants	2 cohort studies, one RCT, rest cross-sectional study design	Most studies (n = 19) revealed a higher potential exposure or a greater potential impact of unhealthy food advertising among ethnic minority or lower SEP children. Few studies reported no difference in exposure to unhealthy food advertising between ethnic minority and non-ethnic minority children. Children from minority and socio-economically disadvantaged backgrounds are disproportionately exposed to unhealthy food advertising. Regulations to restrict unhealthy food advertising to children should be implemented to improve children's diets and reduce inequalities in dietary intake. Evidence of the differential impact of unhealthy food and beverage advertising is mixed, albeit from relatively a small evidence base (n = 4 studies). Of particular concern was the finding that ethnic minority children are likely to be disproportionately exposed to a greater proportion of unhealthy food advertising, suggesting targeted advertising practices.	However, there is very little evidence to suggest higher volumes of unhealthy food advertising leads to greater consumption of unhealthy food and greater weight gain, due to most studies being observational. This limits our ability to draw any causal inference between exposure of unhealthy food and beverage advertising and food intake, and associated differences across socio-economic and ethnic groups.	Article screening and data extraction were conducted by two independent reviewers, however 15/25 studies were rated as fair or poor quality.
3	Chellian	The Power of Packaging: A Scoping Review and Assessment of Child Targeted Food Packaging	2020	incipitation to December 2019	no	Product packaging is a powerful form of food marketing aimed at children, yet no published studies examine the range of literature on the topic or the "power" of its marketing techniques.	children age 3-12, but ages above and below are captured in the data	food packaging marketing, examining child targeted food packaging and assessing it with respect to persuasive power.	no control groups	17	not provided	all peer reviewed literature, cross sectional studies, descriptive studies	The majority of child-directed packaged foods are of poor nutritional quality, suggesting that the very foods designed to appeal to kids could work to compromise their long term health. Food packaging employs powerful techniques to attract children and more attention on these persuasive techniques, and their specific impact on children, is warranted.	As our goal was to explore the scope of literature on this topic in order to identify trends and research gaps, we did not evaluate the quality of the evidence.	scoping review, did not assess any causal effects, but only available information about the persuasive power of packaging of unhealthy food for children
4	Reusens	The effect of screen advertising on children's dietary intake: A systematic review and meta-analysis	2018	1988 to April 2018	yes	Evidence indicates that screen advertising for unhealthy food results in significant increases in dietary intake among children. This review was undertaken with the main aim of estimating the quantitative effect of screen advertising in experimental and nonexperimental conditions on children's dietary intake.	children between 2-18 years	screen advertising	experimental studies had to have a non-advert control group (on TV)	19	not provided	RCT and non-experimental studies, from business and economic databases	Food advertising was found to increase dietary intake among children (age range 2-14, mean 8 years) in experimental conditions for television (TV) advertising and advergames. 2. Meta-analysis revealed that children exposed to food advertising on TV (11 studies) and advergames (five studies) respectively consumed an average 80 kcal (95% confidence interval [CI], 3.1-136.9) and 53.2 kcal (95% CI, 31.5-74.9) more than children exposed to nonfood advertising. 3. There was also an effect by body mass index. 4. Findings from nonexperimental studies revealed that exposure to TV food advertising was positively associated with and predictive of dietary intake in children. Short-term exposure to unhealthy food advertising on TV and advergames increases immediate calorie consumption in children. (88).	Resulting excess calorie consumption. 2. Experimental studies provided information about immediate food consumption, whereas children in 'normal life' are exposed to various media in combination and over longer periods of time. More research on the effect of advertising duration and dose of exposure would be particularly useful, as would longitudinal work which considers the longer term outcomes of advertising exposure.	Combination of experimental studies and non-experimental studies where the information about exposure to screen advertising was estimated from other (less accurate) sources. Study heterogeneity was high and CIs were large for television advertising meta-analysis, indicating that caution should be taken with these results overall.
