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1 **Systematic literature review of the effects of food and drink advertising on food and**
2 **drink-related behaviour, attitudes and beliefs in adult populations**

3

4 Susanna DH Mills^{1*}; Louise M Tanner¹; Jean Adams¹

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6 ¹Institute of Health and Society, Baddiley-Clark Building, Richardson Road, Newcastle upon
7 Tyne, NE2 4AX (where the research was also conducted)

8

9 **Corresponding author:** Jean Adams, telephone +44 191 222 8124; fax number +44 191 222
10 6043; email address j.m.adams@ncl.ac.uk

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1 **Abstract**

2 A large body of research confirms that food advertising affects the food preferences and
3 behaviour of children. The impact of food advertising on adults is less clear. We conducted a
4 systematic review exploring the effects of advertising of food and non-alcoholic drinks
5 (referred to as ‘food’ throughout) on food-related behaviour, attitudes and beliefs in adult
6 populations.

7 We searched seven electronic databases, grey literature sources, and references and citations
8 of included material for experimental studies written in English investigating the effects of
9 commercial food advertising on the food-related behaviours, attitudes and beliefs of adults
10 aged 16 years and over.

11 Nine studies, rated moderate to poor quality, were included in the review; all were from
12 developed countries and explored the impact of televised food advertising. Overall, the
13 results did not show conclusively whether or not food advertising affects food-related
14 behaviour, attitudes or beliefs in adults, but suggest that the impact varies inconsistently
15 within subgroups, including gender, weight, and existing food psychology.

16 The identification of a small number of relevant studies, none of which were high quality,
17 and with substantial heterogeneity, highlights the need for further research. Future studies
18 investigating longer-term outcomes, diverse advertising formats, and in countries with
19 different levels of economic development, will be of particular value.

1 **Abbreviations**

2 UK: United Kingdom

3 PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

4 ASSIA: Applied Social Science Index and Abstracts

5 IBSS: International Bibliography for the Social Sciences

6 RCT: randomised controlled trial

7 WTP: willingness to pay

8 BMI: body mass index

1 **Introduction**

2 Countries worldwide are facing an obesity epidemic(1), and in the United Kingdom (UK),
3 research has highlighted significant, steady increases in population levels of overweight and
4 obesity, creating an environment in which adult overweight is no longer an exception, but has
5 become the norm(2). The substantial health and economic impacts of obesity have generated
6 widespread commitment to tackling this epidemic(3, 4).

7 Food and non-alcoholic drink (collectively referred to as ‘food’ throughout) advertising is
8 hypothesised to play an important role in the growing levels of obesity(4), and provides a
9 significant contribution to UK media, with an estimated 10% of all advertising spend directed
10 towards the food market(5), and approximately 15% of total television advertising time
11 devoted to food(6). With the mean time spent viewing television of four hours per day in the
12 UK in 2011(7), this represents substantial overall exposure to these television food
13 advertisements. UK advertising expenditure in the food and confectionery sector was
14 calculated at £821.9 million in 2010(8), and recent evidence supports a disproportionate over-
15 representation of ‘less healthy’ foods high in fat and/or sugar e.g.(9, 10). The potential for
16 food advertising to drive an increase in total overall energy consumption, especially of ‘less
17 healthy’ foods, and its role in establishing new cultural values and norms, is of particular
18 controversy and concern(11).

19 A large body of evidence regarding the extent, nature and effects of food promotion to
20 children has been reviewed, with regular updates(10, 12), and associated international
21 recommendations for practice have been developed(13). However, we are not aware of any
22 analogous reviews of the effects of food promotion, including food advertising, specifically
23 on adults. Food promotion involves a range of activities beyond traditional advertising,
24 including event sponsorship, product placement, viral marketing and use of social media.
25 Evidence is growing in support of the relationship between food advertising and increased
26 intake of calorie-dense products in adult populations e.g.(14), and policy makers are
27 becoming generally more accepting of an association linking advertising and dietary
28 choices(15). This study therefore aims to systematically review current experimental
29 evidence regarding the effects of food advertising on food-related behaviour, attitudes and
30 beliefs in adult populations.

1 **Methods**

2 *Inclusion criteria*

3 We searched for published and unpublished experimental studies of the effects of food
4 advertising on adult food-related behaviour, attitudes and beliefs. Inclusion and exclusion
5 criteria are detailed in full in Table 1.

6 *Search strategy*

7 Our methods were developed using existing guidance on systematic reviewing
8 methodology(16-18) and reported using the Preferred Reporting Items for Systematic
9 Reviews and Meta-Analyses (PRISMA) guidelines(19). The protocol was registered with the
10 PROSPERO International Prospective Register of Systematic Reviews(20) in advance of
11 commencing searches (see <http://www.crd.york.ac.uk/prospero/> protocol registration number:
12 CRD42012002264).

13 Electronic databases of peer-reviewed literature were chosen according to the extent of their
14 coverage of relevant studies. The databases searched were: Applied Social Science Index and
15 Abstracts (ASSIA), the Cochrane Library, International Bibliography for the Social Sciences
16 (IBSS), Medline, Psycinfo, Scopus and Web of Science.

