Television food advertisements and childhood obesity: A systematic review

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Abstract: The prevalence of childhood obesity has increased worldwide and various environmental factors have accelerated this trend. Several reports have suggested that food advertising causes childhood obesity. We proposed a review study to evaluate the relationship between TV food advertisements and obesity in children. By searching over electronic databases (including PubMed, Web of Science, Scopus, and Google Scholar), the reference lists of original studies, and reviews using key search terms, 1181 articles were identified. Out of these, only 9 articles met the inclusion and quality criteria. Most of the longitudinal study carried out at the national level have reported a significant association between commercial viewing and BMI in children. The duration of these studies varied between 7 months and 5 years. The children's TV viewing time was between 1.5 and 3.5 hours per day. Results of the reviewed studies have revealed a controversial attitude about the influence of TV food advertisements on obesity. However, three of four modeling studies indicated an increment in the prevalence of overweight and obesity following exposure to food advertisements. Further interventional and longitude studies are needed to achieve more precise results.

Keywords: BMI, child, obesity, TV food advertisement

Introduction

Childhood overweight and obesity are the increasing public health problems that have recently received significant public, political, and economic attention [1]. Childhood obesity increases the risk of non-communicable diseases (NCDs) such as type 2 diabetes (T2D), a cardiovascular disease which can lead to poor quality of life and shortened lifespan [2]. Various micro- and macro-obesogenic environments contribute to childhood obesity. At the micro level, individual-related factors such as consumption of a calorie-dense, nutrient-poor (EDNP) diet and low physical activity are the key risk contributors. At the macro level, which is often beyond the control of individuals, the food industry and governmental policies as well as the media have been recognized as a strong correlate of childhood [3, 4]. It is often assumed that the mechanism underlying the relationship between time spent with the media and obesity is due to the sedentary nature of television viewing. However, watching television is inevitably accompanied by large amounts of commercials for food products. Television food advertisement is dominated by advertising junk foods such as fast foods and unhealthy food categories [5]. Strong evidence has confirmed that exposure to TV food advertisements affects children's food preferences, eating behaviors, food consumption, and purchase requests [6–8]. However, the strength of this effect decreases with the length of the putative causal chain from advertising to obesity [9].

To the best of our knowledge, there are no systematic review papers about the long-term effects of TV food and beverage advertisement on childhood obesity with a focus on body weight as the main outcome. Therefore, the present study was conducted to review the related articles about the effects of TV commercials on body weight/ body mass index (BMI) in children.

Methods

The present study was conducted to review the research assessing the effects of TV food commercials on obesity in children. The results were expressed in terms of body

weight, BMI, and BMI z-score. The reporting procedures followed the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines [10].

Search strategy

A search strategy was employed to identify all the published studies that have evaluated the effects of TV food advertisements on body weight and BMI of children. The following electronic databases were searched to identify the relevant studies from 01/01/2000 to 01/01/2019: PubMed, Web of Science, Scopus, and Google Scholar. The databases were searched with the following terms and variations: TV OR Television OR mass media OR small screen OR video OF film AND food* OR beverage* OR drink* OR snack OR meal OR diet* AND advertisement OR announcement OR propaganda OR commercial OR ad AND child*, kid* AND obese* OR overweight OR weight OR BMI.

The reference lists of the retrieved articles were also searched to identify the potentially relevant studies. All the search results were imported in Endnote software for screening. The entire article-screening procedure was conducted independently by two individuals. In case of disagreement, a final decision was reached by discussion and consultation.

Inclusion and exclusion criteria

Studies were included if they: (i) enrolled children aged from 3 to 13 years old; (ii) evaluated the effect of TV food advertisements on children obesity with bodyweight or BMI or BMI z-score; and (iii) were published in an English language journal without limitation in the study design. Studies analyzing the effects of TV food advertisements on food preference, food choice, or other factors related to behavior and psychological factors and effects of screening time on obesity were excluded. Studies providing insufficient empirical evidence for our research question or being rated with a poor or fair quality score were excluded as well.

Study selection, data extraction strategy and quality assessment

Two reviewers independently screened all the study titles and abstracts for inclusion. Full articles of the potentially relevant studies identified from this first stage were retrieved and independently screened for eligibility by two reviewers. Disagreements were resolved through discussion and the reasons for exclusion were recorded for each of the excluded full-text articles. Two researchers also conducted data extraction independently, with disagreements being resolved through discussion. The data extracted included the study background information (i.e., authors and year of publication), target population characteristics, country, methodological characteristics (study design: quantitative versus qualitative), independent variable (i.e., any kinds of television advertisement), and outcome (e.g., BMI z-score, BMI, and body weight). The quality of the included studies was assessed using a critical appraisal skills program (CASP) [11].

