

US FOOD COMPANY BRANDED ADVERGAMES ON THE INTERNET: CHILDREN'S EXPOSURE AND EFFECTS ON SNACK CONSUMPTION

**Jennifer L. Harris, Sarah E. Speers, Marlene B. Schwartz and
Kelly D. Brownell**

Public health researchers express concern about branded computer games on food company websites (i.e. advergames) that enable marketers to engage children for unlimited lengths of time to promote calorie-dense nutrient-poor foods. Study 1 examines children's exposure to US food company websites with advergames: 1.2 million children visit these sites every month and spend up to 1 hour per month on some. They primarily promote candy, high-sugar cereals, and fast food. Study 2 demonstrates their potential impact. After playing unhealthy food advergames, children consumed more nutrient-poor snack foods and fewer fruits and vegetables. Children who previously played advergames were affected the most; older and younger children were similarly affected. Advergames encouraging healthy eating did increase fruit and vegetable consumption: however, only one website in our analysis used advergames to promote primarily healthy foods. These findings support the need for restrictions on companies' use of advergames to market nutritionally poor foods to children.

KEYWORDS advergames; advertising; health policy; food marketing; Internet; nutrition; self-regulation

Introduction

There is growing evidence of the enormous volume of food marketing targeted to children, the poor nutritional quality of foods promoted, and the negative effects of exposure on children's diet and other health-related outcomes (Federal Trade Commission [FTC], 2008; Harris, Pomeranz, Lobstein, & Brownell, 2009; Institute of Medicine [IOM], 2006). In response, calls for improvements have increased (White House Task Force on Childhood Obesity, 2010); and several companies in the United States have pledged to shift their child-targeted advertising to "better-for-you" foods through the voluntary Children's Food and Beverage Advertising Initiative (CFBAI) sponsored by the Council of Better Business Bureaus (Peeler, Kolish, & Enright, 2009). Recent research demonstrates some decline in television food advertisements targeted to children (e.g. Powell, Sczyepka, & Chaloupka, 2010). However, most studies have examined television advertising only, which represents less than half of food company youth-targeted marketing budgets (FTC, 2008). Further research is needed to identify potential improvements to other common food marketing practices (Harris, Pomeranz, et al., 2009; Hastings et al., 2003; IOM, 2006).

In this paper, we examine branded computer games on US food company websites known as advergames, a relatively recent form of marketing that targets children. We report

the results of two studies that measure young people's exposure to advergames on food company websites and potential effects of playing healthy and unhealthy advergames on children's snacking behaviors.

Theoretical and Empirical Background

In recent years, young people have become frequent users of the Internet and other digital media (Rideout, Foehr, & Roberts, 2010). Food and beverage companies have taken advantage of this trend, expanding child-targeted marketing on commercial websites, third-party Internet advertising (i.e. placement of banner advertising on other companies' websites), online videos, social media, and advergames (Faber, Lee, & Nan, 2004). In 2006, US food companies spent \$76.6 million on Internet advertising directed at children and adolescents (FTC, 2008). Food and beverage websites are estimated to attract forty-nine million child visitors annually, with users spending as much as 1 hour or more on these sites (Moore & Rideout, 2007).

Child-targeted food company websites commonly feature advergames, or online games designed to market a brand in a manner that is fun and engaging and to increase exposure and positive associations with the brand (Winkler & Buckner, 2006). They typically include features to encourage children to return to the website and play the game multiple times (Santos, Gonzalo, & Gisbert, 2007). In 2009, companies spent a projected \$676 million to produce advergames (Lee, Choi, Quilliam, & Cole, 2009).

According to content analyses of food and beverage websites, approximately 80% of US food websites promoted on children's television networks included advergames (Culp, Bell, & Cassady, 2010). More than 540 advergames were found on food company websites, and some websites contained as many as sixty-seven games (Moore & Rideout, 2007). More than 97% of all food and beverage advergames contained at least one brand identifier, such as a food or package image, a brand character, or a company/brand logo (Culp et al., 2010; Moore, 2006). As with television advertising, the majority of foods and beverages promoted in advergames contain high levels of sugar, sodium, and/or fat; nearly three-quarters promoted candy, cereals, soft drinks, or salty snacks (Lee et al., 2009). Just 3% of advergames contained information about nutrition or health.

