

Unhealthy Food Marketing: The Impact on Adults

Background

As part of commitments made in 'chapter 2' of its Childhood Obesity Plan published in June 2018, the Government has consulted on restricting unhealthy food and drink advertising on TV and online. Published alongside the consultation, an Impact Analysis (IA) considers the potential costs and benefits of various policy options. In the IA the cost benefits of further restrictions to unhealthy food marketing advertising have been limited to modelling the impact on children only via an acute consumption effects pathway. According to the IA, this is due to a lack of conclusive evidence drawing firm conclusions on the impact of unhealthy food advertising on adults' food preferences and purchasing behaviour.

The Obesity Health Alliance (OHA) commissioned Dr Emma Boyland (University of Liverpool) to review existing evidence on the impact of advertising on adults to understand if a strong case can be made to include the benefits of restrictions on unhealthy advertising to adults in the next iteration of the IA.

Objectives

To produce two summary papers to inform the OHA response to the UK Government's consultation on restricting unhealthy food and beverage advertising on TV and online:

- (i) A review of the impact of advertising on adult preferences: learnings from tobacco and alcohol.
- (ii) A review of existing evidence of the impact of unhealthy food and beverage advertising on adults.

Conclusion/ summary

There is a moderate, and growing, amount of (largely, but not exclusively) cross-sectional evidence on the impact of advertising on food-related beliefs and behaviours in adults. This is consistent with, and supported by, a more substantial body of cross-sectional and experimental evidence of effects of alcohol advertising on equivalent drinking-related outcomes in adults, including a notable amount of robust data from UK populations in particular. While there appears to be insufficient evidence specifically on adults' acute food consumption following controlled food advertisement exposure for these data to be modelled in an equivalent manner to the child data in the IA, the evidence evaluated here supports a need for effects on adults to be considered in any analyses seeking to comprehensively model the efficacy of strengthening advertising restrictions on population level health outcomes in the UK.

1. Methodology

1.1 Identification of evidence

A scoping review was undertaken in Web of Science (including Science Citation Index Expanded, Social Science Citation Index, Arts & Humanities Citation Index) and Business Source Complete using the search string shown in Table 1 (adapted from ¹ to remove food-related terms [to cover both review foci] and to restrict to peer-reviewed articles published 2000 – present [to focus on recent evidence]). Reference lists of the identified articles and key reviews were hand-searched for further relevant studies.

Table 1: Search strategy for Web of Science

| Set | Search term (title, abstract, keyword fields) | Hits |
|-----|---|-----------|
| #1 | Market* OR commercial* OR advert* | 1,153,261 |
| #2 | Adult NOT child* | 69,992 |
| #3 | #1 AND #2 | 1,398 |

The search of Business Source Complete (limited to peer review publications) yielded a further 712 articles. Nine additional relevant articles were identified from searches of reference lists of full text articles.

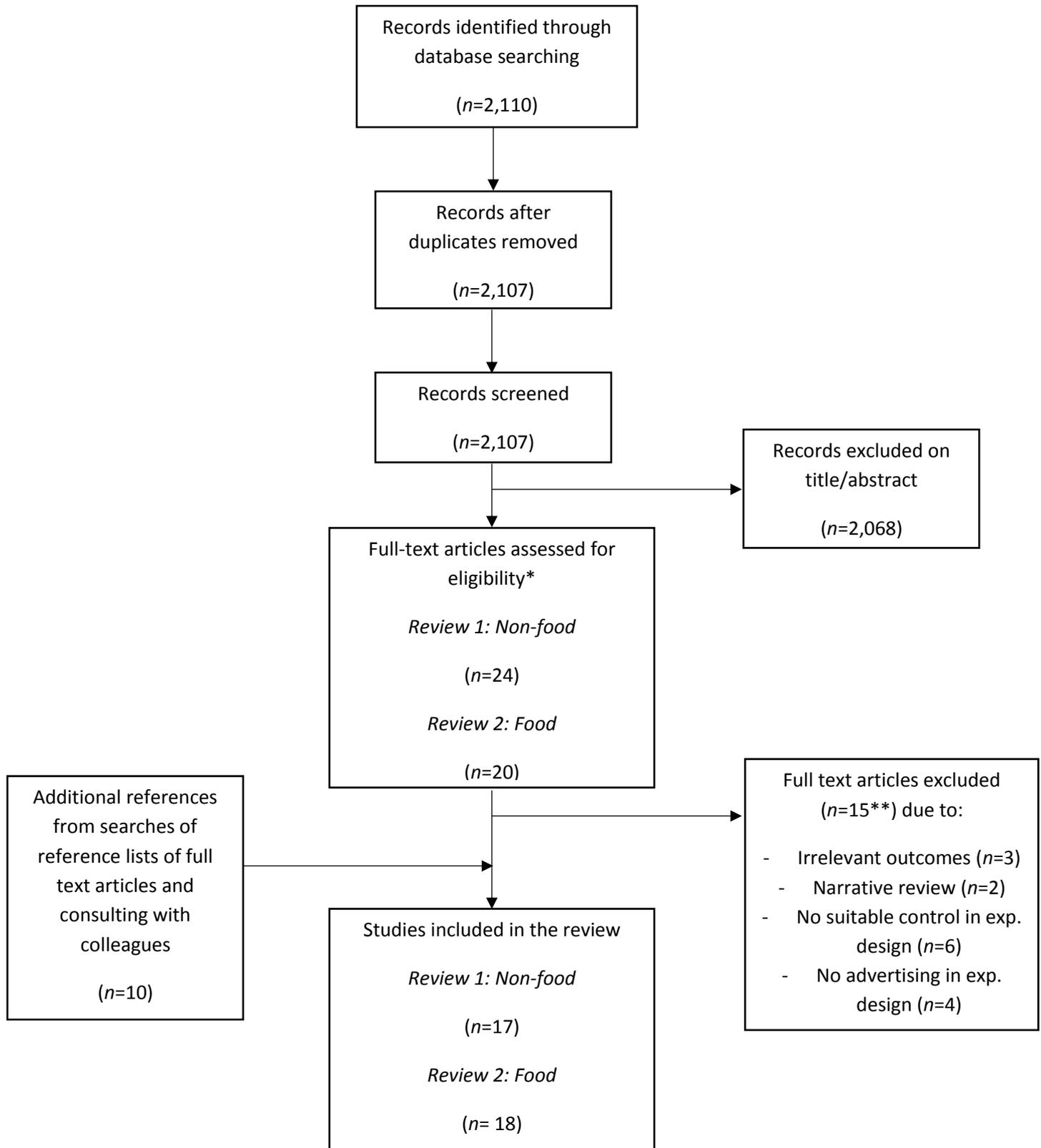
1.2 Screening for eligibility

Titles and abstracts of articles identified through database searching were initially screened to exclude those definitely not relevant to the review. Full-text versions of all articles deemed potentially suitable for inclusion were screened against a checklist of inclusion criteria (Table 2). Reasons for the rejection of studies were recorded.

