

# Food and beverage advertising on children's web sites

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## What is already known about this subject

- Food and beverage advertising contributes to childhood obesity.
- Display advertising on children's web sites is a prominent technique used to promote food to children.
- Industry self-regulation has not substantially improved food marketing to children in other media, such as television and food company web sites.

## What this study adds

- More than 3 billion display advertisements for food and beverages were viewed on popular children's web sites from July 2009 to June 2010.
- Three-quarters of these advertisements promoted brands that food companies identified as healthier dietary choices to be included in child-directed food advertising.
- However, 84% of these ads promoted products high in fat, sugar and/or sodium.

## Summary

**Background:** Food marketing contributes to childhood obesity. Food companies commonly place display advertising on children's web sites, but few studies have investigated this form of advertising.

**Objectives:** Document the number of food and beverage display advertisements viewed on popular children's web sites, nutritional quality of advertised brands and proportion of advertising approved by food companies as healthier dietary choices for child-directed advertising.

**Methods:** Syndicated Internet exposure data identified popular children's web sites and food advertisements viewed on these web sites from July 2009 through June 2010. Advertisements were classified according to food category and companies' participation in food industry self-regulation. The percent of advertisements meeting government-proposed nutrition standards was calculated.

**Results:** 3.4 billion food advertisements appeared on popular children's web sites; 83% on just four web sites. Breakfast cereals and fast food were advertised most often (64% of ads). Most ads (74%) promoted brands approved by companies for child-directed advertising, but 84% advertised products that were high in fat, sugar and/or sodium. Ads for foods designated by companies as healthier dietary choices appropriate for child-directed advertising were least likely to meet independent nutrition standards.

**Conclusions:** Most foods advertised on popular children's web sites do not meet independent nutrition standards. Further improvements to industry self-regulation are required.

**Keywords:** Children, display advertising, food marketing, Internet.

**Abbreviations:** CFBAI, Children's Food and Beverage Advertising Initiative; FTC, Federal Trade Commission; IWG, Interagency Working Group on Food Marketed to Children; RACC, reference amount customarily consumed per eating occasion.

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## Introduction

Marketing calorie-dense, nutritionally poor foods and beverages to children contributes to childhood obesity (1–4). Food marketing increases children's preferences and requests for advertised products and negatively affects children's diet and long-term health (3). On television alone, children in the United States view 12.7 food and beverage advertisements on average every day, and 86% of those ads promote products high in sugar, saturated fat and/or sodium (5). On the Internet, US companies spent \$113 million in 2009 on food advertising targeted to children and adolescents (6), including food company-sponsored entertainment web sites and display advertisements (appearing at the top, side, or as pop-ups on web pages) (7) on other companies' (i.e. third-party) web sites. Youth-targeted Internet food marketing expenditures increased 60% from 2006 to 2009, and three-quarters of these expenditures promoted cereal, fast food restaurants, beverages and snack foods (6).

Internet-based advertising raises concerns due to the amount of time children spend on the computer: 46 min per day on average for 8- to 10-year-olds and 1 h and 46 min for 11- to 14-year-olds in the United States (8). Internet advertising often occurs while children are actively engaged with other material (e.g. playing a game) (9,10) and blurs the lines between advertising and content (11). As a result, children have difficulty identifying Internet advertising (12,13) and its persuasive intent (13,14), and these abilities may develop at a later age compared to television advertising (12). Therefore, Internet advertising may be more impactful than television advertising, especially for young children. Yet, few safeguards exist to protect children from Internet advertising (11). While advertising on children's television is limited to 10.5 to 12 min per hour (15) and advertising embedded within children's television programming (i.e. product placements) is prohibited in the United States (16), there are no restrictions on the amount of advertising nor advertising embedded with entertainment content on children's web sites. Advertisers must only post a notice to indicate that the content is advertising (16).