17 The search terms used were ‘food’, ‘beverage’ and ‘advertising’, with synonyms chosen
18 according to each database thesaurus and medical subject heading term availability. A large,
19 previous review of food promotion to children was used to guide this approach(10). The
20 search strings created were iteratively expanded according to the results generated from
21 initial pilot searches. A full record of the search string utilised for the Medline database is
22 shown in Table 2.

23 Additional resources searched for suitable articles are shown in Box 1. Relevant publications,
24 websites, grey literature sources and experts in the research field were identified, and
25 contacted or searched directly. All the references cited in studies meeting the inclusion
26 criteria were reviewed, and full citation searches of these studies were also undertaken using
27 the Science and Social Sciences Citation Indices.

1 ***Screening and data extraction***

2 Titles and abstracts of studies located through literature searches were initially screened by
3 the lead reviewer (SM), to exclude those definitely not relevant to the review. Search results
4 from the ASSIA, Medline and Psycinfo databases and grey literature (27% of total
5 references found) were also independently screened by a second researcher (LT). Full text
6 versions of all references deemed potentially suitable for inclusion, or where an abstract was
7 unavailable but further information was required to guide decision-making, were obtained.
8 Study authors were contacted for additional details where necessary. A standardised checklist
9 of inclusion criteria was used independently by the two reviewers (SM and LT) to guide
10 decision-making, and reasons for the rejection of studies were recorded.

11 A bespoke data extraction tool, piloted on a small sample of literature included in the review
12 and modified as necessary, was used as a template for recording study characteristics and
13 results. These included details on study design, number of participants, participant
14 demographics, intervention and comparator, setting, time period, outcomes and outcome
15 measures, results, analysis, and conclusions. Data were extracted by the lead (SM) and
16 second reviewer (LT), and a tabulated summary produced.

17 Throughout the research, whenever the two reviewers initially disagreed, a discussion was
18 held to explore their rationale and reach an acceptable consensus, and a third researcher (JA)
19 was consulted for advice as required.

20 ***Data synthesis and quality appraisal***

21 As previously(21), studies similar in terms of overall results and conclusions were grouped
22 together in a tabulated summary for narrative synthesis. It was anticipated that heterogeneity
23 in the design and outcomes of the studies would be too great to permit meta-analysis.

24 The Quality Assessment Tool for Quantitative Studies(22), which has previously
25 demonstrated inter-rater and test-retest reliability, and acceptable content validity(23), was
26 used to undertake quality appraisal at both the study and outcome level (see Table 3). Studies
27 included in the review were appraised independently by the two researchers (SM and LT),
28 and a consensus then reached through pooling and discussion of evaluations. The tool
29 dictionary was used to improve familiarity with the task, and enhance the robustness of this
30 process(24), and the quality of studies was recorded in a tabulated summary.

1 **Results**

2 *Studies identified*

3 Database searches initially retrieved 7,869 studies; after automated removal of duplicates,
4 6,830 studies remained, with five additional records identified through searching other
5 sources. Preliminary screening led to the exclusion of 6,730 studies. Of the remaining 105
6 studies, for which the full text was obtained, nine studies met the inclusion criteria and were
7 included in the narrative synthesis (see Figure 1).

8 Inter-rater percentage agreement between the reviewers, and Cohen's kappa coefficients,
9 were calculated: ASSIA 94% and 0.313, Medline 97% 0.492, Psycinfo 95% and 0.560,
10 other sources at initial screening 100% and 1.000, and all studies at full text stage 80% and
11 0.379. Due to heterogeneity between studies in terms of design, outcome measurement and
12 reporting, meta-analysis was deemed inappropriate.

13 *Characteristics of included studies*

14 The nine studies included in the review (summarised in Table 4) were published between
15 1980 and 2012, and all badged as randomised controlled trials (RCTs). Five studies (56%)
16 used university students as participants(25-29), one study university staff members(30), and
17 another American households(31). Two studies (22%) did not describe the participants(32,
18 33). Five studies (56%) sub-classified participants according to specific descriptive criteria.
19 In three studies (33%) this was eating restraint(26, 27, 32): "a tendency to constantly and
20 consciously restrict one's food intake instead of using physiological cues, hunger and satiety,
21 as regulators of food intake"(34, p71). In another study, participants were sub-classified
22 according to external eating status(28): an individual's responsiveness to food-related sensory
23 cues in the immediate environment(35). In a further study, participants were sub-classified by
24 obesity(33). With the exception of the experiment conducted in American households(31),
25 the studies were carried out on a small scale, with between 40 and 227 participants, and
26 only two studies provided a power calculation as rationale for the study size(29, 32). The
27 mean age of subjects was stated in six studies and was young, ranging from 19.6 to 27.0
28 years.