Results

We identified 1,181 articles from the database searches and 2 articles from the reference lists of the identified articles (Figure 1). A total of 910 articles remained after removing the duplicates, of which 92 potentially relevant studies were identified from screening titles and abstracts and retrieved as the full texts. Following the full-text review, 83 of these studies were excluded, of which only 9 were eligible and were included in the review (Figure 1).

The characteristics of the included studies are presented in Table 1 with regard to their methodology [8, 12–19]. Also, 4 out of the 9 included studies were modeling studies that have simulated the effects of TV food advertisements on body weight or obesity [8, 13, 16, 18]. The age range of the participants in the included studies was between 3 and 13 years old and, only in the 2 studies, the mean and standard deviation of the ages were reported. The children's TV viewing time was between 1.5 and 3.5 h per day. However, most of the included studies were from the USA and European countries and only one study was conducted in South Korea [15]. In the descriptive studies, the follow-up duration was varied from 7 months to 5 years. Nevertheless, in some of the studies, the effect of TV food advertisements on food intake such as the number of sugar-sweetened beverages was evaluated as a secondary outcome.

Discussion

We found nine articles that examined the effects of food advertising on body-mass-index (BMI) [8, 12–19]. With the chronological order, the first article in this area was conducted by Lobstein et al. [18]. Their work was a secondary analysis of data in 1996 about TV advertisement for children based on the average of only 20 h of recording on commercial channels. They found a significantly positive association between the share of overweight children and number of television advertisements for sweet or fatty foods broadcast in a 20-h period in nine countries (seven EU countries, the USA, and Australia). They estimated that TV food advertising could explain up to half of the variation between the prevalence of overweight in