Most studies on the effects of advergames have used adult participants and examined marketing outcomes. Not surprisingly, playing advergames increases positive brand attitudes (Winkler & Buckner, 2006; Wise, Bolls, Kim, Venkataraman, & Meyer, 2008) and brand recall (Cauberghe & de Pelsmacker, 2010; Lee & Faber, 2008). Two studies examined branding effects of food advergames on youth. Children, aged 7–8 years, who played a Froot Loops cereal advergame reported higher preferences for Froot Loops over other cereals as compared to children who played another game, but not a higher intent to request Froot Loops from their parents (Mallinckrodt & Mizerski, 2007). Additionally, 6- to 10-year-olds who played a 7-Up advergame showed greater implicit memory for the 7-Up brand; this effect was greater for children who frequently play advergames (Owen, Auty, & Lewis, 2010).

The Need for Additional Research

Although research has begun to examine advergames targeted to children on food company websites, research has not yet determined: (1) the number of young people who

visit advergame websites and how much time they spend there; (2) whether exposure to advergames for unhealthy products contributes to increased consumption of unhealthy categories of food; and (3) whether advergames that promote nutritious foods can positively influence children's healthy food consumption.

Young people's exposure to the primarily unhealthy messages on US food company advergame websites is concerning because of the significant amount of time spent playing advergames (Moore & Rideout, 2007). Unlike television advertising, the Federal Communications Commission (FCC) does not limit the number of commercial minutes allowed per hour of children's online screen time (Moore & Rideout, 2007). CFBAI participants have pledged to refrain from advertising unhealthy products on child-targeted websites (Peeler et al., 2009). However, little is known of their compliance with these pledges.

The impact of exposure to food advergames beyond preferences for advertised brands is also unknown. The American Psychological Association (APA) suggests that interactions with online food promotions endanger children's long-term health by influencing nutritional knowledge and creating poor eating habits (Kunkel et al., 2004). Some argue that advergames may be more effective than television advertising because they blur the distinction between advertising and entertainment content and make it difficult for children to identify the game as advertising (Mallinckrodt & Mizerski, 2007; Moore, 2006). Additionally, the immersive nature of advergames may unconsciously encourage users to focus on playing the games rather than observe the advertising (Lee et al., 2009; Winkler & Buckner, 2006).

On the other hand, advergames could also serve as an educational tool to teach children about nutrition, healthy eating, and physical activity in a manner that is fun and engaging (Lee et al., 2009). The effects of nutrition- and physical activity-promoting advergames have not been tested. However, playing active video games on a regular basis increases children's overall level of physical activity and energy expenditure (Graf, Pratt, Hester, & Short, 2008; Lanningham-Foster et al., 2009). Similarly, playing video games can increase healthy eating. In one study, low-income African American children playing a Pacman-inspired game were more likely to select the type of snack (i.e. healthy or unhealthy) that was rewarded for being consumed in the game (Pempek & Calvert, 2009). In another study, children who played two video games with interactive motivational and goal-setting content consumed more fruits and vegetables compared to children who played knowledge-enhancing nutrition and physical activity games (Baranowski et al., 2011).

The Present Research

In Study 1, we utilize syndicated Internet traffic and usage data to examine the number and age of visitors to food company websites and relative usage of sites that contain advergames, including time spent and repeat visits. In Study 2, we investigate whether playing advergames that promote either healthy or unhealthy foods affects children's consumption of both healthy and unhealthy snack foods. This study also examines whether these effects differ by children's age and previous advergame use. Together, these studies provide a more complete picture of food companies' usage of advergames to promote their products to children and potential impact of advergames on children's health.

Study 1

This analysis tests the hypotheses that advergames represent a marketing technique inherently targeted to children. We predict that food company websites that contain advergames appeal disproportionately to children and that young people stay longer and visit them more often as compared to websites with other types of content that are popular with children (e.g. videos, viral features). Although researchers have suggested that advergames should be considered a child-targeted marketing technique (Lee et al., 2009), the CFBAI does not identify advergames as a form of child-directed marketing if the website has a child audience that comprises less than 35–50% of its total audience (the percentage varies by company) (Peeler et al., 2009).

Data and Methods

The comScore Media Metrix database provided data for these analyses (comScore, 2010a); comScore maintains the largest Internet audience measurement panel with information on approximately one million users in the United States, including individual exposure for both children and adults in the same household (comScore, 2009). These panel data estimate the number of unique visitors within the total US population who have visited a given website(s) at least one time in a given month (comScore, 2010b), and provides exposure data for any websites visited by at least 30 comScore panel members in a given quarter (comScore, 2010c). If enough panel members have visited the site, comScore also provides unique visitors by age and usage patterns, such as average minutes spent on the site per visit.