Table 2: Inclusion criteria for studies included in scoping review of effects of advertising on adults

| Study component | Inclusion criteria |
|--------------------------------|--|
| Study design | Primary studies (e.g. cross-sectional, longitudinal, experimental or qualitative) published in peer-reviewed journals or systematic reviews/meta-analyses (not narrative reviews) of studies |
| Study characteristics | Written in English |
| Population | At least some participants 18y+ |
| Intervention or topic of study | Commercial advertising delivered by TV, print media, radio, outdoor billboards, digital, or other relevant method. (Review 1: Advertising for non-food products; Review 2: Advertising for food products, inclusive of non-alcoholic beverages) |
| Control | If relevant (i.e. if experimental study): non-food advertising, no advertising, or other relevant comparator (e.g. non-alcoholic beverage advertising) |
| Outcome | Consumption-related behaviour e.g. attitudes, beliefs, preference, choice, consumption/use, purchase (Review 1: Outcomes for non-food products; Review 2: Outcomes for food products) |

1.3 Flowchart of study selection process



* n=5 articles were assessed for eligibility for both reviews

** each article counted once, even if excluded for both reviews

2. Results and summary paper: Review 1 - The impact of advertising on adult preferences: learnings from tobacco and alcohol

2.1 Review objectives

To identify recent evidence on the impact of advertising for unhealthy commodities other than food (e.g. tobacco, alcohol) on behaviours (e.g. preferences, choices, purchases, intake) and beliefs (e.g. attitudes) among adults (19 years and above).

2.2 Results

The vast majority of included articles explored the effects of alcohol advertising, with two articles studying advertising of other unhealthy commodities, specifically tobacco products² and e-cigarettes³. A systematic review reported on studies of advertising impact across a range of unhealthy commodities (including food)⁴ and an industry paper reported on assessments of advertising campaigns across a range of products, covering consumables as well as other products and services⁵.

Of the 15 articles reporting on quantitative evaluations of the impact of non-food advertising on relevant outcomes in adults, 6 articles⁵⁻¹⁰ ($n=4$ from UK, $n=1$ from US, $n=1$ from Australia) reported a significant association between alcohol advertising and behaviours/beliefs, 9 articles^{2-4,11-16} (including a systematic literature review) reported inconsistent associations and no studies reported no association. A further 2 qualitative studies reported outcomes consistent with advertising exposure being associated with altered behaviours/beliefs. In each case, where effects were reported, they were in the direction of greater use/intended use or enhanced positive attitudes/beliefs towards the advertised product or product category.

Where inconsistent associations are reported, this evidence should not be dismissed as a lack of an effect. In many cases, there are numerous significant detrimental effects of advertising exposure reported, just not necessarily in all possible spheres – therefore, what this shows is that effects appear to differ across different sub-groups, or by stimuli or outcome measure used. For example, in one UK study by Gunter et al. (2009)¹³ exposure to alcohol advertising generally was not associated with overall alcohol consumption among young adults but exposure to ads for alcopops and cider was a significant predictor of consumption of those drink types. In both McClure et al. (2016)¹⁵ and Jones et al. (2016)¹⁴ greater engagement with online alcohol marketing overall was associated with increased alcohol consumption and binge drinking, but some other factors (e.g. visiting a brand's Facebook page) was not shown to be associated with consumption. This does not render the former significant finding less valid, rather likely reflects that advertising operates through an integrated communication strategy where by individual platform exposures are less impactful than the full system combined (see below for further data from Binet & Field (2009)⁵ to support this interpretation). Furthermore, in the Buchanan et al. (2018) systematic review (several articles cited here are included in the review) assessing the relationship between digital marketing and young people's attitudes and behaviours towards unhealthy commodities⁴, although the overall summary is one of an inconsistent association (as the effect was not universally found), a majority of studies found significant detrimental effects of digital marketing exposure on intended use (7 of 9) and actual current consumption (11 of 17 studies) of alcohol, tobacco and food. Arguably, when considering the underpinning evidence in the context of policy development, all detrimental effects of advertising on health outcomes (even for associations deemed "inconsistent" using scientific nomenclature) are indicative of a factor where a policy to restrict exposure could have a positive impact on health at the population level.

As an overview of the articles identified, this published peer-reviewed research demonstrates that adult exposure to alcohol advertising specifically is associated with:

- Increased consumption of advertised product types¹³
- More frequent alcohol consumption⁸⁻¹⁰
- More frequent risky alcohol consumption (binge drinking)^{6,7,9,10}
- Greater intention to consume^{4,11}
- Earlier age of first alcohol consumption⁶
- More drinking problems⁹
- Greater perceived parental and peer/social acceptability of drinking^{10,17}
- Normalization of alcohol consumption among young adults¹⁸

And advertising per se is associated with:

- Growth in brand market share⁵

For example, two large, recent UK-based cross-sectional surveys ($n=405$ and $n=3399$ respondents respectively, with the latter involving some 18 and 19 year olds as well as children) have used the Alcohol Use Disorders Identification Test (AUDIT) tool (validated for use in the UK¹⁹ and used by the National Institute for Health and Care Excellence as a screening tool²⁰) to explore effects of alcohol advertising on self-reported drinking behaviours. In Critchlow et al., (2016)⁷ it was found that respondents were aware of being exposed to alcohol advertising through more than 10 channels (mean of 4.3 traditional, including TV [80% awareness], 6.23 digital, including ads associated with on demand TV [88% awareness]). Greater awareness of such advertising was significantly associated with increased frequency of high episodic drinking (drinking 6 (female)/8 (male) units on a single occasion) in the previous year. The 2019 article by the same lead author¹⁰ found that 82% of respondents were aware of having been exposed to at least one form of alcohol marketing in the previous month, and higher awareness was significantly and positively associated with being a current drinker, more frequent high risk drinking, and perceived parental and peer approval of consumption. The reported effects are strong, with current drinkers of medium marketing awareness found to be twice as likely to be higher-risk drinkers as those reporting low awareness. In both articles, relevant demographic variables (e.g. age, gender, race, ethnicity) were controlled for in analyses. Therefore, with validated tools and robust statistical analyses across large UK samples, these findings are a strong indication of the efficacy of alcohol advertising on the UK adult population.