Display advertising is the most common form of advertising on the Internet (17). An estimated 98% of children's web sites permit advertising and more than two-thirds of youth-targeted sites rely primarily on it for revenue (18). Child-targeted display advertisements are highly engaging and eye-catching; they commonly use large text, bright colors, dynamic images, animation or games and interactive activities embedded within the ad to attract attention (19–22).

Display advertisements often contain links to drive traffic to the advertiser's web site (20–23) or encourage product purchase (21,24). However, even when un-clicked, display advertisements increase brand loyalty (9), brand and ad awareness (9), and favourable brand attitudes (25). Research examining food advertising to children on the Internet has focused primarily on food company-sponsored web sites (11,26–28), especially the common use of sites with branded games (i.e. 'advergames'). These advergame web sites attract millions of young visitors per month (29) and affect children's snack choices and consumption (29–31). A few studies have examined food company display advertising on popular third-party children's web sites (19,28,32). The Federal Trade Commission (FTC) documented approximately 2.1 billion food and beverage display ads viewed on children's web sites in 2009 (6), and recent reports analyzed display advertisements on children's sites promoting cereal, fast food and sugary drinks (20–22,33).

To address concerns about unhealthy food advertising to children, 16 companies in the United States have joined the Children's Food and Beverage Advertising Initiative (CFBAI) and pledged to advertise only healthier dietary choices to children (34), including in display advertising on child-directed web sites (35). However, this voluntary programme has been criticized by public health experts for numerous limitations in company-defined standards (5,36). For example, participating companies set their own nutrition criteria for products that can be advertised to children (37) and their pledges cover advertising only in child-directed media, which most companies define as television programmes or web sites with an audience composition of 35% or more children under 12 (38). Research examining television and food company-sponsored web sites has shown that food companies continue to advertise unhealthy products in media widely viewed by children despite these pledges (5,36,39). To address limitations of the CFBAI, in 2009, the US Congress commissioned an Interagency Working Group on Food Marketed to Children (IWG) with representatives from four government agencies to develop more effective guidelines for responsible food marketing to children (40). Despite widespread support by the public health community for the IWG proposed guidelines (41,42), substantial lobbying by the food industry forestalled formal publication of the proposals (43).

In light of extensive use of display advertising on children's web sites, the potential for harmful effects of unhealthy food advertising targeting children in this way, and questions about the effectiveness of CFBAI

pledges to reduce unhealthy food advertising to children, it is important to monitor this form of food advertising on children's web sites. This study is the first to thoroughly document all food and beverage display advertisements viewed on these web sites and the nutritional quality of brands promoted in these ads. This analysis also assesses the proportion of advertising covered by CFBAI self-regulatory pledges.

## Methods

Researchers first identified popular children's web sites and quantified display advertising on those sites. Each ad was classified according to whether it promoted a food, beverage, restaurant or non-food product. Food ads were further classified by company, category, whether the company participated in the CFBAI, and whether products from CFBAI companies were approved for child-directed advertising (44). Finally, the nutritional quality of advertised packaged foods was evaluated using proposed IWG nutrition standards (38).

### Display advertising on children's web sites

Syndicated data from comScore provided information on visitors to children's web sites and display advertisements that appeared on those web sites during a 12-month period (July 2009 through June 2010). comScore maintains the largest existing Internet audience measurement panel, capturing behaviour of approximately 250 000 individuals in the United States monthly (45). It tracks web site visitation by different computer users within the same household without requiring logon (42). comScore provides numbers of unique visitors by age group for web sites visited by 30+ panel members in the age group that month and extrapolates these data to represent the total US population (45).