29 All the studies included in this review were conducted in economically developed countries
30 (France, the Netherlands and the United States of America). The majority of studies (seven,
31 78%) investigated the effects of food advertising by showing television programmes or films,

1 interspersed with food or beverage advertisements. Other parallel intervention groups in these
2 studies varied according to the project aims. Amongst these seven studies, the control
3 conditions described were non-food television advertisements(25, 26, 28, 33), being alone in
4 a quiet room(32), water advertisements(27), or no advertisements (29). A differing study
5 design investigated the effects of exposure to negative media information regarding beef-
6 related diseases, positive food advertising for beef, both media exposures, or a control of no
7 information(30). A further study used split-panel experiments in American households, with
8 participants receiving either television advertisements for Frito-Lay brands, or public service
9 announcements(31).

10 Six studies addressed individual food consumption during exposure to television including
11 food advertising(25, 27-29, 32, 33), whilst another measured food intake shortly after
12 exposure to advertising, in the form of a ‘taste-test’(26). In all of these seven studies, the
13 foods offered for consumption differed from those featured in the advertisements shown.
14 Participants’ ratings of taste or palatability of the foods offered for consumption were only
15 measured in two studies(26, 32), and in only one case was this associated with actual
16 consumption(26). One study investigated participants’ willingness to pay(30) (WTP: the
17 amount of money someone is prepared to exchange in return for goods or services). A further
18 study measured sales volume changes for specific food brands(31).

19 Quality appraisal of included studies resulted in none receiving a strong quality rating; six
20 studies (67%) designated as moderate(25, 27-29, 31, 32); and three studies (33%) classed as
21 weak(26, 30, 33) quality (see Table 3). The most common weakness was selection bias,
22 indicating that conclusions drawn from the review may not necessarily be generalizable to the
23 wider population. Furthermore, performance in terms of blinding of the participants and
24 experimental assessors was not classified as strong in any of the included studies.

25 ***Study results***

26 The main experimental characteristics, and results from included studies, are shown in Table
27 4 and described here, classified into three groups on the basis of results.

28 *Group 1: Studies demonstrating a significant positive effect of food advertising on food-*
29 *related behaviour, attitudes and beliefs.*

30 Falciiglia & Gussow (1980) found that food advertising increased the consumption of cookies
31 amongst females whilst watching television adverts, and the effect was greatest for obese

1 subjects(33). Koordeman *et al.* (2010) found that television advertisements for sugar-
2 sweetened beverages positively affected concomitant soda consumption amongst women,
3 whereas commercials for water did not increase water intake(27). Risky's (1997) study of
4 television advertising for Frito-Lay brands indicated that sizable sales volume increases
5 occurred for slightly over half of brands advertised (57%). They also reported that
6 advertisements for smaller brands were more likely than larger brands to result in significant
7 volume increases, and adverts for new innovations were more successful in comparison with
8 existing product lines or attributes(31). Information on other potentially important factors,
9 such as price, were not reported in this study.

10 *Group 2: Studies showing food advertising is not effective in influencing food-related*
11 *behaviour, attitudes and beliefs.*

12 Bellisle *et al.* (2009) measured food consumption in grams and kilojoules during meals in a
13 number of varied environments. Food intake during exposure to television with food
14 advertising did not significantly differ from consumption whilst viewing in the absence of
15 food-related cues(32). Wonderlich-Tierney (2010) investigated the number of cookies eaten
16 during food adverts, in comparison with non-food, and no advertising, and found no
17 significant impact of commercial condition on food intake(29).

18 *Group 3: Studies yielding inconclusive findings on the effects of food advertising on food-*
19 *related behaviour, attitudes and beliefs.*

20 Harris *et al.* (2009) measured food consumption using a standardised score computed for
21 each participant by calculating z-scores for the quantity of each of a number of foods
22 presented in grams, and averaging the standardised scores across foods. They found that food
23 consumption immediately subsequent to television advertisements for snack foods was
24 significantly greater than that immediately subsequent to television advertising for nutritious
25 'healthy' foods. However, the food score for those exposed to non-food adverts only was not
26 significantly different from that in those who viewed snack food advertisements, or those
27 who saw 'healthy' foods advertisements. Snack food advertising had the greatest influence on
28 food consumption in males, and groups of restrained eaters(26).

29 Messer *et al.* (2011) investigated WTP for hamburgers and found that positive generic beef
30 advertising did not significantly increase the sum offered compared to no media exposure.
31 However, the effects of advertising were shown to counteract negative media information

1 regarding beef-related diseases, such that combined conditions reported WTP significantly
2 higher than the negative media information condition alone, and similar to WTP amongst
3 those who had no media exposure of either kind(30).

4 Van Strien *et al.* (2012) noted that food advertising influenced subjects' intake in grams of
5 crisps, but not chocolate. Furthermore, results were significant only for the cohort with a full
6 range of external eating scores, not for the extreme-scores group(28). Anschutz *et al.* (2011)
7 found that food consumption measured in kilocalories increased amongst females whilst
8 viewing televised food advertisements in comparison with non-food adverts, whereas food
9 intake was lower amongst males when viewing the food advertisements, compared to non-
10 food adverts. Overall, advertising condition did not influence food consumption, after
11 controlling for gender(25).