To obtain a comprehensive list of food company websites, we first identified URLs listed in previous research on advergaming sites (Harris, Schwartz, et al., 2009; Moore & Rideout, 2007) and those identified by CFBAI participants (Peeler et al., 2009). We then searched the comScore database for all CFBAI participants (Peeler et al., 2009), companies included in the FTC (2008) report on food marketing to children, and the twenty fast food companies with highest sales in 2009 (Romeo, 2009) to identify additional food company URLs.

To identify the sites commonly visited by young people, we used the comScore Media Metrix Key Measures Report to obtain the number of unique visitors per month (ages 2+ years and 2–17 years) for each quarter in 2009 for the above URLs. Any website without data for at least three quarters during 2009 was removed from the analysis, as were websites with a low proportion of youth visitors. In 2009, 2- to 17-year-olds represented 20.3% of all unique visitors to the Internet; therefore, websites with less than half that proportion of youth visitors (i.e. 10.2% or fewer) were excluded.

The final sample of websites was accessed to identify those that contain advergames. For this analysis, advergames were defined as fun, interactive games and other user-directed activities featuring individual products or brands. Examples include puzzles and classic games, arcade-style games, and other highly engaging features such as building avatars or using pieces of candy to “paint” pictures. Content not identified as advergames included online videos, downloadable features such as screen savers, viral features (i.e. generating messages to send to friends), contests, and promotions. Two researchers independently reviewed all sites to confirm consistent classification of advergaming content. For each URL they noted the company sponsor, whether the company participates in the CFBAI, the category of food promoted in the games and, for CFBAI companies, whether the products are approved to market to children aged 2–11 years (Peeler et al., 2009).

Measures and Analysis

We examined data for the following age groups: children (2–11 years), adolescents (12–17 years), and total visitors (2+ years). The 2–11 age category corresponds to the CFBAI definition of children (i.e. under 12 years) (Peeler et al., 2009). Additional age breaks for youth visitors were not available from comScore. For each website, we calculated: (1) average unique visitors per month for children, adolescents and total visitors; (2) average proportion of child and adolescent visitors by dividing the average number of unique visitors per month for these age groups by the average total unique visitors per month; and (3) average monthly usage for all youth visitors (2–17 years), including average pages per visitor, minutes per visit and visits per visitor. We used the comScore Media Metrix Key Measures report to obtain quarterly data for 2009 and computed annual monthly averages by adding quarterly monthly averages and dividing by the number of quarters for which data were available. We report combined usage for all youth as many of the websites did not have enough traffic to obtain separate usage data for children and adolescents. We also obtained a comScore Media Metrix Audience Duplication Report for all URLs that contained advertgames. This report controls for overlap of visitors to multiple sites and provides unique visitors and pages visited across all requested sites combined.

We conducted chi-square analyses to determine whether the usage of advertgame sites differed for CFBAI participants and other companies. We also utilized independent samples *t*-tests to compare the exposure and usage numbers for URLs with and without advertgames and CFBAI versus other companies.

Results

The initial search for food company websites with available comScore data identified 480 URLs. After removing URLs with a low proportion of youth visitors and those with only one or two quarters of data available, we obtained a list of 102 URLs for further analysis. Companies participating in the CFBAI sponsored 69% of these URLs ($n = 70$); and advertgames were present in 38% ($n = 39$). There was no significant difference between the percentage of URLs that included advertgames for companies participating in CFBAI versus other companies (37% vs. 41%, respectively), $\chi^2(1, 102) = 0.11, ns$.

Table 1 presents comparisons of exposure and usage for different types of food company sponsored websites. The number of child and adolescent visitors to food company URLs with and without advertgames did not differ significantly (all $ps > .50$); however, children and youth comprised a significantly higher proportion of all visitors to the advertgame sites, $t(101) = 5.15, p < .001$, and $t(101) = 4.83, p < .001$. Usage numbers were also significantly higher for sites that contained advertgames: young people visited 77% more pages on advertgame versus other sites, $t(99) = 1.73, p = .09$; spent 88% more time per visit, $t(99) = 2.88, p < .01$; and visited them 17% more often, $t(99) = 1.80, p = .08$. Composition of visitors to URLs with advertgames and site usage did not differ significantly for CFBAI versus other companies (all $ps > .18$). The analysis of combined exposure to all advertgame sites indicated that 1.2 million children and 0.9 million adolescents visited at least one of these sites on average each month in 2009, and they visited 35 pages on average across all sites.