The qualitative studies (both UK-based) are consistent with these findings, and explain possible mechanisms for the effects. They found that young adults in the UK thought alcohol branding was appealing and that online advertising of alcohol actively targets young people (by aligning themselves with events and interests of young adults in social media) and encourages alcohol use. There was evidence that the creative content of ads was powerful in driving internalisation of the messages inherent in the ads (e.g. certain brands were associated with masculinity) which then affected reported drink choices and acceptability among peer groups.

The findings of Binet and Field (2009)⁵ support the study outcomes reported above. In this study, the authors analysed 880 cases from the UK Institute of Practitioners in Advertising (IPA) advertising awards, using an outcome metric of “Effectiveness Success Rate” (ESR) to identify which campaigns were associated with “very large” (as defined by case authors, the advertisers themselves) improvements in one of more business metrics (sales, market share, penetration, loyalty, price sensitivity or profit). They found a correlation between the brand’s advertising’s “share of voice” and its rate of market share growth (across various categories). In addition, over the period (1980-2006) campaigns that included TV advertising in the mix outperformed those that did not both in terms of effectiveness (size of business effects) and efficiency (size of effects relative to budget). The authors report that TV campaigns performed significantly better than press and outdoor campaigns, and that the effects of TV were getting bigger over time – the effects of TV advertising on market share was 40% greater in the period 2000-2006 compared

with the 1980s (with the data suggesting that the addition of online advertising actually increases the effectiveness of TV).

2.3 Conclusion: learnings from tobacco and alcohol literature

There is a growing body of evidence to demonstrate that alcohol marketing is associated with greater, and more risky, alcohol consumption in UK adults. The studies are largely cross-sectional, but use validated tools such as AUDIT and have large sample sizes to engender confidence in the findings. The studies demonstrate the strength of the association, and, given that no studies reported a lack of any association, the effects are relatively consistent across different media (TV, outdoor, digital), populations (UK, US, Australia), and designs (quantitative, qualitative). These are key factors that help build the case towards evidence of causality between alcohol advertising exposure and drinking using an internationally-recognised causality framework²¹ that has previously been applied to support the case for policy action to restrict food advertising to children²². It is likely that we can apply similar conclusions to the impact of HFSS food advertising on adults. Other than the fact that alcohol has psychoactive ingredients whereas food does not, the differences are minimal, both are both very similar, desirable products for adults, that are intrinsically rewarding upon consumption and are marketed using a brand-driven approach. There is no reason to believe that the mechanisms through which advertising exerts its effects would be any different for alcohol than for food.

3. Results and summary paper: Review 2 - Existing evidence of the impact of HFSS food advertising on adults

3.1 Review objectives

To review the existing evidence of the impact of HFSS food and beverage advertising on adults, evaluating the strength of the evidence cited in the Government's Impact Assessment and any relevant evidence that was not considered in the assessment.

3.2 Results

3.2.1 Evaluation of evidence cited in the Government's Impact Assessment

In their assessment of the impact of food advertising on adults, the Government cited evidence from five articles^{1,23-26}, of which one is a systematic review¹ and one a systematic review and meta-analysis²⁶. All are experimental (controlled intervention) studies (or syntheses of such studies) with objectively measured food-related behaviours (e.g. preference, choice, purchase, consumption) and beliefs (e.g. attitudes) as outcome measures. All individual studies of adults included in the Boyland et al. (2016) SR and meta-analysis and the Mills et al. (2013) systematic review are included in Table 5 for reference, with the exception of: Falciglia & Gussow (1980)²⁷ and Risky (1997)²⁸ (publication dates prior to 2000) and Messer et al. (2011)²⁹ because the lead author's work has been largely discredited and much of it retracted since the review was published (<https://www.vox.com/science-and-health/2018/9/19/17879102/brian-wansink-cornell-food-brand-lab-retractions-jama>). Harris et al. (2009)²⁴ and Koordeman et al. (2010)²⁵, included as separate individual studies in the IA, were also included in both reviews.

Zimmerman and Shimoga²³, not featured in either review, exposed 351 adults to advertising in a 2 (ad type: food v non-food) x 2 (cognitive demand: low v high) controlled intervention study. Participants' snack food intake (from a range of healthier and less healthy options) was objectively measured after viewing. Those exposed to food advertising chose 28% more unhealthy snacks than those exposed to non-food advertising, with a total caloric intake that was 65 calories higher. The effect was not significant for those in the low cognitive load group, but large and significant for those in the high cognitive load group (43% more unhealthy snacks and 94 more calories consumed). This study can be assessed as being of moderately strong quality, the study design is robust and relevant

confounders are controlled for in analyses, but experimenters were not blind to study condition (challenging when the researcher is often required to provide access to the relevant media) and there are possible issues with selection bias given the University population used.

Mills et al.¹ and Boyland et al.²⁶ were rigorously conducted reviews, reported using internationally recognised PRISMA guidelines. The conclusions drawn in both papers, that effects of advertising on food-related beliefs and behaviours in adults are inconclusive on the basis of the experimental data included, are valid. However, there are several factors that warrant consideration when evaluating this evidence. Firstly, several studies included in the reviews did find significant associations between food advertising exposure and food beliefs or behaviours, either as a main effect^{27,28,30} or a subgroup effect^{31,32}. These studies were not identified as being less rigorously conducted than studies finding no effects, therefore those results should be acknowledged equally. Also as noted above in review 1, an overall interpretation of “inconsistent effects” should not be dismissed as indicative that there is an absolute absence of effect. Secondly, studies with adult participants may be limited in their sensitivity to identify immediate advertising effects because adults are particularly attentive to their own food intake in laboratory situations where they are aware of monitoring taking place²⁶. Thirdly, there is additional evidence not captured by either review, in a large part due to a rapid increase in focus on digital marketing impacts in the last few years but also because there are non-experimental designs, and studies with outcomes other than immediate eating or choice behaviours that provide important insights into advertising effectiveness in this population. Indeed, narrative reviews in this field have previously concluded that there is more than one pathway through which advertising exposure affects dietary consumption and health^{33,34} and in adults, a pathway via altered preferences and norms over time leading to poorer dietary quality may be more likely to reflect the true effect (but less likely to be captured by acute experimental exposure and immediate intake studies).