12 **Discussion**

13 This is the first study to systematically review experimental evidence regarding the effects of
14 food advertising on food-related behaviour, attitudes and beliefs specifically in adult
15 populations. Overall, the results did not show conclusively whether or not food advertising
16 affects food-related behaviour, attitudes or beliefs in adults, but suggest that the impact varies
17 inconsistently within subgroups, including gender, weight, and existing food psychology. A
18 remarkable lack of high quality experimental evidence regarding food advertising in adults
19 was also highlighted. The review identified several factors that may moderate the effects of
20 food advertising, which are discussed here.

21 *Gender*

22 Four studies included in this review addressed the role of gender in modifying the effects of
23 food advertising(25, 26, 29, 30). Wonderlich-Tierney (2010) did not find a statistically
24 significant interaction between gender and advertising condition on food intake(29).
25 Similarly, Messer *et al.* (2011) noted that gender did not interact significantly with media
26 exposure condition on WTP for a hamburger (30). Harris *et al.* (2009) found that snack food
27 adverts were most effective in increasing the amount of food eaten amongst males(26). In
28 contrast, Anschutz *et al.* (2011) observed that amongst females, food advertisements resulted
29 in greater food consumption than non-food adverts, whereas for males, food consumption
30 during programming with non-food advertisements was higher than during programming
31 with food adverts(25).

1 Overall, the influence of gender on the impact of food advertising appears inconsistent.
2 Research in children has shown that boys respond to televised food advertisements by
3 increasing their consumption of snack foods more than girls(36). This may be because, even
4 amongst children, social drive to thinness is perceived more strongly by girls than boys(37),
5 and evidence suggests that self-control mechanisms are lower in boys than girls(38).
6 Furthermore, boys generally demonstrate greater responses than girls to external cues(39, 40).
7 However, in adulthood, women may be more strongly influenced by food advertising than
8 men due to a greater likelihood of influence from normative cues(41) and demonstration of
9 restrictive eating patterns(42) with associated increased attentional focus on food cues(43).

10 *Obesity*

11 Falciglia & Gussow (1980) investigated a moderating role for obesity in the relationship
12 between food advertising and food intake. They found that food adverts increased cookie
13 consumption more amongst obese participants than those of normal weight(33). This is
14 consistent with previous research demonstrating an association between raised body mass
15 index (BMI) and greater attention towards food cues(44). Halford *et al.* (2004) also identified
16 a significant effect of body weight on response to food advertising amongst children. They
17 reported that selective recognition of food advertisements, as assessed through the
18 identification of an item from a list of products, which may or may not have been shown in
19 the advertisements, was greater amongst overweight and obese participants than those of
20 normal weight(45).

21 *Food psychology*

22 Three studies included in this review addressed the impact of eating restraint on the
23 relationship between exposure to food advertising and food intake(26, 27, 32). Two found no
24 evidence of a significant influence of eating restraint on the effects of advertising condition
25 on food-related behaviour, attitudes or beliefs(27, 32). The third identified a borderline
26 statistically significant interaction between advertising condition and eating restraint, such
27 that the effect on food consumption of viewing snack food advertisements, versus nutritious
28 or non-food advertisements, was greater in those high in eating restraint(26).

29 Van Strien *et al.* (2012) focussed on external eating, and found a moderating effect on the
30 relationship between advertising exposure and food consumption. High external eaters
31 exposed to food advertising ate more crisps, but not chocolate, than high external eaters

1 viewing non-food advertising(28). Dietary restraint(46) and external eating(47) have
2 previously been associated with enhanced responsiveness to food cues; however the validity
3 of tools used to measure these factors has been controversial(32, 48). The inconclusive results
4 in this review may therefore be attributable to variations in data collection and analysis
5 methods. Wonderlich-Tierney (2010) investigated the impact of transportation: “a distinct
6 mental process, an integrative melding of attention, imagery and feelings”(49, p 701), on the
7 relationship between food advertising and food intake. The results indicated no significant
8 interaction between transportability and the association between advertising condition and
9 food consumption(29).

10 *Adults versus children*

11 A systematic review conducted in 2011 addressed the effects of food advertising delivered by
12 television only, on children and adults(50). The authors concluded that, amongst adults, a
13 trend exists for a strong association between advertising exposure and effects on food-related
14 behaviour, but the evidence is less consistent than that for children(50). Indeed studies
15 investigating the impact of food advertising on children have noted significant effects across
16 several age groups e.g.(26, 51).

17 The discrepancy between the inconclusive picture of results presented by studies included in
18 this review of adult food advertising, and the more consistent findings noted in previous
19 reviews concerning children(10, 12), could be attributable to several factors. The surprisingly
20 small number of studies conducted amongst adults creates difficulties in drawing clear
21 inferences from the sparse results, and it is important not to confuse no evidence of an effect
22 with evidence of no effect(16). The network of multiple interacting factors influencing food
23 intake is notoriously complex(4), and as external societal influences gain importance with
24 age, these routes may become increasingly complicated. Disparities between adults and youth
25 in the mechanisms through which advertising exerts any effects, for example intellectual
26 engagement compared with appealing imagery(21), may also account for diversity in
27 conclusions. Furthermore, adults may have greater understanding of the persuasive intent of
28 advertising, and therefore be less vulnerable to its impacts.