Popular children's web sites were identified using comScore's Media Metrix Key Measures Report. Child-targeted web sites included in this analysis met three criteria (46): they (1) were visited by 100 000+ different children (2–11 years) on average per month; (2) had an average monthly child-audience share of 20%+, calculated by dividing the number of child visitors by total visitors to the web site (i.e. more than twice the 9.5% of all Internet visitors that are children); and (3) contained child-targeted features. All web sites listed by comScore as 'Kids' Entertainment' sites were identified as having child-targeted content. Researchers also visited all other web sites that met the first two criteria to determine whether they contained child-targeted features identified in previous

studies, including animated characters and interactive content designed for children (i.e. online games, virtual worlds, avatars or virtual pets) (11,19,21). Sites that addressed a specific audience (e.g. parents, teachers, teens) and sites for shopping, information regarding non-online games and gaming sites offering cash or other prizes were excluded.

The comScore Ad Metrix Advertiser Report provided total number of display ads viewed (i.e. impressions) on each of the children's web sites. comScore provides display ad impressions at the company and product level (i.e. brands, web sites and promotions) for products with 10+ impressions by panel members that month (45). Researchers identified food products using the company name or, if the company also produced non-food products, the product name. Nutrition supplements and supermarkets were classified as non-food. Food products were classified by category according to the IWG definitions of food categories advertised most often to children (38). Separate categories for energy and sports drinks, other non-carbonated beverages, fast food restaurants, other restaurants and fruits and vegetables also were included. Food products not in one of these categories were classified as 'all other'. Advertisements for web sites, promotions and companies, were classified as 'unidentifiable'. If comScore listed a brand with varieties in more than one food category, the brand was assigned to the category with the most varieties, as identified in the following nutrition analysis. Companies participating in the CFBAI were noted, as well as whether products were approved by companies for child-directed advertising as of May 2009 (44).

For all children's web sites identified, researchers calculated the monthly number of display ad impressions and the percentage of total impressions for food products. The estimated number of food ads viewed (i.e. average food ad impressions) per month per unique visitor was calculated by multiplying food ad impressions by child-audience share and dividing by average number of unique child visitors.

### Nutrition analysis

The nutritional quality of advertised brands was evaluated using the standards proposed by the IWG to identify foods that should be advertised to children (41). Researchers collected nutrition information from company web sites during December 2011 and January 2012, including serving size (g) and calories, sugar (g), saturated fat (g), trans fat (g) and sodium (mg) per serving. If information was not available on the web site, researchers called companies'

customer service help lines. As in studies of television advertising to children, restaurant foods were excluded from this analysis (5,47). Fast food display ads in 2009 had been thoroughly analyzed in a previous study (21). 'Unidentifiable' food products, food products comprised of multiple brands (e.g. Post Cereals) and products without available nutrition information also were excluded.

The comScore product designation typically specifies brand name (e.g. Capri Sun) but not individual variety (e.g. Capri Sun Sunrise Orange). For all brands included on CFBAI companies' lists of foods approved to advertise to children, only varieties listed on companies' pledges as of May 2009 (44) were included in the analysis. To evaluate the nutrition quality of all other brands, nutrition information was collected for all varieties listed on company web sites, excluding seasonal varieties and variety packs. If nutrition information was provided for multiple sizes of the same food, one size was included. For beverages (sometimes available in kids' or mini sizes), smaller sizes and an 8-oz size (or closest equivalent) were included. If a brand included varieties within multiple food categories (e.g. Twix candy and ice cream), only varieties within the category with the most varieties were included (i.e. Twix candy).

The IWG standards specify maximum amounts of nutrients to limit, including saturated fat, trans fat, sugar and sodium (41). These criteria were applied to all varieties using the nutrition data obtained, with adjustments for naturally occurring saturated fat and sugar, as proposed in the IWG guidelines (see Table 1) (41). The percent of varieties for each brand that met each nutrient target were computed. The IWG guidelines proposed that foods also must contribute to a healthful diet by containing specific amounts of fruit, vegetable, fat-free or low-fat dairy, whole grain, extra lean meat, eggs, nuts or seeds or beans (41). However, the nutrition facts panels did not provide the necessary information, so this standard could not be used for this analysis.