The most common food category promoted on websites with advertgames was candy ($n = 9$), followed by cereal ($n = 8$) and fast food ($n = 6$). One-half ($n = 13$) of the websites

TABLE 1
 Unique visitors and usage for food company websites: Average per month in 2009*

	Unique visitors (000)			% of all visitors			Usage by visitors 2–17 years		
	2–11 years M (SD)	12–17 years M (SD)	18–24 years M (SD)	2–11 years M (SD)	12–17 years M (SD)	18–24 years M (SD)	Pages per visitor M (SD)	Minutes per visit M (SD)	Visits per visitor M (SD)
Food company URLs									
With advergames (n = 39)	36.3 (53.2)	28.2 (50.2)	26.7 (10.5)	15.7 (9.0)	26.7 (10.5)	10.8 (17.5)	4.9 (4.8)	1.57 (0.76)	
Without advergames (n = 63)	29.4 (48.5)	30.8 (55.2)	17.6 (8.3)	8.4 (5.3)	17.6 (8.3)	6.1 (5.5)	2.6 (2.0)	1.34 (0.35)	
URLs with advergames									
CFBAI participants (n = 26)	44.3 (63.5)	32.4 (60.3)	28.0 (9.2)	16.2 (8.4)	28.0 (9.2)	11.5 (19.8)	4.6 (4.4)	1.57 (0.80)	
Better-for-you products (n = 13)	74.6 (79.4)	51.0 (82.0)	33.0 (8.5)	20.8 (7.9)	33.0 (8.5)	15.5 (26.2)	6.3 (5.5)	1.64 (0.56)	
Products companies pledge to not advertise to children (n = 13)	14.0 (10.3)	21.6 (29.3)	22.9 (7.2)	11.7 (6.3)	22.9 (7.2)	7.1 (8.2)	3.9 (3.4)	1.51 (1.02)	
Other companies (n = 13)	20.3 (12.7)	20.0 (17.4)	24.0 (12.7)	14.6 (10.4)	24.0 (12.7)	9.3 (10.1)	5.5 (6.0)	1.55 (0.68)	
Food company websites with advergames (combined)	1,167.0	932.8	27.4	15.2	27.4	34.7	N/A	N/A	
Total Internet	18,656.4	21,158.9	20.3	9.5	20.3	1,632.8	29.3	37.6	

* Data for individual websites retrieved from comScore Media Matrix Key Measures Report and combined data for all advergames websites retrieved from comScore Media Matrix Audience Duplication Report.

from companies that participate in the CFBAI had games for products that they have identified as not appropriate to market to children, including carbonated beverages, ice cream, cookies, and chips. Only one site (dole.com) primarily promoted fruits and vegetables.

Discussion

Although food company websites with advergames did not attract significantly more absolute numbers of young people compared to sites that did not contain advergames, they did attract disproportionately more young people as a percent of their total audience. On average, 16% of advergame site visitors were 2- to 11-year-olds, compared to 8% of visitors to food company websites without advergames and 9.5% of Internet visitors overall. Additionally, as hypothesized, young people were significantly more engaged in sites with advergames compared to other food company-sponsored websites as evidenced by more page visits, time spent per visit and repeat visits.

Notably, only one website promoted exclusively healthy foods. This analysis confirmed that the most commonly promoted products within advergames continue to be those traditionally advertised heavily to children, including candy, cereals, and fast food (IOM, 2006). In spite of their pledges to improve marketing practices targeted to children, two-thirds of advergaming sites were sponsored by CFBAI participating companies, and children's usage of these sites did not differ from those of other companies. We also identified 13 examples of CFBAI company websites with advergames for products they claim are not advertised to children. Although these sites may not meet the food industry's definition of "child-directed" advertising as children represented less than 35% of their total audience, the fact that children are disproportionately drawn to sites with advergames indicates that any type of advergame could be defined as child-targeted advertising (Grier & Kumanyika, 2010).