29 *Strengths and weaknesses of studies in this review*

30 All the studies included in this review were reported as RCTs, considered the gold standard in
31 study design(52). However, the process of randomisation was not described in any study, and

1 quality appraisal revealed mixed results, with none allocated a strong rating (see Table 3).
2 The stringent assessment criteria used in the quality appraisal tool could partially account for
3 this outcome. Some studies did not report a complete data set e.g.(33), and others provided
4 few details on their statistical methods.

5 With the exception of one study(31), all were conducted on a small scale, and only two
6 provided a power calculation to justify the study size(29, 32). Unfortunately, due to the
7 limited information provided in most papers, we were unable to conduct retrospective power
8 calculations to determine the detectable effect size. Research was generally carried out in
9 populations of young adults, and important details such as socioeconomic position and
10 ethnicity were rarely provided. A large proportion of studies apparently relied on self-referral
11 of participants, resulting in biased recruitment, and the majority explored the effects of food
12 advertising on consumption of a very small range of food and beverages. It is arguable this
13 provides poor prediction of behaviour in the wider environment with extensive choice.

14 All the studies included in this review were conducted in economically developed countries,
15 and investigated the impact of televised food advertising only, rather than advertising
16 delivered through other media. With the exception of one(31), every study was conducted in
17 an experimental environment. Although several cited strategies used to create a naturalistic
18 setting, participants would nonetheless be aware of involvement in a research project. This
19 may limit generalizability to snack food consumption in the home environment, which may
20 be maximised when people feel relaxed and uninhibited in a familiar location. The main
21 experimental outcomes were inconsistent between studies, thereby introducing complexity in
22 drawing comparisons and conclusions, particularly for WTP(30) and sales volume
23 effects(31). Six studies measured individual food consumption during advertising
24 exposure(25, 27-29, 32, 33). This may be appropriate for short-term, impulsive eating
25 behaviour; however it is likely that such patterns are influenced in an experimental setting,
26 and do not necessarily reflect longer-term effects.

27 Considering the overall weighting apportioned to each of the nine studies included in this
28 review, both study size and risk of bias are crucial. Anschutz *et al.* (2011)(25), Risky
29 (1997)(31), van Strien *et al.* (2012)(28) and Wonderlich-Tierney (2010)(29) were ranked
30 highest in these respects, each with more than 80 participants and a moderate quality rating.
31 However, these studies encompass the full range of overall conclusions drawn by the lead
32 reviewer (SM) (see Table 4), thereby illustrating the disparity between results.

1 *Strengths and weaknesses in relation to other reviews*

2 It is possible that studies meeting the inclusion criteria were not retrieved through the search
3 strategy, or were excluded during screening of results and that the review does not represent
4 all relevant literature. However, comparison with other literature in the field, such as a
5 systematic review of televised food advertising only, concerning both children and
6 adults(50), indicates that this review has not failed to retrieve relevant studies. Furthermore,
7 analysis of the references and citations from studies initially included in this review identified
8 just one additional study suitable for inclusion(33). Previous research has shown that the vast
9 majority of food advertising studies are reported in English(10). Therefore, the impact of
10 including English language studies only is likely to be minor. This review addressed the
11 effects of food advertising, but not the impact of wider food promotion activities. Given that
12 large-scale research projects have identified important findings regarding the impact of such
13 marketing on children(10, 12), it will be critical to similarly extend future work in adults.
14 This review was also limited to studies of experimental design. Assessment of observational
15 studies is likely to provide additional valuable insights.

16 *Unanswered questions and future research*

17 All the studies included in this review were conducted in developed countries. Given the
18 rapid growth in consumption within the food and beverage industry in developing
19 nations(53), it will be crucial to undertake research in less economically developed areas.
20 Studies generally focussed on young adults. However, in view of the ageing population
21 demographic(54), it will be important to conduct studies involving older people. A review of
22 observational studies, with longer-term follow up addressing weight change over time, may
23 be required to address the practical significance of the size of any impact of food advertising.
24 All of the studies included in this review focused on television food advertising. In future it
25 will also be important to investigate the potential effects of food advertising delivered
26 through other means, such as the rapidly developing new media sources. For example, 76%
27 of UK households had access to broadband internet in 2011 and 39% of UK adults owned
28 smartphones(7). Similarly, further research is also required to explore the impacts of broader
29 food promotion activities beyond just traditional food advertising. Both of these issues pose
30 methodological challenges. Consistent outcome reporting between studies, and the use of
31 standardised measurement tools should be encouraged to facilitate accurate comparisons and
32 reliable conclusions.

1 **Conclusions**

2 Concern regarding the effects of televised ‘unhealthy’ food advertising on children’s food
3 preferences and behaviour has resulted in recent advertising restrictions(55), but no
4 comparable regulations currently exist for adults. The results of this review suggest that the
5 potential effects of food advertising on adults cannot be ignored and merit further research.