3.2.2 Evaluation of evidence not considered in the Government’s Impact Assessment

Of the 8 articles identified by this search that were not included in the reviews or the IA (of which one, Buchanan et al. (2018)⁴ is a systematic review), 6 studies³⁵⁻⁴⁰ showed a significant detrimental association between food advertising exposure and food beliefs and behaviours and 2 studies^{4,41} showed inconsistent associations. No studies showed no association. It should be noted that the systematic review features only a single study of unhealthy beverage (energy drink) advertising (Buchanan et al. (2017)³⁶, and that study is also included in the current review as an individual study so the systematic review will not be assessed further in this section.

As an overview of the articles identified, this published peer-reviewed research demonstrates that adult exposure to unhealthy food or beverage advertising is associated with:

- Improved attitudes towards those products³⁶
- Increased consumption intention towards those products³⁶
- Increased purchase intention towards those products³⁵
- Greater likelihood of trying a brand’s products⁴⁰
- Desire to eat an available food⁴¹
- Greater consumption of those products³⁸

Also, regulations restricting unhealthy food advertising to youth also affect adult purchasing behaviour with studies showing that regulations are associated with reductions in:

- Fast-food household expenditure³⁷
- “Junk food” sales generally³⁹

The experimental designs are well controlled intervention studies, with objective measurement of outcomes, confounders controlled for in analyses, and largely non-University student populations (and therefore findings are more generalisable to the wider population). Although UK-specific evidence is limited here, most studies have been conducted in culturally similar contexts (Australia, USA). Therefore, overall, more recent experimental data largely support the notion that food advertising is associated with some immediate or short-term detrimental changes to dietary behaviours in adults in the UK, and this is reinforced by cross-sectional survey data with similar findings. Interestingly, here, two large scale secondary data analyses evaluating more ecologically valid outcome measures for adults (purchasing behaviour) also support this view^{37,39}.

Dhar & Baylis (2011)³⁷ analysed household expenditure data from over 9000 households in Canada, comparing differences in expenditure on fast-food between households affected by the Quebec ban on fast-food advertising and those unaffected by the ban. Their models estimated that the ban significantly reduced propensity to consume fast-food by 13% for the affected households, with reductions due to lower frequency of visits rather than reduced expenditure per visit. Kovic et al. (2018)³⁹ used retail and food service volume food sales data to evaluate the impact of restrictions ($n=79$ policies) to limit “junk food” advertising on TV on sales of these products. The analysis demonstrated that countries with HFSS food broadcast marketing policies saw a decrease in per capita “junk food” sales over time, whereas those without policies saw an increase. The decrease in sales was associated with statutory implemented policies, countries with self-regulatory policies saw sales rise. Both analyses were adjusted for numerous pertinent and potential confounding variables such as household level demographics, and development and deprivation indices, etc. These data are likely to reflect a mechanistic pathway outlined in Kelly et al. (2015)³⁴ whereby pestering and purchase requests from children drive purchasing behaviour in adults.

3.3 Conclusion

Although still limited relative to the data on children, recent evidence of the impact of experimental food advertising exposure on immediate food-related beliefs and behaviours in adults from well controlled studies demonstrates relatively consistent effects on both appetitive factors that are predictors of eating behaviour (such as desire to eat, improved attitudes and willingness to try) and actual eating behaviours (consumption). Importantly, large scale secondary analyses using objective sales data to measure the impact of youth-oriented advertising bans show that indirect effects on adults via changes in children’s requests are also evident. These are important to consider in this policy context - household level reductions in purchase of unhealthy foods have the potential for population-level health impacts regardless of whether this occurs via reducing the influence of advertising on adults, or children, or both. Overall, there is sufficient new evidence available beyond Mills et al. (2013)¹ and Boyland et al. (2016)⁴², as well as the IA, to draw the conclusion that unhealthy food advertising exposure does appear to be associated with detrimental effects on dietary health in adults.

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Appendix

Table 3 Characteristics of the included quantitative studies (Review 1 – non-food advertising)

| Author (date) | Population (country) | Study aims | Data collection (Study design) | Study factor | Outcome measure | Results (Overall association) |
|------------------------|---|---|---|--|--|--|
| Alhabash et al. (2015) | University students, mean age 21y n=379 (USA) | To determine effects of viral behavioural intentions (to like, share and comment on) for status | Experimental: 2 (likes: low v high) x 2 (shares: low v high) x 3 (display ad type: alcohol ad v anti-drinking public service announcement v local bank ad) x 6 (status update repetitions) (Controlled intervention study) | Likes and shares on Facebook (Objectively measured) | Attitudes and viral behavioural intentions towards the display ads and status updates Intention to consume alcohol (Alcohol) (Self-reported) | Attitude towards status updates and viral behavioural intentions towards status updates positively predicted alcohol consumption intention. Attitudes towards ads display and viral behavioural intentions towards ads display (B = 0.1, t = 1.9, p = 0.06) did not predict alcohol consumption intention. No variables were adjusted. (Inconsistent association) |
| Binet and Field (2009) | Analysis of n=880 IPA Effectiveness Awards (UK) | To assess which advertising strategies best increase advertising effectiveness in terms of sales and profit performance | Analysis of 880 Institute of Practitioners in Advertising (IPA) award cases to identify strategies most associated with ad effectiveness (Secondary data analysis) | Advertising strategies (Natural experiment) | Effectiveness success rate (ESR) calculated as % of cases reporting very large (as defined by case authors) improvements in one or more business outcome metrics (sales, market share, penetration, loyalty, price sensitivity or profit) (Various) (Objectively measured) | Correlation between a brand's advertising "share of voice" and the rate at which its share of market grows. Between 1980-2006, campaigns that included TV advertising outperformed those that did not both in terms of effectiveness (size of business effects) and efficiency (size of effects relative to budget). Effects of TV increased by 40% since 1990s, addition of online advertising increases effectiveness of TV. Multichannel campaigns more effective than single channel. No variables were adjusted. (Significant detrimental association) |
| Buchanan et al. (2018) | Young people aged 12-30y n=28 studies (International, including UK) | To systematically assess the relationship between digital marketing and young people's | Systematic review of 6 databases, Google Scholar, websites and grey literature sources, hand-searching of | Any marketing or promotion of unhealthy commodities including food and | Perceptions and attitudes, purchase and consumption intentions, purchase and consumption behaviours | A majority of included studies found significant detrimental effects of digital marketing on the intended use (7 of 9 studies; 5 on alcohol, 1 on tobacco) and actual current consumption (11 of 17 |