This study has some limitations. Since only host companies have data on traffic to individual website pages, we cannot determine how many young people actually played the advergames. This presents a greater issue for websites with a wide variety of content (e.g. those with adult-targeted content such as recipes and nutrition information) than it does for sites primarily composed of advergames. Additionally, we did not conduct a detailed content analysis of sites to determine proportion of content devoted to advergames, specific products featured or nutrition messages presented in the games. However, a study conducted in early 2009 of cereal company websites found extensive use of advergames across child-targeted sites and very few examples of content that promoted healthy eating (Harris, Schwartz, et al., 2009). Additionally, nearly all pages contained branded content that promoted cereals comprised of one-third sugar or more. Thus, in spite of their CFBAI pledges, the cereal companies have made no apparent progress to use advergames to promote good nutrition (e.g. Lee et al., 2009; Moore & Rideout, 2007). Additional detailed content analyses are needed to determine whether advergaming practices of other food companies have improved.

Study 2

In Study 2 we examine the effects of playing advergames on children's ad libitum snack consumption utilizing an experimental method adapted from previous research on effects of television food advertising exposure (Harris, Bargh, & Brownell, 2009). We

measured grams consumed of healthy, moderately healthy, and unhealthy snack foods following a short exposure to one of three types of computer game play: (1) advergames featuring unhealthy foods (unhealthy advergames condition); (2) advergames featuring healthy foods (healthy advergames condition); and (3) nonfood computer games (control condition). We predict that, (a) children in the unhealthy advergames condition will consume more snack foods immediately afterwards as compared to children in the control condition, and (b) children in the healthy advergames condition will consume more of the healthy and less of the unhealthy foods compared to those in the control condition. Additionally, we examine possible individual differences in effects of advergame exposure, including whether children who regularly play advergames are more affected (Owen et al., 2010), as well as younger children who are less likely to understand the persuasive intent of advergames (Mallinckrodt & Mizerski, 2007).

Participants

A total of 152 children from the New Haven, Connecticut area participated including eighty boys and seventy-two girls. Ages ranged from 7 to 12 years ($M = 9.4$ years); and 85% were White, non-Hispanic ($n = 129$). According to their parents, children averaged 4.2 hours of media usage per day and 42% ($n = 64$) had a television in their bedroom. Additionally, 39% of parents reported that their child never plays advergames ($n = 60$), 27% reported that their child plays advergames occasionally or more ($n = 41$), and 32% reported not knowing whether their child plays advergames ($n = 49$).

Stimuli and Methods

Researchers pretested fourteen advergames to identify games that children reported liking the most that were neither too difficult nor easy. Two games were selected for each condition (Appendix). All games were available online, clearly labeled as appropriate for children, and contained no additional third-party advertising. The healthy advergames promoted fruit and vegetable consumption (Dole Foods); whereas the unhealthy advergames promoted consumption of sweet snack foods (Pop-Tarts and Oreo cookies). JewelQuest and TumbleBugs were selected as the control games. Consumption of six different snack foods was evaluated. These foods were also pretested to find those that children reported liking and that ranged in perceived healthiness from very healthy (carrots and grapes), to somewhat unhealthy (fruit snacks and goldfish crackers) to very unhealthy (potato chips and chocolate chip cookies).

Parents and children in grades 2–5 were invited to participate through letters distributed at local elementary schools and advertisements posted on craigslist.com. Participating parents brought their children to the research center for the study where they provided written informed consent. Children provided verbal consent. All procedures were approved by the University's Human Subjects Committee.

Children participated alone in one of three randomly assigned conditions. They first played two games that were open on a computer screen. Children were told they could play the games in any order and for any length of time as long as they played each once. The researcher waited outside the room in case the child had questions or computer problems. After 12 minutes, the researcher entered the room, asked the child to stop playing, and informed her/him that they would take a snack break before completing the

second part of the study. The child was brought to another room with preweighed snacks in bowls on the table that contained approximately 1.5 servings of each food: 100 g each of carrots and grapes and 50 g each of the others. The children were asked to take a seat and help themselves to as much as they wanted while the researcher left to set up the second part of the study. After 5 minutes, the researcher returned and asked the child to complete a questionnaire indicating on a smiley face scale how much they liked each food and how healthy they thought it was. They were permitted to continue snacking for up to 20 minutes and asked to inform the researcher when they finished eating and answering the questionnaire. After 20 minutes, the researcher returned to the room and asked the child to finish. Separately, parents completed a short questionnaire about their children's media use, including how often the child plays advergames and whether the child has a television, computer, or video game console in his or her bedroom. One debriefing was held for the parent and child following completion. Afterwards, the researcher recorded the weight of the remaining snacks.