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- 1 **Table 1:** Inclusion criteria for studies included in a systematic review of the effects of food
 2 advertising in adults

Study component	Inclusion criteria
Study design	Interventional experimental studies presenting data (RCTs and non-randomised studies of acceptable quality)
Study characteristics	Written in English
Population (at least 50%)	Adults aged 16 years and older; capacity for decision-making; no recorded eating disorder
Intervention	Commercial food (excluding non-food supplements) advertising delivered by television, print media, radio, outdoor billboards, internet, or other new media techniques
Control	Condition permitting isolation of effects of food advertising eg non-food adverts; measured absence of food advertising
Outcome	Food-related behaviour eg food consumption; food purchasing; food preferences; food-related psychology eg beliefs and attitudes towards food

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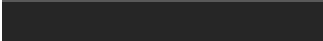
- 1 **Table 2:** Example search strategy (Ovid Medline) used in a systematic review of the effects
 2 of food advertising in adults

Search term	Hits
food*.ti, ab.	224259
beverage*.ti, ab.	11243
soda*.ti, ab.	2287
cola*.ti, ab.	2196
(fizzy adj drink*).ti, ab.	38
(carbonated adj beverage*).ti, ab.	254
(carbonated adj drink*).ti, ab.	124
(soft adj beverage*).ti, ab.	12
(soft adj drink*).ti, ab.	1738
diet fads/ or energy intake/ 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10	28311
marketing.ti, ab.	254053
commercial.ti, ab.	14251
exp Mass Media/ Periodicals as Topic/	76707
marketing/ or advertising as topic/	36868
(adverti?ement or ads or advert or adverts or adverti?ed or adverti?ing).ti, ab.	32452
12 or 13 or 14 or 15 or 16 or 17	14774
11 and 18	9832
limit 19 to (English language and humans)	173466
limit 18 to "all adult (19 plus years)"	8164
	4294
	1137

1 **Table 3:** Quality appraisal of studies (risk of bias) included in a systematic review of the effects of food advertising in adults

Author (date)	Selection bias	Study design	Confounders	Blinding	Data collection	Withdrawals	Global rating
Anschutz <i>et al.</i> (2011)(25)	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate
Bellisle <i>et al.</i> (2009)(32)	Strong	Moderate	Moderate	Strong	Strong	Moderate	Moderate
Falciglia & Gussow (1980)(33)	Moderate	Moderate	Weak	Moderate	Strong	Moderate	Weak
Harris <i>et al.</i> (2009)(26)	Moderate	Moderate	Weak	Moderate	Strong	Moderate	Weak
Koordeman <i>et al.</i> (2010)(27)	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate
Messer <i>et al.</i> (2011)(30)	Strong	Moderate	Moderate	Strong	Moderate	Weak	Weak
Riskey (1997)(31)	Moderate	Moderate	Moderate	Strong	Moderate	Weak	Moderate
van Strien <i>et al.</i> (2012)(28)	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate
Wonderlich-Tierney (2010)(29)	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate

2 Key

Strong quality  four strong ratings with no weak ratings
Moderate quality  less than four strong ratings and one weak rating
Weak quality  two or more weak ratings

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4 All ratings reflect the lead reviewer’s appraisal (SM), excepting the global rating which was deduced by mutual consensus using the ratings
 5 derived from both reviewers (SM and LT).

1 **Table 4:** Characteristics and results of studies included in a systematic review of the effects of food advertising in adults

Author (date)	Sample size and gender	Procedure	Intervention and control	Primary outcome	Results	Reviewer's interpretation
Falciglia & Gussow (1980)(33)	102, all female	Showing of soap opera with 2 commercial breaks. Cookies available beforehand, and during TV viewing.	1) adverts for jelly (English jam) and breakfast cereal. 2) control: non-food adverts.	Concomitant snack food consumption (number of cookies).	Both condition (food advertising) and weight (obesity) significantly associated with increased food consumption (p<0.001). Significant interaction: food adverts increased consumption more amongst obese subjects..	Food advertising increased concomitant food intake amongst ♀, with greatest effect amongst obese subjects. Conclusion: Effective
Koordeman <i>et al.</i> (2010)(27)	51, all female	Showing of film with 2 commercial breaks. 3 types of soda or water available during TV viewing.	1) 4 soda adverts + 10 non-food commercials. 2) control: 4 water adverts + 10 non-food adverts.	Concomitant soda consumption (ounces).	Soda consumption for soda adverts>water adverts (p=0.027). Effect of advertising condition on water intake NS (p=0.187).	Advertising for sugar-sweetened beverages increased concomitant soda consumption amongst ♀. Conclusion: Effective