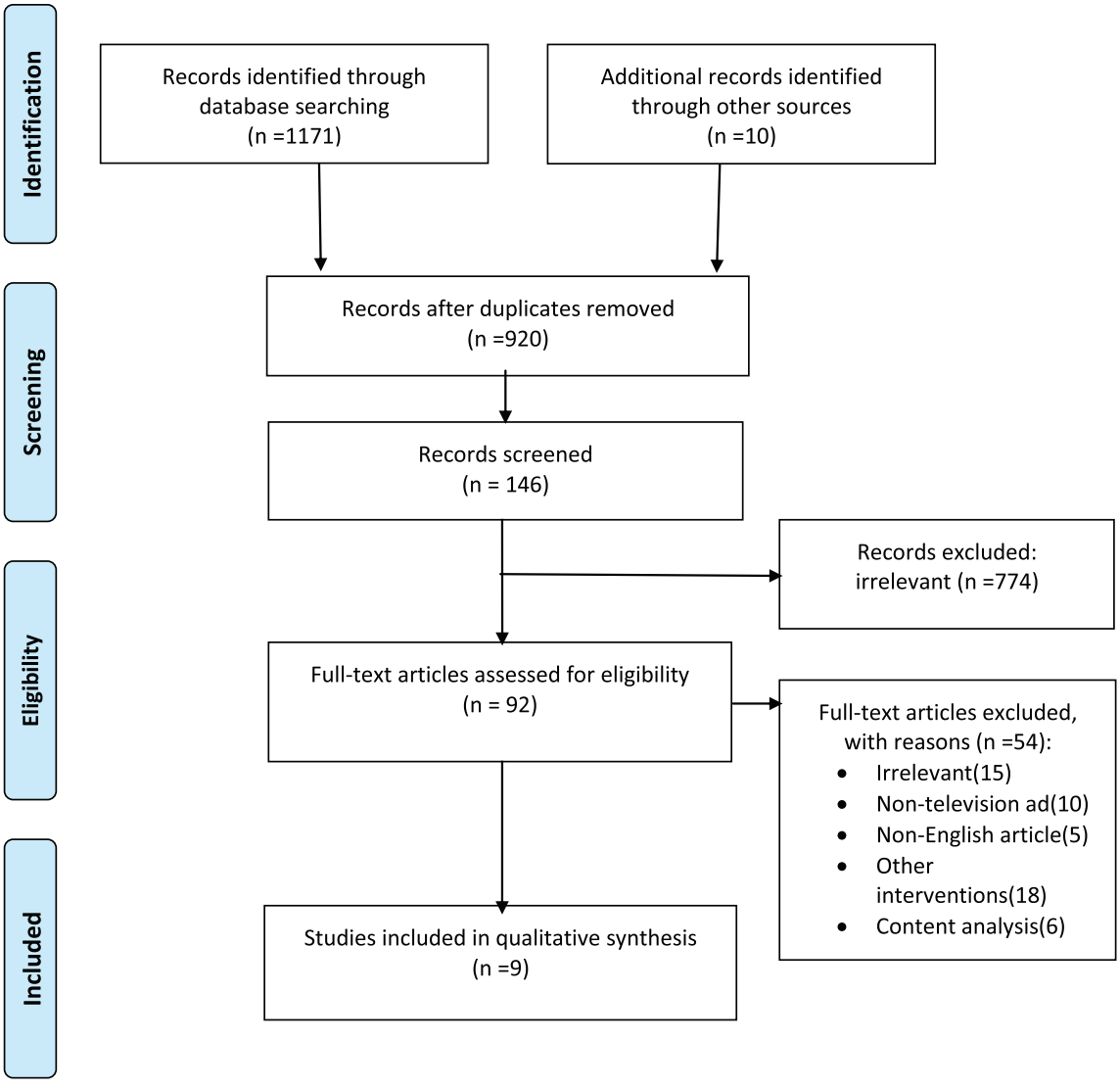

Figure 1. PRISMA (preferred reporting items for systematic reviews and meta-analyses) flow diagram of study selection.

different countries [18]. Furthermore, a recent study by Zimmerman et al. (2010) revealed a significant association between viewing commercials in 1997 and BMI z-score in 2002 for children aging 0–6 years old [17].

In modeling study in six Western countries, the impact of a TV advertisement on BMI and prevalence of obesity was simulated in children with the age of 6–11 years old. Estimates of the average exposure of children to TV food advertising ranged from 1.8 min/day in the Netherlands to 11.5 min/day in the United States. As a result, the prevalence of childhood obesity was estimated at about 16–40% in the United States, 10–28% in Australia and Italy, and 4–18% in Great Britain, Sweden, and the Netherlands [8].

The results of another modeling study conducted by Veerman et al. suggested that one in every 3 to 7 obese children in the United States might not have been obese in the absence of advertising for unhealthy food on TV. They estimated that reduction of food advertisement to zero would decrease the average BMI by 0.38 kg/m^2 and lower the prevalence of obesity from 17.8 to 15–16% in the United States [16]. However, the results from the United States were not comparable with those from other countries with less prevalence of obesity and amount TV food advertising than the United States.

Chou et al. (2008) analyzed data from the 1979 Child-Young Adult National Longitudinal Survey of Youth and concluded that exposure to fast food advertising increased BMI in children. Although their work was the secondary analysis of pooled samples from a different year, they reported that reducing fast food restaurant advertising to about 30 min/week decreased the number of overweight

Table 1. Summary of included studies with measured outcomes

Author: year	Country	Study design	Population (N)	Age range (years)	Exposure	Type of food advertised	Baseline BMI z score Mean (SD) (kg/m^2)	Baseline body weight Mean (SD) (kg)	Baseline over weight and obesity (%)	Screen time (hr/day)	Follow up duration (month)	Findings
Lobstein, T et al; 2005	Australia	Ecological study	1985	7–11	Number of sweet/fatty foods TV advertisement per hours	Sweet/fatty foods TV advertisement	–	–	19.9	–	–	Increment in prevalence of overweight and obesity
	USA		Not report	6–11					26.00			
	UK		Not report	6–15					19.6			
	France		1499	7–9					16.1			
	Germany		Not report	7–11					16.1			
	Denmark		Not report	7–11					13.5			
	Greece		Not report	7–12					14.3			
	Netherlands		14500	7–12					17.5			
	Finland		64,147	7–11					12.3			
	Sweden		Not report	9–11					16			
Chou Sh.Y et al; 2008	USA	Ecological study	1997	3–11	Decrease fast-food restaurant advertising about 30 min/week	Fast food	17.60 (4.63)	–	–	3.62 (3.64)	12	Reduce the number of overweight in a fixed population by 18% (decline for boy approximately 4% larger than girls)
Goris, J, et al; 2009	Australia	Ecological study	1688	6–11	Unhealthy food advertising on TV about 4.9 min/day	–	–	–	Boy: 26.6 Girl: 30.8	1.93	–	Increase prevalence of obesity about 10–28%
	England		4238		Unhealthy food advertising on TV about 2.4 min/day		–	–	Boy: 23 Girl: 27.1	2.4		Increase prevalence of obesity about 4–18%
	Italy		21544		Unhealthy food advertising on TV about 6.2 min/day				Boy: 32.2 Girl: 28.9	2.33		Increase prevalence of obesity about 10–28%
	Netherlands		43393		Unhealthy food advertising on TV about 1.8 min/day				Boy: 14.5 Girl: 15.9	2.00		Increase prevalence of obesity about 4–18%
	Sweden		913		Unhealthy food advertising on TV about 2.9 min/day				Boy: 19.9 Girl: 23.8	1.5		Increase prevalence of obesity about 4–18%
	USA		981		Unhealthy food advertising on TV about 11.5 min/day	–	–	–	Boy: 32.2 Girl: 34	3.31		Increase prevalence of obesity about 16–40%
Veerman, J.L et al; 2009	USA	Ecological study	NR	6–12	Zero TV food advertisement	–	–	–	17.8% obese and 16.3% overweight	From 80.5 min/ week to zero	–	Decrease the BMI by 0.38 kg/m and lower the prevalence of obesity from 17.8 to 15–16% Decrease total consumption by 4.5%.