5	Wehrhahn	Current Guidelines for Obesity Prevention in Childhood and Adolescence	2018		no	To summarize and to discuss internationally available guidelines, recommendations, and prevention strategies for obesity prevention in childhood and adolescence, general prevention of removal of advertising in children's TV programming included.	children	all strategies for prevention of obesity	various, depending on which strategy they were looking at. Only 1 for advertising on TV	not provided	not provided	RCT and reviews	Additionally, advertising of foods especially targeted at pre-school children has a net negative influence. Exposure to (not only) TV advertisements should be limited or completely avoided whenever possible.	the paper described all possible strategies and was too broad, not enough detail was provided about advertising	
6	Almazrou	Content analysis of advertisements related to oral health in children: a systematic review and meta-analysis	2018	incipitation to October 2017	yes	The evidence about the content of TV advertisements broadcast during children's viewing times with an emphasis on the number of food advertisements and the number of cariogenic food advertisements was systematically reviewed and meta-analysed.	children	TV advertising of HFSS products	no control groups	10	not provided	observational studies	Food advertising during children's programs is dominated by food items that are high in sugar (and harmful to oral health). Moreover, the advertisements shifted toward food items that appeared healthy but contain a large amount of hidden sugar. 38% of the advertisements released for children were based on food. According to the results of meta-analysis, we also showed that about 70.6% of food advertisements were related to cariogenic foods (high in sugar). Four of five studies showed that more than 60% of advertised food and drinks were of high sugar content and acidic, which are harmful for oral and dental health. Results from meta-analysis: 38.0% (95% CI: 28.6 to 48.6) of advertisements were related to food, and 70.6% of food advertisements related to cariogenic food. The most highly advertised food categories for children were confectioneries, sugared dairy products, and sugared cereals. There are also significant differences in broadcasting of harmful foods in children's programs compared to other programs. Cheuruti and Ahsan (2002), one-third of TV advertisements in the UK are related to food and drinks. Of the 342 food and/or drink advertisements identified, 95% related to foods high in sugar and/or acid.	no info about what impact the nature of the adverts has on eating behaviour	Authors state focus of the study was children's TV adverts, however not clear how children's TV adverts were defined. Majority of studies reported as having high risk of bias as they covered limited number of channels and their length of recording day.
7	Wahlqvist	The persuasive effect of advertisements promoting unhealthy foods among children: A meta-analysis	2018	incipitation to 20 May 2018	yes	Studies indicate that, compared to control conditions (no food advertisements or no advertisements), children who play advertisements that promote food consume energy-dense snacks.	Children aged 5-17 years	Advergames (form of online advertising that features messages, logos, and track characters in a video game format)	Each study provided a comparison between an advertisement condition and a control condition	10	203	randomised control trials only	Employing a random-effects model, the composite effect of advergames yielded a small-to-moderate and significant effect of g=0.30. Results show that advertisements promoting unhealthy foods induced unhealthy eating behavior among children. Parents and children are often unaware that advertisements have a marketing element to them and instead often mistake them for online games.	There may be different effects depending on the age of children, however there is not enough evidence available to investigate this in detail.	There was variation in the way researchers measured food consumption. Some studies asked children what food they thought wanted to eat after playing advergames. Other
8	Schmidpeter	Influence of unhealthy food and beverage marketing on children's dietary intake and preference: a systematic review and meta-analysis of randomized trials	2018	incipitation to January 2015	yes	the effects of unhealthy food and beverage marketing on dietary intake (grams or kilocalories) and diet preference (preference score or percentage of participants who selected preferred foods/beverages) among children 2 to 18 years of age	Children 2-18	the intervention (unhealthy food or non-alcoholic beverages advertising delivered through TV/news commercials, advergames (electronic games played on a product and might be played online or offline) or use of branded logos, packaging with licensed characters/ booklets/magazine advertisements	the intervention (unhealthy food or non-alcoholic beverages advertising delivered through TV/news commercials, advergames (electronic games played on a product and might be played online or offline) or use of branded logos, packaging with licensed characters/ booklets/magazine advertisements	29	not provided	29 for review, 17 for meta-analysis of dietary preference and 9 for dietary intake	in children exposed to unhealthy dietary marketing, dietary intake significantly increased (mean difference [MD] +30.4 kcal, 95% confidence interval [CI] 2.9 to 57.9, and MD +4.8 g, 95% CI 0.0 to 8.8) during or shortly after exposure to advertisements. Similarly, children exposed to the unhealthy dietary marketing had a higher risk of selecting the advertised foods or beverages (relative risk = 1.1, 95% CI 1.0 to 1.2, P = 0.02). The evidence indicates that unhealthy food and beverage marketing increases dietary intake (moderate quality evidence) and preference (moderate to low quality evidence) for energy-dense, low-nutrition food and beverage.	Unhealthy food and beverage marketing increased dietary intake and influenced dietary preference in children during or shortly after exposure to advertisements. Long-term effects not known.	Five items were assessed: (1) Does this study address a clearly focused research question? (2) Was a theoretical model/framework used? (3) Is the methodology used in the study appropriate for the research question? (4) Are relevant limitations acknowledged? (5) Are the main findings clearly stated, including a summary of the strength of evidence for each main outcome? Each of the studies identified from the full-text eligibility assessment was then rated on each of these criteria using three dimensions (1) not met; (2) partially met and (3) definitely met. A quality score was then calculated based on the mean score of these three quality dimensions, and studies were categorized according to the following three levels of quality: (1) poor (<40 percent); (2) fair (40-50 percent) and (3) good (>50 percent). Only food quality studies were included.