Riskey (1997)(31)	Not stated (American households)	Split-panel experiments in BehaviourScan markets, delivering advertising or no-advertising conditions to households.	1) TV advertising for Frito-Lay brands. 2) control: brand's adverts replaced with public service announcements.	Sales volume (percentage change).	57% adverts showed sizable sales volume increases in advertised households compared to controls. Average gain in sales volume between conditions = 15%. Smaller brands more successful than larger (83% vs. 27%) and innovations more successful than existing attributes (88% vs. 40%) in generating significant volume increases.	Food advertising increased purchases for slightly over half of advertisements. Conclusion: Effective
Bellisle <i>et al.</i> (2009)(32)	40, all female	5 days of experiments, each 7 days apart. Self-service meals of main dish and dessert provided at lunchtime.	1) participants ate in groups of 3. 2) participants ate alone with TV on (no food cues). 3) participants ate alone, with TV showing a series of food adverts. 4) participants ate alone, listening to the radio. 5) control: participants ate alone in a quiet room.	Concomitant food consumption (grams and calorie intake in kJ).	NS interaction between meal condition and eating restraint level on food intake. Overall, energy and main dish intake ($p < 0.05$), and degree of post-prandial fullness ($p < 0.0001$), lower in the group meal condition than the others, which did not significantly differ.	Food advertising did not affect concomitant food intake amongst ♀, compared to TV without food cues. Participants ate less in groups than when eating alone under other conditions. Conclusion: Not Effective
Wonderlich-Tierney (2010)(29)	83, 43 female	Showing of TV comedy program with commercial breaks totalling 20mins or no breaks. Cookies available during viewing.	1) 20mins of food adverts. 2) 20mins of non-food adverts. 3) control: no adverts.	Concomitant snack food consumption (number of cookies).	NS effect of advertising condition on consumption ($p = 0.64$).	Food advertising did not influence concomitant food consumption. Conclusion: Not Effective

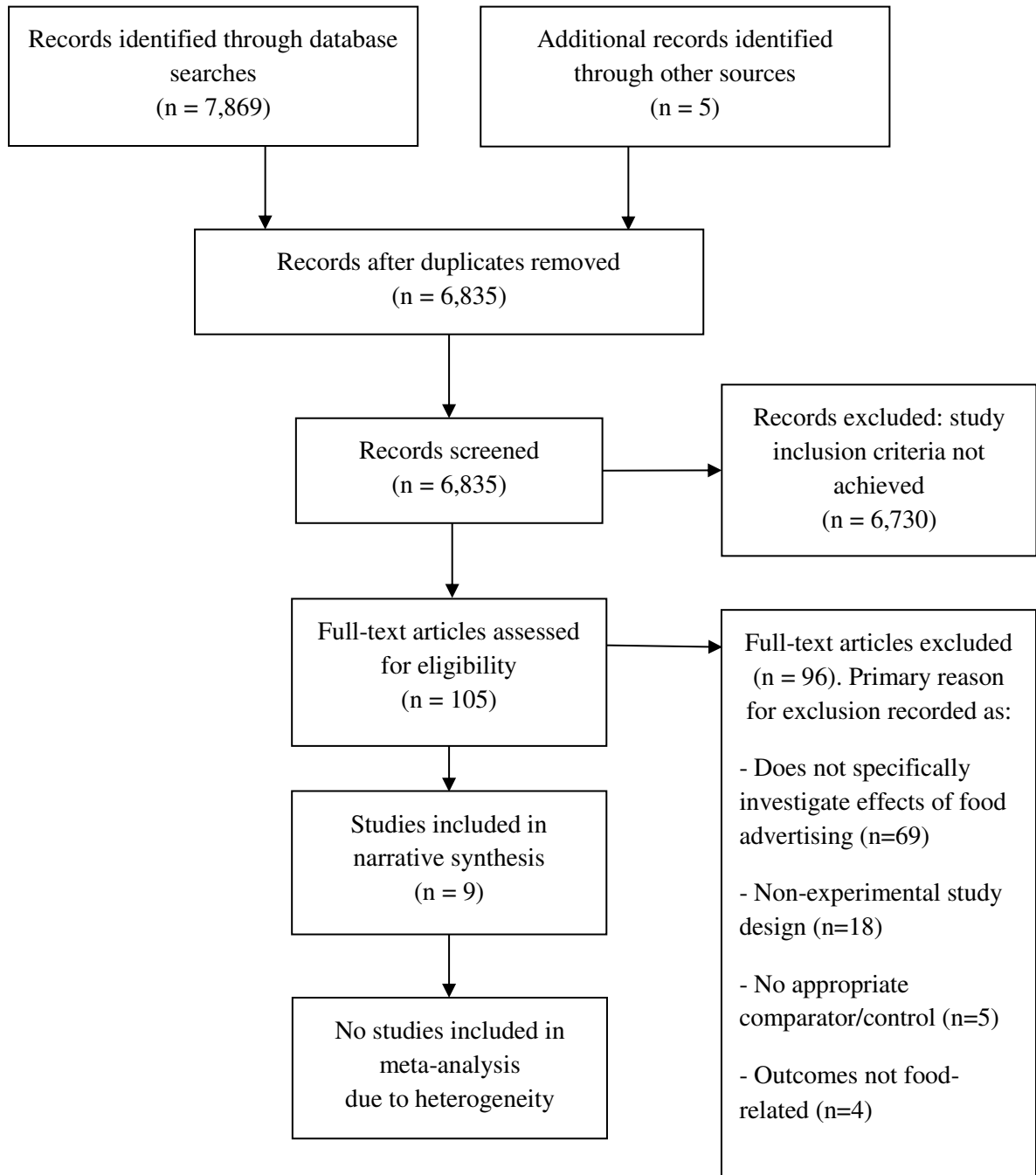
Anschutz <i>et al.</i> (2011)(25)	82, 41 female	Showing of nature film with 2 commercial breaks. Crisps, M&Ms and water available during viewing.	1) 6 adverts for energy-dense foods + 10 non-food adverts. 2) control: 16 non-food adverts.	Concomitant snack food consumption (calorie intake in kcal).	In ♀, food consumption for food adverts>neutral adverts; amongst ♂ consumption for neutral adverts>food adverts (p<0.05). Food intake in ♂>♀ (P<0.05). Addition of commercial condition to regression model predicting food intake showed NS increase in explained variance.	Food advertising showed opposite effect on concomitant food consumption for ♂ and ♀. Conclusion: Inconclusive
Harris <i>et al.</i> (2009)(26)	98, 60 female, 6 unknown gender	Showing of TV comedy program with 2 commercial breaks. Taste tests for ‘unhealthy’ and ‘healthy’ foods following viewing.	1) 7 non-food adverts + 4 food and beverage adverts with snacking message of ‘fun and excitement’ 2) 7 non-food adverts + 4 food and beverage adverts with nutrition message. 3) control: 7 same non-food adverts + 4 further non-food adverts.	Subsequent food consumption (standardized food consumption score).	Food consumption for snack adverts>nutrition adverts (p<0.01); snack adverts vs. control NS (p=0.08); nutrition adverts vs. control NS (p=0.30). Snack adverts had greatest effect on ♂ (interaction between advertising condition and gender p=0.04), and restrained eaters (interaction between advertising condition and eating restraint p=0.07). Food consumption for ♂>♀ (p<0.001).	Food advertising showed varying impact on subsequent food intake according to type of commercial (nutrition/snacking), gender, and eating restraint. Conclusion: Inconclusive