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Table 1. (Continued)

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Zimmerman, F.J et al; 2010	USA	cohort study	2037	7–13	TV food advertisement	–	0.28 (1.34)	–		1.47 (1.25)	60	commercial viewing was significantly associated with greater BMI z scores in 2002 (BMI z score: 0.58 (1.13))
Andreyev. T et al; 2011	USA	cohort study	9760	6–11	Advertising on TV	Soft drink and fast food	0.668 (1.113)	–	–	2.362 (1.245)	24	BMI increase in overweight and obese children but not in normal ones. 9.4%, 1.1% rise in children's consumption of soft drinks and fast food
Beales, J.H et al; 2013	USA	Ecological study	1867	2–13	TV food advertisement	–	17.74 (4.78)	–	–	1.437 (1.336)	60	No significant relationship
Lee, B et al; 2014	South Korea	Cross-sectional study	2418	11–13	TV food advertisement	Energy-dense/ nutrient-poor food	18.65 (0.09)	–	–	2.11	7	Children in the highest total EDNP food advertising exposure quartile had twice the risk of being overweight/obese (odds ratio, 2.41; P for linear trend <0.001).
Powell, L; et al; 2017	USA	Cohort study	8340	8–11	Advertising on TV	Soft drink and fast food and cereal	66.2 (29.5)	–	–	2.5 (1.3)	36	Cereal advertising was significantly associated with increase in BMI but exposures to fast-food and soft drink advertisements were not.

and obese children in a fixed population by 18% (decline for boys was approximately 4% larger than girls) [14].

Another research conducted on 2419 children aged 11–13 years old to estimate actual exposure to food advertising during last 7 months showed that children's exposure to television advertising for EDNP food in the highest television viewing quartile led to a three-fold increase in the overweight or obesity relative to children in the lowest quartile. However, after adjusting for the overall amount of television watched, these relationships vanished for all the food groups [15].

In another study, Beales et al. retrospectively analyzed dairy data of 1867 children to assess the effects of total television viewing and food advertisement on BMI states. Contrary to the previous studies, they reported no significant relationship between food advertisements and children's BMI. They suggested that restrictions on television advertising for children are unlikely to have a significant effect on childhood overweight and obesity [13].

To the best of our knowledge, all the mentioned studies have used secondary data and simulation models to predict the association between TV food commercials and being overweight. The only original study in this field was done by Andreyeva, who took a nationally representative sample from Early Childhood Longitudinal Survey-Kindergarten Cohort (ECLS-K) and the Nielsen Company data on television advertising of cereals, fast food restaurants, and soft drinks from 9760 children aged 6–11 years old between 1998 and 2007. The results indicated lack of any detectable links between overall advertising exposure and average body weight, but fast food advertising was significantly associated with higher BMI for overweight and obese children (85^{th} BMI percentile), revealing detectable effects for a vulnerable group of children [12].

The mechanisms, by which TV food advertising affects obesity in children, are likely to vary by contextual and individual factors. Findings from previous studies have revealed that following exposure to TV food advertising, food decisions by children were made faster and tended to favor taste over health. For example Sadeghirad et al. found that 3.8 min of food marketing increased immediate calorie consumption of about 30.4 kcals in children, but its long term effects were not investigated properly [20]. However, long screen time was independently related to the childhood obesity via decreasing physical activity [21].

Strengths and limitations

As far as we know, in the most of the previous studies, the effect of TV food advertising on dietary intakes and food choice has been reviewed [22], but the effects on body weight and BMI are not reviewed. Therefore, our study was the first, in which the effect of TV food advertising on the prevalence of childhood overweight and obesity was systematically review. However, the present results included only high quality publications with large sample size which could be considered as the best representative of the large population.

There may have been limitations in the lack of enough information and heterogeneity in the study design in the included studies, which restricted us to conduct meta-analysis to reach conclusive results. However, most of the studies conducted in this topic have had an ecological design and used modeling methods for simulating the effect of TV food advertising on the prevalence of childhood overweight and obesity. Results from ecological studies are prone to ecological fallacy. Ecological studies examine large groups of people, instead of individuals, and typically investigate the association between outcome measures using correlation analysis. The results are therefore open to bias [23].

Conclusion

The results of the reviewed studies indicated a relatively controversial idea about the influences of TV food advertisements on obesity, which may be due to the heterogenic design and data of the included studies. As mentioned before, there are scarce original studies that evaluate the effect of TV food advertisements on childhood obesity [16] and lack of interventional studies makes it difficult to obtain a decisive conclusion. Therefore, further interventional and longitude studies are needed to achieve more precise results.

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