9	Conting	Beyond Food Promotion: A Systematic Review on the Influence of the Food Industry on Obesity-Related Dietary Behaviour among Children	2015	incipitation to March 2014	no	This paper reviews the nature and extent of food industry influences which expose children to commercial influences and thus might affect unhealthy dietary behaviour and finally contribute to obesity	children 2-11	evaluated food industry marketing strategies on various dietary-related environments of young children	no control groups	30	not provided	qualitative and quantitative; descriptive, experimental and quasi-experimental designs	A narrative synthesis of the reviewed studies revealed six key obesogenic environments by which the food industry possibly influences obesity-related dietary behaviour in young children. These were schools, retailers, mass media 'television', mass media 'internet', home and promotional campaigns. First, food products that are high in sugar, fat and sodium such as fast food, sweets, snacks and unhealthy cereals are overwhelmingly promoted while healthy foods high in fibre, vitamins and minerals such as fruits and vegetables are often less advertised. Second, the food industry uses persuasive marketing techniques such as attractive product packaging, toys, and emotional appeals to forge long-lasting relations with children and create brand loyalty in the short and long run. 'advergames' may have a significant influence on diet-related behaviours in children. Specifically, most advergames promoted unhealthy food and did not include an age-limit specification. This raises the possibility that children may have access to advergames that are not child-age appropriate. Children are particularly susceptible if development includes a high number of brand identifiers, or when they can play these games without any restriction.		

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Paper No.	Lead author	Title	Year published	Date range	Meta-analysis included? Y/N	Rationale for the study	Population	Intervention or exposures	Comparison or control groups	Number of studies included	Participants (n)	Study designs included	Outcomes of interest	Gaps in the evidence	Quality of evidence / bias	
14	Chambers	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	2010	inception to march 2012	Yes	To identify and review evidence on 1) the effectiveness of statutory and self-regulatory actions to reduce the volume, exposure or water impact of advertising for foods high in fat, sugar and salt (HFSS) to children, and 2) the role of educational measures.	Children up to 18	Advertising in traditional media (TV, radio, magazines, newspapers and new media (internet and weblogs))	A comparator (studies with behavioural measures, experimental and quasi-experimental designs, or comparisons)	42	370n statutory regulation, 25 on self-regulation and 6 on educational approaches	Experimental, cross-sectional, modelling studies	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. 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. 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. Results from two studies indicated that changing the advertising environment encouraged healthier food choices, unlike one study where regulation of advertising for foods HFSS did not have the desired impact on attitudes towards healthy and unhealthy food.	This review supports findings of divergence in the results from peer-reviewed papers and industry-funded reports. 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 centrally.	Large variation between study types, such as experimental, cross-sectional, modelling, measuring advertising content retrospectively after policy has been done to check if content changed. Overall, the review highlights the lack of consistency of outcome measures, variation criteria and time-lapses within the evidence. Further evaluation is required where statutory legislation is in place, and independent assessment of industry self-regulation is also necessary.	
15	Peav	Factors influencing obesogenic dietary intake in young children (0-6 years): systematic review of qualitative evidence	2012	inception to 2012	Yes	To describe the barriers to and facilitators of obesogenic dietary intake in early childhood, in order to inform interventions and public health decisions to prevent obesity.	Children 0-6	The following foods were included as obesogenic: diets/snacks high in sugar, salt or fat (eg. crisps, chips, cakes, pastry, sweets and biscuits), combinations of foods (eg. fast food, junk food, convenience food and takeaway food), diets categorised by other researchers as obesogenic (eg. non-core foods, non-quantified diet and western diet) and SDA, such as drinks, fruit juices, other sweetened drinks).	no control groups	26	with 10 identified in a second search, but only included in the discussion	1000	Focus group, interview and ethnography	Environmental factors increasing intake include: availability, advertising, societal, cultural and preschool/childcare influences. Ten studies reported that children and parents are influenced by marketing of obesogenic foods. Advertising, food packaging, food placement in supermarkets, and high availability of unhealthy foods in public places made it difficult for parents to make healthy food choices.	Studies included in this review were almost all from developed countries, although a few were set in the UK. Furthermore, very few fathers or carers were included as participants, which limits the scope of the findings.	All but 2 of the 26 included studies were assessed to be of 'high' methodological quality and only 2 were of 'intermediate' quality.