| | | | | | | |
|-------------------------|--|--|--|---|---|---|
| | | attitudes and behaviours towards unhealthy commodities | reference lists of included articles and key reviews (Systematic review) | beverages, tobacco and alcohol (Various) | (Various) (Various) | studies, 8 on alcohol, 2 on tobacco) of unhealthy commodities. Adjusted variables: Various (multiple studies) (Inconsistent association) |
| Carrotte et al. (2016) | Young people aged 15-29y n=1001 (Australia) | To explore the relationship between alcohol marketing on social media and alcohol consumption among young people | Online survey (Cross-sectional study) | Alcohol marketing social media use (like/follow pages on Facebook, Instagram or Twitter) (Self-reported) | Alcohol consumption (number of standard drinks consumed on a typical day of drinking and risky single occasion drinking), age of initiation of drinking (Alcohol) (Self-reported) | Liking or following any alcohol marketing page was significantly associated with early age (10-14y) of first alcohol consumption. More risky alcohol consumption associated with liking or following alcohol marketing pages. Adjusted variables: Gender, age, education, location, sexuality, country of birth, recreational spending per week, recent mental health problems, every used illegal drugs, age at first alcohol consumption (Significant detrimental association) |
| Critchlow et al. (2016) | Young people aged 18-25y n=405 (UK) | To examine the relationship between awareness of traditional, digital marketing and young people's frequency of high episodic drinking (HED) | Survey (Two waves) (Cross-sectional study) | Awareness of and participation with 11 digital marketing channels, awareness of nine traditional marketing channels (Self-reported) | Frequency of high episodic drinking (HED) (Alcohol) (Self-reported) | Participation with digital marketing increased the frequency of HED Adjusted variables: Age, gender, religious beliefs, ethnicity (Significant detrimental association) |
| Critchlow et al. (2019) | Adolescents and young adults aged 11-19y n=3399 (UK) | To explore relationship between awareness of alcohol marketing and alcohol consumption, higher-risk drinking and susceptibility | Online survey (Cross-sectional study) | Awareness of alcohol marketing (Self-reported) | Alcohol consumption, higher risk consumption, susceptibility to drink (Self-reported) | 82% of respondents were aware of at least one form of alcohol marketing in the past month. Higher awareness of marketing was associated with being a current drinker, higher risk drinking and perceived parental and peer approval of consumption. Adjusted variables: age, gender, ethnicity, resident country of UK, living status, legal purchasing status for alcohol (>18y), index of deprivation, peer drinking behaviours (Significant detrimental association) |

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| Dunlop et al. (2016) | Young people aged 12-24y n=8820 (Australia) | To assess the exposure of young Australians to online tobacco advertising and branding and to determine whether exposure has changed in recent years | Telephone surveys (four waves) (Repeat cross-sectional study) | Exposure to internet-based tobacco advertising and branding in the past month (Self-reported) | Smoking behaviours: Current smoking (never-smokers, experimenters, current smokers, ex-smokers), smoking susceptibility (Tobacco) (Self-reported) | Current or ex-smokers had lower odds of being exposed to internet-based advertising than experimenters or never-smokers. In non-smokers aged 12-17y, exposure to online advertising and branding, or branding along, increased susceptibility to smoking. Adjusted variables: demographic characteristics, year of interview, average daily internet use, SES status, smoking exposures (friends, household) (Inconsistent association) |
| Fleming et al. (2004) | Young people aged 15-29y n=1220 (USA) | To assess whether the impact of alcohol advertising exposure on intentions to drink and actual consumption is mediated by cognitive responses to advertising messages and positive expectancies about alcohol use | Telephone surveys (Cross-sectional study) | Exposure to alcohol advertising through various media (including TV) (Self-reported) | Attitudes towards alcohol advertising, alcohol use expectancies, intention to consume alcohol (underage youth; 15-20y), current consumption (young adults; 21-29y) (Alcohol) (Self-reported) | Positive responses to alcohol ads associated with positive expectancies about alcohol consumption for 15-20y, but not 21-29y. Positive expectancies significantly predicted underage youth's intentions to drink as adults as well as the young adults' consumption of alcohol. Adjusted variables: age, gender, education, city size, income, relatives with alcohol problems (Inconsistent association) |
| Grievesson and Djafarova (2013) | Young people aged 18-24y n=56 (UK) | To identify whether a ban on alcohol advertising would be effective at reducing consumption in young adults | Online survey Focus group (Cross-sectional mixed methods study) | Weekly TV exposure (Self-reported) | Frequency of alcohol consumption, binge drinking (Alcohol) (Self-reported) | Greater TV viewing (proxy for ad exposure) associated with more frequent alcohol consumption but not binge drinking. No variables were adjusted. (Significant detrimental association) |
| Gunter et al. (2009) | University students and secondary school students, 17-21y n=298 (UK) | To investigate relationships between exposure to alcohol advertising and reported alcohol consumption | Survey (Cross-sectional study) | Exposure to alcohol advertising in various media (including TV) (Self-reported) | Current alcohol consumption, alcohol consumption of people known to them (Alcohol) (Self-reported) | No significant relationships between exposure to alcohol advertising and general alcohol consumption. Exposure to TV ads for alcopops and cider significant predictors of consumption of those drink types. Adjusted variables: age, gender, family drinking behaviours, peer group drinking behaviours, media consumption. |