For each brand, the percentage of varieties that met IWG nutrition standards was multiplied by the number of display ad impressions on children's web sites. These numbers were used to calculate the weighted average percentage of impressions (i.e. % impressions or ads viewed) that met IWG nutrition standards for all foods, each food category and by CFBAI status.

### Validation of classification methods

To validate assumptions used to select and classify food varieties, researchers collected a sample of

**Table 1** IWG standards for nutrients to limit (41)

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Saturated fat:	1 g or less per reference amount customarily consumed per eating occasion (RACC) or per 50 g for foods with small RACC and 15% or less of calories for individual foods (per 100 g and less than 10% of calories for main dishes and meals).
Trans fat:	0 g (<0.5 g) per RACC or per 50 g for foods with small RACC for individual foods (per serving for main dishes and meals).
Added sugar:	No more than 13 g of added sugar per RACC or per 50 g for foods with small RACC for individual foods (per serving for main dishes and meals).
Sodium (interim limit):	No more than 210 mg per serving for individual foods (450 mg per serving for main dishes and meals).
Adjustments to nutrients reported on nutrition facts panels:	
1.	Some targets for nutrients to limit are based on RACC with adjustments for foods with small RACC (30 g or less) (38). For these foods, nutrient limits were applied per 50 g.
2.	Nutrient limit targets differ for individual foods and main dishes and meals (38). Prepared foods and meals were classified as main dishes or meals if they had a serving size $\geq 170$ g and contained at least two food groups.
3.	As proposed in IWG guidelines (41), adjustments were made for naturally occurring sugar and saturated fat such that it did not count towards nutrient limits. Sugar contained in fruit products (not in heavy syrup), 100% fruit juice and vegetables did not count towards sugar limits. Naturally occurring sugar in fat-free or low-fat milk and yogurt was estimated using naturally occurring sugar in the same quantity of fat-free plain milk or yogurt listed on the USDA National Nutrient Database for Standard Reference (48) and subtracted from total sugar to obtain estimated added sugar for these products. Additionally, saturated fat reported in fat-free or low-fat dairy products, extra lean meat or poultry, fish, nuts, seeds, fruit or vegetables not in sauce was considered naturally occurring and did not count towards saturated fat limits.

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display advertisements ( $n = 881$ ) that appeared in February 2011 on the 10 children's web sites with the most food advertising (see online Supporting Information for detailed methods and results). Agreement with the study methods was good: 80% of food ads received the same food category and 77% received the same CFBAI status using both methods. Most differences were due to previously unidentifiable ads (e.g. company-level ads) that

**Table 2** Unique child visitors and food ad impressions per month on popular children's websites

Web site	Unique child visitors (ages 2–11)		Food ad impressions		
	Average visitors per month (000)	Child-audience share*	Impressions per month (000)	% of total impressions	Average impressions per unique visitor per month
Nick.com	2690	29%	84 769	32%	9.1
NeoPets.com	605	27%	66 256	15%	30.0
CartoonNetwork.com	2615	30%	45 859	37%	5.3
Disney Channel	1786	22%	38 451	27%	4.7
Roblox.com	713	31%	16 839	11%	7.3
Millsberry.com	406	29%	9148	70%	6.6
CoolMath-Games.com	880	34%	6066	19%	2.3
iCarly.com	900	33%	3146	41%	1.2
NickJr.com Playtime	886	24%	2431	7%	0.7
FunSchool.com	161	23%	2298	12%	3.3
Yahoo! US Kids	269	26%	912	25%	0.9
HotWheels.com	224	33%	825	15%	1.2
Barbie.com	903	34%	775	5%	0.3
CoolMath4Kids.com	294	31%	671	22%	0.7
KidsWB.com	148	32%	633	6%	1.4
Playhouse Disney	597	27%	594	13%	0.3
FunBrain.com	1222	28%	490	8%	0.1
EdEddNEddy.com	189	29%	421	47%	0.6
PollyPocket.com	273	33%	362	11%	0.4
SproutOnline.com	249	39%	356	4%	0.6

Source: comScore Media Metrix Key Measures Report and Ad Metrix Advertiser Report (July 2009–June 2010).