16	Worram S	Consumption of energy drinks by children and young people: a rapid review examining evidence of physical effects and consumer attitudes	2016	January 2000 to April 2016	No	Rapid review of patterns of energy drink consumption by children and young people, attitudes towards these drinks, and any associations with health or other outcomes.	Participants aged 11-18 from King's in North America or Europe	Study explored associations between children and young people's health and well-being and their consumption of energy drinks. It also sought to explore consumer experiences and attitudes towards sugary drinks.	None	46	Not defined	Quantitative, qualitative or mixed methods	Advertising and brand loyalty emerged as major influences on young people's use of energy drinks, with participants reporting seeing them advertised on TV, the internet, through games promotion, via sports sponsor-ship and in shops.	Study was a rapid review of both quantitative and qualitative studies, focusing on a broad range of factors that influence consumption of sugary drinks - therefore limited applicability to our policy question.	Many of the included studies relied on self-report data, therefore introducing various types of bias (response bias, recall bias etc)	
17	Boydell EJ	Advertising as a cue to consume: a systematic review and meta-analysis of the effects of acute beverage advertising on unhealthy food and nonalcoholic beverage advertising on intake in children and adults	2016	inception to March 2016	Yes	To examine the evidence for a relationship between acute exposure to experimental/unhealthy food advertising and food consumption	Children and adults exposed to experimentally manipulated adverts	Advertising exposure (from television or internet) was experimentally manipulated and subsequent food intake was measured. Authors conducted subgroup analysis of TV adverts vs internet & children vs adults	control conditions were non-food advertisements or no advertisements	22	in systematic review and 16 in meta-analysis	Only studies with experimental designs were included (both within-subjects/ repeated-measures and between-subjects/independent groups) in which there was an exposure and control group	Small to moderate effect size for advertising on food consumption with participants eating more after exposure to food advertising than after control conditions (SMD: 0.37, 95% CI: 0.09, 0.66, I ² = 98%) Sub-group analysis found no evidence of an effect for adults. BUT significant effect of moderate size for children, whereby food advertising exposure was associated with greater food intake (SMD: 0.56, P < 0.001, 95% CI: 0.36, 0.76)	Experimental adverts were exposed to children and adults under particular conditions (e.g. laboratory, while in school). Can not be certain that these same effects would be experienced in the home.	As blinding was not possible in the majority of studies there is the possibility of a social acceptability and experimenter bias. Experiments were conducted predominantly in laboratories or schools, so responses may be different to that in the home (i.e. what foods available in the house would be a determining factor)	
18	Kraai VJ	Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs	2015	January 2000 to May 2014	No	Many popular cartoon brand mascots and media characters are used to promote products high in added sugar, salt and fat, which contribute to unhealthy weight gain and poor diet quality for children. Analysis of experimental studies that measured how food companies' mascots and entertainment companies' media characters influence up to 12 diet related cognitive, behavioural and health outcomes for children under 12 years	Children aged 2-12	Exposure to food food companies' mascots or entertainment companies' media characters	Not defined	11	Not provided	Experimental and non-experimental studies	Cartoon media character branding can positively increase children's fruit or vegetable intake compared with no character branding. However, media character branding is a more powerful influence on children's food preferences, choices and intake, especially for energy-dense and nutrient poor foods (e.g. cookies, candy or biscuits) compared with fruits or vegetables. Children tend to prefer a familiar media character used to promote energy-dense foods such as sugary cereal, potato chips, crackers and candy compared with fruits or vegetables.	Included studies had several limitations including: small and heterogeneous sample sizes, several did not report or analyse moderating factors including sex, ethnicity, greater differences		
19	Saltbath	The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review	2013	January 2000 to October 2012	No	Many WHO Member States have relied on self-regulatory pledges as their principle strategy for reducing marketing pressure on children. This study summarised evidence on the impact of regulation and industry self-regulation on curbing children's exposure to the advertising and commercial promotion of less healthy foods and beverages.	Children (ages not defined)	Numbers, proportions or frequency of promotional marketing messages to which children were exposed	Two approaches: 1. changes in children's exposure before and after the introduction of government regulation or self-regulatory pledges. 