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| Hoffman et al. (2014) | University students, mean age 21.4y n=637 (USA) | To examine the relationship between college students' use of social media, their exposure to alcohol marketing messages through social media and their alcohol-related beliefs and behaviours | Online survey (Cross-sectional study) | Engage with alcohol-related marketing on websites and social media sites (Self-reported) | Drinking behaviours: Problem drinking as measured by problem-drinking index, use in past 30 days, use on 1 typical occasion (Alcohol) (Self-reported) | The use of alcohol marketing applications on social media predicted more drinking problems, more frequent alcohol use in past 30 days, heavier consumption in a single occasion. Adjusted variables: private or public University affiliation, demographic variables including sex, age, reported family income, reported grades in school, expectations for educational attainment, year in college (Significant detrimental association) |
| Jones et al. (2016) | Young people aged 16-24y n=283 (Australia) | To examine the association between Facebook users' interactions with alcohol brands and alcohol consumption | Online survey (Cross-sectional study) | Recalled exposure to alcohol marketing on Facebook, interaction with alcohol brands on Facebook (e.g. liking, commenting) (Self-reported) | Alcohol use amount (number of drinks), alcohol use frequency, binge drinking frequency (Alcohol) (Self-reported) | Having ever liked, posted, commented or uploaded or tagged alcohol brands on Facebook was associated with increased alcohol use frequency, increased alcohol use amount and increased binge drinking frequency. No association between quantity of alcohol consumed and having visited alcohol brands' Facebook page, alcohol website via Facebook link, or by viewing an event creating/sponsored by an alcohol company Adjusted variables: Socio-demographic backgrounds (Inconsistent association) |
| McClure et al. (2016) | Young people aged 15-20y n=2012 (USA) | To examine the longitudinal association between internet alcohol marketing engagement and alcohol use transitions among youth | Telephone surveys at two time points (1 year apart) (Longitudinal study) | Internet alcohol marketing receptivity: exposure to alcohol advertising on the internet, visiting alcohol brand websites, being an online alcohol brand fan (Self-reported) | Ever drinking and binge drinking (Alcohol) (Self-reported) | Internet alcohol marketing receptivity increased the likelihood of initiating binge drinking, the higher the receptivity score, the greater the impact. Internet alcohol marketing not associated with initiation of ever drinking. Adjusted variables: baseline drinking status, socio-demographics, peer drinking, parent drinking, general time spent on the internet, sensation seeking (Inconsistent association) |

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| Pinsky et al. (2010) | Young people aged 14-25y n=1091 (Brazil) | To explore Brazilian adolescents' and young adults' exposure to alcohol advertising and to assess the relationship between exposure and alcohol consumption | Face-to-face interviews with quantitative questions (Cross-sectional study) | Perceived exposure to alcohol marketing in different media (including TV and internet) (Self-reported) | Alcohol consumption: high intensity drinkers (drink at least once per week) v low intensity drinkers (drink less than once per week) (Alcohol) (Self-reported) | Seeing or watching ads in various media more than once per day not significantly associated with high intensity drinking. Seeing or participating in alcohol promotions (in pubs, restaurants or on internet) associated with increased odds of high intensity drinking. Adjusted variables: sex, age (Inconsistent association) |
| Reinhold et al. (2017) | University students aged 18-24y n=5983 (USA) | To explore young adults' perceptions of harm and acceptability of use of e-cigarettes and whether e-cig advertising affects these perceptions | Online survey (Cross-sectional study) | E-cigarette advertising exposure through different media channels (including TV and the internet) (Self-reported) | Lifetime e-cigarette use, perception of harm, addictiveness and acceptability of e-cigarette use in places where tobacco cigarettes are banned (E-cigarette) (Self-reported) | Having seen an e-cig ad on the internet was significantly associated with lower perceived harm of e-cigarette use, and having seen an ad in any media (other than a magazine) associated with acceptability of e-cigarette use in various locations. Exposure to e-cig advertising not associated with perceived addictiveness of e-cigarettes. Adjusted variables: age, gender, race, family income, smoking status, lifetime e-cig use (Inconsistent association) |

Table 3 Characteristics of the included qualitative studies (Review 1 – non-food advertising)

| Author (date) | Population (country) | Study aim (product) | Data collection | Results |
|------------------------|--|--|--|--|
| Atkinson et al. (2017) | Young people aged 16-21y n=70 (UK) | To analyse the use and contents of alcohol marketing on the social network sites (SNS) and to explore young people's perspectives and experiences on alcohol marketing on SNS (Alcohol) | Stage 1: Content analysis of five alcohol brands' interaction with users on SNS over a 1 month period Stage 2: 14 semi-structured interviews with peer groups of young people | Branding of alcohol appealed to young people. The social acceptability of consuming certain drinks and brands and being 'seen' drinking these on SNS were influenced by ad message connotations (e.g. masculinity). Influence of SNS marketing mediated by peers' online activities – engagement with alcohol on SNS via friend's interaction or third party content (e.g. music and sporting events). |
| Moraes et al. (2014) | Young adults aged 18-24y n=15 (UK) | To explore the use of Facebook to promote alcohol use among young people (Alcohol) | Focus group Netnographic study (applying ethnographic methods to study cultures and communities emerging through computer-mediated communications) | Facebook used as a tool by alcohol brands to communicate alcohol-related content to young people that encourages alcohol use. Events feature used by alcohol brands to advertise parties, promote their sites and alcohol deals. Wall comments, drinking-related group memberships, events, photographs and other social communications on Facebook normalized alcohol consumption among young people. |