Messer <i>et al.</i> (2011)(30)	227, gender not stated	Participants indicated willingness to pay (WTP) for cash , a pen, and a hamburger, following media exposure.	1) 5min negative information video on BSE and nvCJD. 2) 5min positive video of TV beef adverts and radio adverts with magazine advert images. 3) negative information + positive advertising. 4) control: no media information.	Willingness to pay (WTP, value in \$).	Negative media information generated significantly lower WTP compared to controls (p=0.000). Positive generic advertising alone showed NS higher WTP (p=0.237). Negative information was counteracted by advertising, with combined conditions reporting WTP significantly higher than negative information alone, comparable with controls (p=0.004).	Food advertising did not significantly increase WTP from baseline, but significantly counteracted effects of negative media information. Conclusion: Inconclusive
van Strien <i>et al.</i> (2012)(28)	125, 65 female	Showing of film with 2 commercial breaks. Crisps, M&Ms and water available during viewing.	1) 6 commercials for energy-dense foods + 10 non-food adverts. 2) control: 16 non-food adverts.	Concomitant snack food consumption (grams).	In the external eating extreme-scores cohort, no main effect of advertising condition on food intake (p=0.71 chocolate; p=0.14 crisps). High external eaters in the food advertising condition ate more crisps than their counterparts in the non-food condition (p=0.025). In the full range cohort, main effect of commercial condition on intake of crisps observed (p=0.026), but not for chocolate.	Food advertising influenced concomitant intake of only one food type, with inconsistent results between data sets. Effect of commercial condition influenced by external eating status. Conclusion: Inconclusive

1 NS, not significant; kJ, kilojoules; kcal, kilocalories; BSE, Bovine spongiform encephalopathy; nvCJD, new variant Creutzfeldt-Jakob disease

1 **Figure 1:** Flowchart showing the systematic review process and refinement of results.

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Box 1: Additional sources searched for studies suitable for inclusion in a systematic review of the effects of food advertising in adults

Advertising Age: www.adage.com

Centre for Science in the Public Interest: www.cspinet.org

Food Politics, curated by Marion Nestle: www.foodpolitics.com

www.google.com (first 100 hits) for: 'food' AND 'advertising'; 'beverage' AND 'advertising

International Journal of Advertising; 2006, 25(2): Food advertising special edition

International Obesity Taskforce: <http://www.iaso.org/>

Sustain (National Food Alliance): <http://www.sustainweb.org>

UK Advertising Association: <http://www.adassoc.org.uk>

Networked Digital Library of Theses and Dissertations (Scirus Electronic Theses and Dissertations Search and Virginia Tech Libraries Visualizer search)

ProQuest Dissertations and Theses database

OpenThesis database

JISC mail lists (FOOD-FOR-THOUGHT, PUBLIC-HEALTH, PUBLICHEALTHFORNHS)