2. absolute levels of exposure in the period after the introduction of the self-regulatory pledges in countries or regions where no earlier data are available for comparison	Not defined	21	Not stated	Not defined	Non-industry sponsored reports show only low levels of improvement over the period. In contrast, there is very strong evidence of improvement reported in industry-sponsored reports in many countries. INTERESTING: exposure similar to that reported in surveys conducted in countries with pre- and post-regulatory information. The implication of this is that the pledges have had only a small or no impact in these countries, as children's exposure levels are not significantly reduced. Although for the UK data show a 51% reduction in exposure (impacts) to TV advertisements high in fat, sugar or salt (HFSS) during the period 2007-2010 for children aged 5-9 years, and a reduction of 23% for children aged 10-15 years in a wide segment of TV programming.	Study focused on differences in reported exposure to advertisements in industry sponsored and non-industry sponsored reports. The focus was advertisement exposure NOT consumption of unhealthy food or drink/health. Study also only focused on TV advertising	The study compared industry sponsored to non-industry sponsored reports. The assumption is that non-industry sponsored reports would not be subject to bias. However academic papers may have reasons to under estimate the impact of bans
20	Chater O B J	The weighty issue of Australian television food advertising and childhood obesity	2006	Not defined	No	Aim of this paper is to provide an accessible overview of evidence from a variety of disciplines in regards to childhood obesity and the contributory role of television food advertising in Australia.	Children (not defined)	TV advertising in Australia	Not defined	Not defined	Not defined	Not defined (descriptive overview of the literature)	Younger children appear particularly vulnerable to television advertising as their appreciation of its persuasive intent only emerges slowly as a function of age and cognitive development. Several studies suggest 75-100% of six- year olds fail to comprehend the basic purpose of television advertising. While it is plausible that observed differences in children's energy consumption can be explained by varied exposure to television food advertising, the evidence to date remains equivocal - i.e. it may be correlation rather than causation. Children that are exposed to more adverts are spending more time watching TV and are therefore less active.	This study argues that exposure to advertisements may actually be a confounding variable. Other factors associated with increased screen time may actually be the cause of obesity. However, as the study does not follow a systematic review methodology this conclusion may not be supported by the literature. However an interesting alternative hypothesis	Review presents low quality evidence, i.e. a descriptive review rather than systematic review. Study focused exclusively on Australia so may be limited generalisability with the UK	
21	Boydell EJ	Television advertising and branding: Effects on children's behaviour and food preferences in children	2012	Not defined: this is a narrative review	Yes	It has been argued that greater than 60% of overweight incidence among children and adolescents could be attributed to television viewing. The influence of television, television advertising, branding on food preference and eating behaviour in children is the focus of this review.	Children (not defined)	TV advertising in the UK	Not defined	Not defined	Not defined	Narrative description of the current literature	Despite regulation, children in the UK are exposed to considerable numbers of food adverts on television. These are predominantly for foods high in fat, salt and sugar (HFSS), which are marketed to children using promotional characters and themes of fun. Such adverts have been shown to cause significant increases in intake, particularly in overweight and obese children, and enhanced preference for high-calorie/dense and high fat foods in children who consume the greatest amounts of television media.	Focus was predominantly on TV advertising as paper was written prior to the recent increase in screen time / exposure to the internet	Narrative description so does not provide the same quality of evidence of a systematic review. Paper was published in 2012 and there have been significant changes in children's behaviour (e.g. screen time) since this time	
22	Norman J	The link between advertising and Advertising on Food Behaviours: Evaluating the Evidence for a Causal Relationship	2016	Not defined	No	The link between advertising and childhood obesity can be difficult to measure. This paper uses the Bradford Hill criteria to explore the presence of a causal relationship	Children (not defined)	All advertising (not just TV)	Not defined	Not defined	Not defined	Narrative description of the current literature	The current evidence on exposure to food marketing and children's food behaviours, when examined together, satisfies all key criteria commonly used to establish causal relationships in epidemiology. As such, there is compelling evidence that the two are causally related. The experimental evidence base is particularly strong for children aged 3-12 years, with exposure to marketing across all media platforms consistently demonstrating significant, negative effects on food preferences, choices and short-term food consumption. Observational	There is a lack of longitudinal evidence and experimental studies that investigate outcomes in adolescents and in the longer term. Majority of studies to date use very short follow-up timeframes	Paper was published in 2012 and there have been significant changes in children's behaviour (e.g. screen time) since this time	