Measures and Statistical Analyses

Multivariate analysis of variance (MANOVA) was used to measure effects of condition on total healthy food (grapes and carrots), unhealthy food (potato chips and cookies), and moderately healthy food (fruit snacks and goldfish crackers) consumed (total g). The consumption variables were not normally distributed; therefore, we performed a square root transformation to achieve acceptable normality. To simplify interpretation, consumption variables are reported in grams. In addition to experimental condition, the MANOVA included age group and previous advergame play as independent factors. We examined two age groups: 7–8 years and 9–12 years to correspond with stages of consumer development (John, 1999; Kunkel et al., 2004). We also examined three groups according to parents' reports of their children's advergame play: those who never play advergames, who play advergames (occasionally to often), and whose parents did not know about their advergame play.

Results

Three children were excluded from the analysis: two parents did not provide information on advergame play and one child did not eat anything. The multivariate effect of condition on food consumption was significant, $F(6, 262) = 2.26, p = .04$; as were the univariate effects of condition on healthy and unhealthy food consumed, $F(2, 132) = 3.53, p = .03$, and $F(2, 132) = 3.12, p = .05$, respectively (see Table 2 for detailed results). Children in the healthy advergames condition consumed 50% more healthy food compared to children in the unhealthy advergames condition; and this pairwise comparison was statistically significant ($p = .02$). Children in the control condition consumed an amount of healthy food that fell between the two advergames conditions; but the differences between the control and advergames conditions did not reach statistical significance.

We found the opposite effects of condition on unhealthy food consumed. Children consumed the most unhealthy food in the unhealthy advergames condition and the least in the healthy food condition; and this pairwise comparison was significant ($p = .03$). Again, children in the control condition consumed an amount between the two advergames conditions; the pairwise comparison between the healthy advergames and control

TABLE 2
Results of MANOVA to predict snack foods consumed by condition, age group, and previous advergame experience

	Healthy Foods			Moderately Healthy Foods			Unhealthy Foods		
	Consumed (g) <i>M (SE)</i>	Main Effect <i>p</i> -value	Interaction with Condition <i>p</i> -value	Consumed (g) <i>M (SE)</i>	Main Effect <i>p</i> -value	Interaction with Condition <i>p</i> -value	Consumed (g) <i>M (SE)</i>	Main Effect <i>p</i> -value	Interaction with Condition <i>p</i> -value
Condition									
Healthy Advergames (<i>n</i> = 47)	86.2 (7.2)	.03		25.2 (3.6)	.58		20.5 (3.7)	.05	
Control Games (<i>n</i> = 50)	75.9 (9.4)			27.6 (4.7)			27.6 (4.8)		
Unhealthy Advergames (<i>n</i> = 52)	57.7 (7.7)			28.6 (3.8)			31.9 (3.9)		
Age									
7–8 years (<i>n</i> = 44)	69.1 (8.3)	.32	.16	28.5 (4.1)	.55	.61	28.8 (4.2)	.36	.55
9–12 years (<i>n</i> = 105)	77.5 (4.5)			25.7 (2.3)			24.6 (2.3)		
Play Advergames (Parents' Report)									
Never (<i>n</i> = 60)	82.6 (6.4)	.32	.49		.54	.88		.50	.06
Sometimes to Often (<i>n</i> = 41)	64.5 (9.5)			29.6 (3.2)			30.8 (3.3)		
Don't Know (<i>n</i> = 48)	72.6 (8.3)			21.4 (4.7)			24.4 (4.9)		
				30.4 (4.2)			24.9 (4.3)		

conditions approached conventional significance ($p = .07$), but the difference between the unhealthy advertgames and control conditions was not significant ($p = .65$). There was no significant effect of condition on moderately healthy food consumed, $F(2, 132) = 0.55$, $p = .58$.

The predicted interaction between condition and previous advertgame play on unhealthy food consumption approached conventional significance, $F(4, 132) = 2.31$, $p = .06$ (see Figure 1). For children who previously played advertgames, according to their parents' reports, unhealthy games increased unhealthy foods and reduced healthy foods consumed compared to children who do not play advertgames; however, the healthy advertgames did not significantly affect these children versus those in the control. Results for children whose parents did not know about their advertgame use fell between the other two groups in most cases. For simplicity, we do not report these findings. Interactions between age and condition were not significant (all $ps \geq .16$); and there were no significant main effects of previous advertgame play or age group on any type of food consumed (all $ps \geq .32$).