\*Unique child visitors/all visitors.

could be assigned to a category or CFBAI status by viewing the ad. Of note, the study methods somewhat overstated the percent of CFBAI company products that were approved for child-directed advertising.

## Results

Seventy-two popular children's web sites were identified in this analysis. More than two-thirds ( $n = 49$ ) displayed advertisements for food products, 10 displayed advertising for non-food products only, and 13 did not contain display advertising. Child-audience shares for children's web sites with food advertising ranged from 21% to 72%. Just 11 web sites had a child-audience share of 35% or higher. From July 2009 to June 2010, 3.4 billion display ads for 254 different food products were viewed on children's web sites, representing 21% of ads on these sites.

Table 2 presents the 20 children's web sites with the most food advertising. These sites accounted for

more than 99% of food ad impressions. Four web sites – Nick.com, NeoPets.com, CartoonNetwork.com and Disney Channel – accounted for 83%. Nick.com displayed more than 1 billion advertisements for food over the 1-year time period; approximately one in three ads viewed on the site. Additional sites with higher-than-average proportions of food ads included Millsberry.com (70% of ads), BobTheBuilder.com (59%), EdEddNEddy.com (47%), iCarly.com (41%) and CartoonNetwork.com (37%). Table 2 also provides average number of food ads viewed per month by each visitor to the children's sites. The most food ads-per-visitor occurred on NeoPets.com (30.0 impressions per month), followed by Nick.com (9.1) and Roblox.com (7.3).

Table 3 presents annual display advertising by food category. Food products that could not be assigned to a specific category included those classified as 'all other' ( $n = 22$ ), web sites and promotions ( $n = 3$ ), and company-level ads ( $n = 40$ ), representing 7% of food display ad impressions. Cereals accounted for nearly one-half (45%) of food ads viewed on

**Table 3** Food ad impressions and nutritional quality of brands advertised on popular children's web sites by food category

Food category	Food ad impressions on children's web sites				Nutrition analysis using proposed IWG standards					
	Impressions per year (000)	% from CFBAI companies	% CFBAI for approved brands	Brand varieties	Met standards for nutrients to limit <sup>†</sup>			Sodium	All	
					Saturated fat	Trans fat	Added sugar			
All food*	3 405 928	89%	83%	2701	86%	99%	22%	80%	16%	
Breakfast cereals	1 537 357	98%	97%	97	100%	100%	3%	84%	3%	
Fast food restaurants	656 582	64%	64%	0	–	–	–	–	–	
Prepared foods and meals	266 133	96%	96%	511	8%	97%	33%	19%	0%	
Dairy products	166 523	96%	100%	216	93%	100%	95%	93%	87%	
Frozen and chilled desserts	155 743	100%	98%	131	98%	100%	74%	100%	74%	
Snack foods	131 668	100%	84%	203	84%	100%	15%	89%	3%	
Other non-carbonated beverages	114 069	98%	94%	238	100%	100%	31%	100%	31%	
Other restaurants	40 571	0%	0%	0	–	–	–	–	–	
Candy	40 396	95%	0%	129	27%	100%	13%	100%	0%	
Baked goods	40 266	32%	43%	107	82%	98%	84%	91%	68%	
Energy and sports drinks	6 714	26%	55%	50	100%	100%	22%	100%	22%	
Carbonated beverages	4 060	100%	0%	19	100%	100%	43%	100%	43%	
Fruits and vegetables	456	10%	0%	346	99%	100%	94%	85%	79%	

Source: comScore Media Metrix Key Measures Report and Ad Metrix Advertiser Report (July 2009–June 2010).

\*All food includes all others category, and unidentifiable products, not listed in table.

<sup>†</sup>Weighted average percentage of impressions that met each standard.