Table 5 Characteristics of the included quantitative studies (Review 2 – food and beverage advertising)

| Author (date) | Population (country) | Study aims | Data collection (Study design) | Study factor | Outcome measure | Results (Overall association) |
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| Anschutz et al. (2011) | University students, mean age 20.4y (female), 20.9y (male) <i>n</i> =82 (Netherlands) | To examine the direct effects of watching television food commercials on concurrent non-advertised snack food intake in young adults. | Experimental: 2 (ad type: food v non-food) x 2 (sex: male v female) (Controlled intervention study) | Experimental group: exposure to 3 unhealthy food ads embedded within a movie (Objectively measured) | Unhealthy snack food intake (Unhealthy food) (Objectively measured) | Female participants consumed more food after food ads compared to non-food ads. Male participants consumed more after non-food ads than food ads. Adjusted variables: satiation, liking of the movie, ad liking and recall, BMI. (Inconsistent association) |
| Bellisle et al. (2009) | Adults, mean age 26.4y (low restraint), 25.9y (high restraint) <i>n</i> =40 (France) | To examine whether dietary restraint moderates the stimulating effect of environmental stimuli on meal intake in normal weight women. | Experimental: 5 (environment: alone v in groups v radio v TV with no food cues v TV with food ads) x 2 (restraint level: low v high) (Controlled intervention study) | Experimental group: exposure to a series of ads for unhealthy foods (Objectively measured) | Test lunch meal intake, main and dessert (Food) (Objectively measured) | No main effect of condition on total or individual item food intake. No effect of restraint group, no interaction condition 3 restraint on food intake. Adjusted variables: Age, BMI (No association) |
| Boland et al. (2013) | University students, 18-29y <i>n</i> =125 (USA) | To determine whether activating health goals helps people regulate food intake later in the day. | Experimental: 3 (ad type: healthy v indulgent v non-food) x 2 (time of day: morning v afternoon) (Controlled intervention study) | Experimental group: exposure to a series of ads for unhealthy foods (Objectively measured) | Snack intake (Unhealthy food) (Objectively measured) | Marginally significant main effect of condition on food intake. Significant interaction between ad condition and time of day (participants consumed more after unhealthy ads in afternoon, compared to participants who'd seen healthy foods ads). Adjusted variables: Habitual snacking, TV viewing, eating restraint (Significant detrimental association) |
| Boyland et al. (2016) | Children (<18y) and adults (18y+) <i>n</i> =22 articles | To assess the impact of acute unhealthy food advertising | Systematic review of 5 databases, SCOPUS, PsycINFO, MEDLINE, Emerald Insight, | Experimental group: TV or internet advergame | Food intake (Various) (Objectively measured) | The experiments with adult participants provided no evidence of an effect of advertising on intake, but a significant effect of moderate size was shown for |

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| | (International, including UK) | exposure on short-term food intake. | and JSTOR, and meta-analysis of pooled data (Systematic review and meta-analysis) | advertising exposure (Objectively measured) | | children, whereby food advertising exposure was associated with greater food intake. Adjusted variables: various (No association) |
| Boyland et al. (2017) | Adults aged 20-62y n=55 (UK) | To examine salivary, cognitive and consumptive responses to televised food commercials in overweight and lean adult females. | Experimental: 2 (ad type: food v non-food) x 3 (time: baseline v during exposure v after exposure) x 2 (weight: lean v overweight) (Controlled intervention study) | Experimental group: exposure to food ads embedded within a programme (Objectively measured) | Pizza intake (Unhealthy food) (Objectively measured) | Food commercial exposure did not increase the number of food-related cognitions or amount of food consumed, but did drive a greater increase in desire to eat prior to pizza consumption than exposure to the control commercials. Adjusted variable: external eating (Inconsistent association) |
| Buchanan et al. (2017) | Young adults aged 18-24y n=60 (Australia) | To assess the impact of online marketing on young adults' perception and consumption behaviours, using energy drinks as an example. | Pre-test/post-test experimental trial, followed by semi-structured interview (Controlled intervention study) | Experimental group: exposure to two energy drink brands websites and social media sites (Objectively measured) | Attitudes towards, purchase intention and consumption intention of, the two exposed energy drinks brands and energy drinks products in general (Energy drinks) (Self-reported) | Exposure to online marketing content for energy drinks improved attitudes towards and increased consumption intention of energy drinks. No variables were adjusted. (Significant detrimental association) |
| Buchanan et al. (2018) | Young people aged 12-30y n=28 studies (International, including UK) | To systematically assess the relationship between digital marketing and young people's attitudes and behaviours towards unhealthy commodities | Systematic review of 6 databases, Google Scholar, websites and grey literature sources, hand-searching of reference lists of included articles and key reviews (Systematic review) | Any marketing or promotion of unhealthy commodities including food and beverages, tobacco and alcohol (Various) | Perceptions and attitudes, purchase and consumption intentions, purchase and consumption behaviours (Various) (Various) | A majority of included studies found significant detrimental effects of digital marketing on the intended use (7 of 9 studies; 1 on energy drinks) and actual current consumption (11 of 17 studies, 1 on food) of unhealthy commodities. Adjusted variables: Various (multiple studies) (Inconsistent association) |
| Burton et al. (2019) | Adults, mean age 42y n=651 (USA) | To examine the influence of repeated exposure to | Online survey (Cross-sectional study) | Various Superbowl ads varying in length, for 5 food and 7 non-food products | Rated 4-5 of the pool of 25 Superbowl ads on previous recalled exposure, attitude to ads, purchase intention (Self-reported) | Greater exposure to ads (more occasions of exposure) was associated with greater purchase intention. Specifically, consumers who had seen an advertisement |

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| | | advertisements on purchase intentions | | (Objectively measured) | | 10 or more times had higher reported purchase intentions than those in categories with less advertisement Exposure. (Significant detrimental association). |
| Dhar & Baylis (2011) | Household expenditure data <i>n</i> =9177 households (Canada) | To evaluate the impact of the Quebec fast food advertising ban on household fast food expenditure | Calculate difference in household expenditure on fast-food between English-speaking and French-speaking households in Quebec (and those with and without children) (Difference in difference estimation) | Treatment group: those households affected by the ban (Natural experiment) | Household fast food expenditure (Unhealthy food) (Self-reported) | Models estimate that the ban significantly decreased propensity to consume fast food by 13% for the affected households. The impact is through fast-food purchase frequency rather than amount spent per visit. Adjusted variables: household-level demographics (Significant detrimental association) |
| Harris et al. (2009) | University students aged 18-24y <i>n</i> =98 (USA) | To examine if exposure to food advertising during television viewing triggers automatic snacking of available food | Experimental: 3 (ad type: unhealthy food with snacking message v unhealthy food with pro-nutrition message v non-food) (Controlled intervention study) | Experimental group: 4 unhealthy food ads and 7 neutral ads embedded within a programme (Objectively measured) | Snack food intake (Unhealthy food) (Objectively measured) | The main effect of advertising condition was significant. Participants who saw snack ads ate more than did participants who saw nutrition ads (but no significant difference to control) Adjusted variables: gender, restraint (Significant detrimental association) |
| Hennessy et al. (2015) | Parents of children aged 3-16y <i>n</i> =371 (USA) | To examine how exposure to SSB advertising is associated with parents' and children's SSB consumption | Telephone survey (Cross-sectional study) | Exposure to SSB advertising in various media, including TV (Self-reported) | Frequency and type of SSB consumption, soda (not diet), fruit drinks, sweetened ice tea, sports drinks and energy drinks (SSBs) (Self-reported) | Adult exposure to SSB advertising was related to their consumption for three SSB types (soda, sweetened tea, fruit drinks) and their child's consumption for two SSB types (sweetened tea and sports drinks) Adjusted variables: age (Significant detrimental association) |
| Koordeman et al. (2010) | University students aged 18-29y | To examine the direct effects of | Experimental: 2 (ad type: SSB v water) | Experimental group: 4 SSB and 10 neutral | SSB and water consumption (SSBs) (Objectively measured) | Participants in the SSB ad condition consumed 1.3 ounces more soda than those in the water commercial condition. |