**Table 4** Food ad impressions and nutritional quality of brands advertised on popular children's web sites by CFBAI status

CFBAI status	Food ad impressions on children's web sites per year (000)	Nutrition analysis using proposed IWG standards					
		Brand varieties	Met standards for nutrients to limit <sup>†</sup>				
			Saturated fat	Trans fat	Added sugar	Sodium	All
CFBAI companies*	3 029 072	1618	87%	99%	20%	80%	14%
Approved brands	2 523 091	241	90%	100%	18%	80%	14%
Other brands	320 001	1377	48%	91%	52%	82%	20%
Other companies	376 857	1083	74%	99%	89%	77%	62%

Source: comScore Media Matrix Key Measures Report and Ad Matrix Advertiser Report (July 2009–June 2010).

\*CFBAI companies include unidentifiable products, not listed in table.

<sup>†</sup>Weighted average percentage of impressions that met each standard.

children's sites, followed by fast food restaurants (19%). Prepared foods and meals ranked third at 8% of food ads viewed. Fruits and vegetables was the least advertised category representing 0.01% of food display ads.

Of the 3.4 billion food ads viewed on children's web sites, 89% were placed by CFBAI participants. Eighty-three percent of CFBAI company ads promoted brands approved for child-directed advertising. However, CFBAI companies also placed 320 million impressions for brands not approved for child-directed advertising, including 95% of candy ads on children's web sites and 100% of carbonated beverage ads. CFBAI companies placed a lower percentage of fast food ads (64%) and 32% or fewer of ads for other categories, including other (i.e. not fast food) restaurants, baked goods, energy and sports drinks, and fruits and vegetables.

### Nutritional quality of advertised foods

Food products excluded from the nutrition analysis included restaurants ( $n = 58$ ); brands without available nutrition information ( $n = 10$ ); products with multiple brands ( $n = 5$ ); and unidentifiable products ( $n = 43$ ). The final nutrition analysis included 2701 varieties of 138 brands, totalling 2.5 billion ads viewed on popular children's web sites and 73% of food ad impressions (see Table 3).

Just 16% of food ads viewed on children's web sites met IWG standards for sodium, saturated fat, trans fat and added sugar. The majority of advertised products met limits for sodium, saturated fat and trans fat, but just one-fifth of ads promoted products that met added sugar limits, including only 3% of impressions for cereal brands. In addition, less than 0.1% of ads for prepared foods and meals met all standards. Ads for dairy products, fruits and vegetables, frozen and chilled desserts,

and baked goods were most likely to meet all IWG standards for nutrients to limit, although each category comprised less than 5% of food ads viewed on children's web sites. In addition, while some products in the frozen and chilled desserts and various beverage categories met standards for nutrients to limit, they would be unlikely to meet the IWG requirement that advertised foods also contain ingredients that provide a meaningful contribution to a healthful diet.

As presented in Table 4, CFBAI companies were less likely to advertise products that met IWG nutrition standards compared with non-participating companies. Just 14% of CFBAI company impressions promoted products that met IWG standards compared with 62% of impressions for products advertised by other companies. Further, brands that met CFBAI companies' nutrition standards for child-directed advertising were less likely to meet IWG nutrition standards than their other brands, primarily due to sugar content of approved brands. Just 18% of ads from CFBAI companies for approved child-targeted brands met sugar limits, while 52% of ads for their other brands met this standard. Of note, 89% of ads placed by non-participating companies met the sugar limit.

### Discussion

This study is the first to comprehensively evaluate food advertising on children's web sites and the nutritional quality of advertised products. With 3.4 billion display ads viewed on popular children's web sites for food products during a 1-year period (21% of all display ads on these sites), display advertising on third-party web sites remains an important advertising technique for food companies to reach large numbers of children. This number is considerably higher than the 2.1 billion

display ads for food viewed on child-oriented web sites reported in a previous analysis by the FTC (6). However, the present analysis identified several children's web sites that were not included in the FTC report. This analysis also reveals that child-targeted display advertising is highly concentrated within a few web sites and placed by a small number of companies. More than one-half of food ads examined appeared on two Viacom sites (Nick.com and NeoPets.com) and CFBAI companies placed 89% of food advertisements on children's web sites.

This analysis also highlights limitations to CFBAI companies' pledges to improve food marketing to children. As previously shown in studies of television food advertising to children (5,36), nearly all ads for brands that CFBAI-participating companies have approved for advertising on child-directed web sites are high in fat, sodium and/or sugar. Added sugar limits were especially problematic for child-targeted brands. Despite CFBAI companies' pledges to market only healthier dietary choices in child-directed media (34), display advertising for CFBAI-approved products was less likely to meet IWG standards than advertising for CFBAI company products not approved for child-targeted media. Further, ads for CFBAI-approved products were less likely to meet the standards than ads from non-participating companies. These findings demonstrate that CFBAI self-regulatory pledges in the United States do not protect children from marketing of nutritionally poor foods. Stronger nutrition standards are required for foods marketed to children, such as those proposed by the IWG, to meaningfully improve the nutritional quality of food and beverage advertising on children's web sites. Of note, this analysis shows that food companies do have products in their portfolios that meet these standards – but they are not heavily promoted to children.

This research also demonstrates that CFBAI definitions of child-directed media fail to capture most of the web sites in this analysis that were clearly targeted to children. As found previously with food company-sponsored web sites (39), just 19 of the 72 popular children's web sites and 1 of the 20 sites with the most food advertising had an audience comprised of 35% or more children and thus qualified as child-directed according to most CFBAI companies (38). Even web sites such as Nick.com, CartoonNetwork.com and Disney Channel, with 1.8 to 2.7 million unique child visitors every month, do not meet CFBAI definitions of 'child-directed'. Nonetheless, the majority of products advertised on

children's sites were placed by CFBAI companies and promoted products approved to be in child-directed advertising, with a few notable exceptions. Candy and carbonated beverage companies, including Mars, Hershey and Coca-Cola, placed ads on children's web sites, despite their pledges to not advertise these products to children under 12 (44).

This research has some limitations. comScore does not provide display advertising exposure data by specific demographic group. Therefore, this analysis documents advertising on web sites clearly targeted to children (i.e. high number of child visitors, disproportionately high child-audience share and child-targeted content) (46) but did not measure children's exposure to advertising on general-audience web sites visited by large numbers of children (e.g. Google.com; Yahoo.com). As with television advertising (49), it is likely that children also view large numbers of food advertisements not specifically targeted to them on general-audience sites. Restaurant advertisements also were excluded from the nutrition analyses as a recent analysis documented display advertising by fast food restaurants in 2009 (21). Additionally, comScore reports do not indicate specific varieties of brands advertised in display ads; therefore, researchers estimated the nutritional quality of each advertised brand by evaluating only approved varieties of CFBAI brands advertised to children and all varieties listed on company web sites for non-approved brands. The validation analysis demonstrates that this method provides a good measure of actual products advertised. However, it also suggests that this study understates the amount of advertising by CFBAI companies for products not approved for child-directed advertising on children's web sites. This study also may overstate the nutritional quality of advertised foods as researchers could not assess whether products satisfied the IWG requirement that they also provide a meaningful contribution to a healthful diet (41).

In conclusion, billions of display advertisements for food products appear on popular children's web sites every year. Despite promises by companies participating in the CFBAI to improve food advertising to children (35), most display advertisements promote products that do not qualify as healthful according to US government-proposed nutrition standards. Further research should document changes in the volume and nutritional quality of foods advertised in display ads on children's web sites over time, including changes following implementation of CFBAI uniform nutrition criteria for individual



categories scheduled for 2014 (50). As Internet advertising practices continue to evolve, public health researchers must continue to monitor this changing food marketing landscape.

## Conflicts of interest statement

The authors report no conflicts of interest.

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## Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Validation of Advertising Classification Methods.