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| | (Netherlands) | television ads for soda on SSB consumption among young women | (Controlled intervention study) | commercials embedded within a movie segment (Objectively measured) | | Water ads did not increase water intake. Adjusted variables: BMI, restraint, usual soda consumption, thirst, first glass consumed before commercial break (Significant detrimental association) |
| Kovic et al. (2018) | Country policy data <i>n</i> =79 (International, including UK) | To evaluate the impact of junk food broadcast marketing policies on nationwide junk food sales and identify policy characteristics effective in reducing sales | Literature review and secondary data analysis (Secondary data analysis) | Broadcast junk food ad regulations (Objectively measured) | Retail/off-trade and food service volume food sales data from 2002 and 2016 (kg per capital country-level sales for select, packaged, processed food categories) (Unhealthy food) (Objectively measured) | Countries with junk food broadcast marketing policies saw a decrease in food sales per capital after implementation, while those without said policies saw an increase. Countries with statutory policies saw a decrease in sales per capita, while those with only self-regulation saw an increase. Adjusted variables: Human Development Index, Corruption Perceptions Index and country median age (Significant detrimental association) |
| Martin et al. (2009) | Adults aged 19-54y <i>n</i> =48 (USA) | To evaluate the effect of viewing TV ads on energy intake in adults | Experimental: 4 (stimuli: TV ads v TV no ads v reading, control) x 2 (sex: male v female) (Controlled intervention study) | Experimental group: 6 food ads and 6 non-food ads embedded in a programme (Objectively measured) | Intake at two test meals (lunch and dinner, low and high fat items) (Objectively measured) | Energy and macronutrient intake did not differ across conditions. Adjusted variables: appetite, restraint |
| Mills et al. (2013) | Adults over 16y <i>n</i> =9 studies (International not including UK) | To explore effects of advertising of food and non-alcoholic drinks on food-related behaviour, attitudes and beliefs in adult populations. | Systematic review of 7 databases, grey literature sources, hand-searching of reference lists of included articles (Systematic review) | Experimental studies of commercial food advertising delivered by various media including TV (Various) | Food-related behaviours e.g. consumption, purchasing, preference, beliefs, attitudes (Various) (Various) | Three studies found significant positive effects of food advertising on food-related behaviour, attitudes and beliefs. Two found no effects. Four found inconsistent effects. Adjusted variables: Various (multiple studies) (Inconsistent association) |
| Van Strien et al. (2012) | University students, mean age 21.3y | To measure the external validity of the Dutch Eating Behaviour | Experimental: 2 (ad type: food v non-food) x (external eating level: high v low) | Experimental group: 3 ads for energy dense foods and 5 ads | Snack food intake (Unhealthy food) (Objectively measured) | Tendency for greater consumption in food commercial condition v non-food for whole group. |

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| | <i>n</i> =125 (Netherlands) | Questionnaire External Eating subscale | (Controlled intervention study) | for non-foods embedded in TV programme (Objectively measured) | | High external eaters consumed more in the food commercial condition than non- food, no difference found for low external eaters. Both effects found for crisps, not chocolate. Adjusted variables: sex, hunger, satiety, commercial recall (Inconsistent association) |
| Wonderlich- Tierney et al. (2013) | University students, mean age 19.6y <i>n</i> =83 (USA) | To examine the impact of television advertisements on food intake according to sex and transportability (or the tendency to become engrossed in what one is viewing) | Experimental: 3 (ad type: food v non-food v no ads) x 2 (transportability: high v low) x 2 (sex: male v female) (Controlled intervention study) | Experimental group: 6 food- related and 1 non- food related ad embedded in programme (Objectively measured) | Snack food intake (Unhealthy food) (Objectively measured) | No significant main effect of ad condition was found. Significant interaction between ad condition and transportability whereby those high in transportability ate more in food ad condition than in other conditions. Adjusted variables: hunger, liking of test food (Inconsistent association) |
| Zimmerman and Shimoga (2014) | University students, age not given <i>N</i> =351 (USA) | To test the effects of TV food advertising on adult food choice | Experimental: 2 (ad type: food v non-food) x 2 (cognitive demand: low v high) (Controlled intervention study) | Experimental group: exposure to 6 food commercials embedded within movie segments (Objectively measured) | Snack food intake (Various food) (Objectively measured) | Those exposed to food advertising chose 28% more unhealthy snacks than those exposed to non-food advertising, with a total caloric value that was 65 kcal higher. The effect of advertising was not significant among those assigned to the low-cognitive-load group, but was large and significant among those assigned to the high-cognitive-load group: 43% more unhealthy snacks and 94 more total calories. Adjusted variables: sex, nationality, income, diet quality, fast food consumption, exercise, year of graduation (Significant detrimental association) |

Table 6 Characteristics of the included qualitative studies (Review 2 – food advertising)

| Author (date) | Population (country) | Study aim (product) | Data collection | Results |
|-------------------------|---|--|----------------------------------|---|
| Gaber and Wright (2014) | Young people aged 17-29y <i>n</i> =40 (Egypt) | To explore the factors that influence young people's attitudes towards fast-food advertising on Facebook (Fast-food) | Focus groups Content analysis | Having friends who liked or commented on Fast-food pages on Facebook increased the likelihood of consumers clicking on the ad or trying the brands. |