Additional results. Although the healthy and unhealthy advertgames had opposite effects on consumption, the correlation between healthy food and unhealthy food consumed was not significant, $r = .05$, $p = .56$. A manipulation check of food healthiness ratings confirmed that children considered the grapes and carrots to be healthy ($M = 4.6$

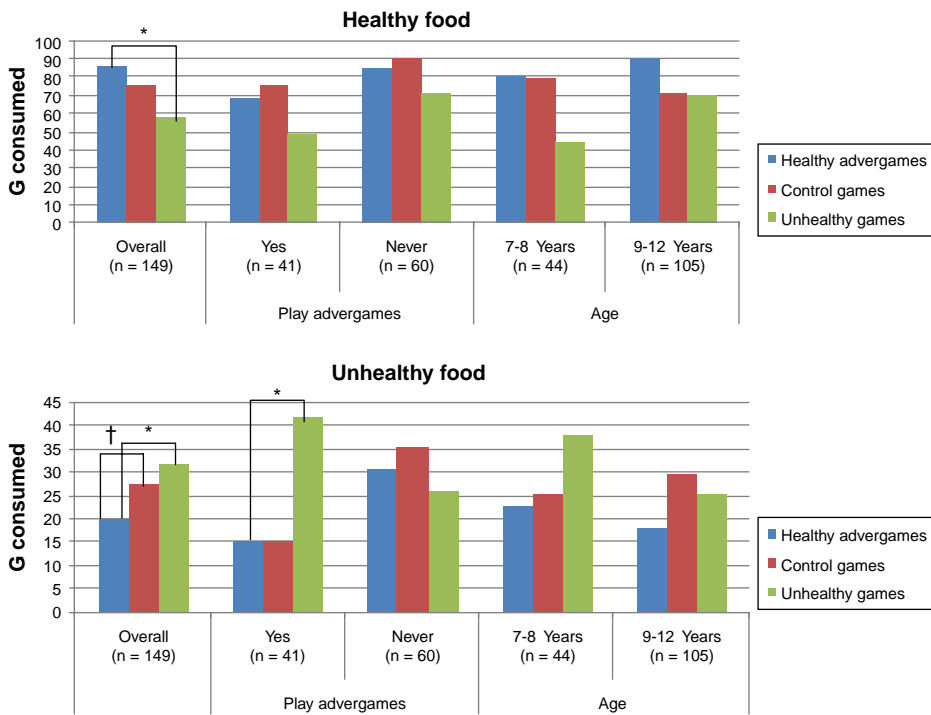


FIGURE 1

Differences in healthy and unhealthy food consumed by condition and individual factors.

* $p < .05$, † $p < .10$

and 4.7 out of 5.0, respectively); the potato chips and cookies as unhealthy ($M = 2.1$ and 1.9 , respectively); and the fruit snacks and goldfish crackers as moderately healthy ($M = 3.0$ and 2.9 , respectively). Children also reported fairly high levels of liking for the foods, with the lowest rating for carrots ($M = 3.7$ out of 5.0) and the highest rating for grapes ($M = 4.4$). Children's age was not significantly related to previous advergaming play, $\chi^2(2, 149) = 2.83$, $p = .24$. The conditions did not differ significantly on any of the child characteristics measured, including age, gender, weight status, race or ethnicity, television in the bedroom, previous advergaming play, or time since last eating (all $ps \geq .28$).

Discussion

As predicted, playing food-branded advergaming affected the amount of both healthy and unhealthy snack foods consumed by children during the experiment. Playing the Pop-Tarts and Oreos advergaming increased children's consumption of unhealthy snack foods by 56% compared to playing the Dole games, and 16% more than playing the control games; totaling an additional 77 kcal and 25 kcal, respectively. In addition, children who played unhealthy advergaming consumed one-third fewer fruits and vegetables than children who played the control and healthy games.

These findings build upon previous evidence that playing unhealthy food advergaming increases children's preferences for advertised products (Mallinckrodt & Mizerski, 2007; Owen et al., 2010); playing nutrition-related computer games affects children's choice of healthy versus unhealthy foods and beverages (Pempek & Calvert, 2009); and television food advertising increases consumption of available snack foods (Halford, Boyland, Hughes, Oliveira, & Dovey, 2007; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Harris, Bargh, & Brownell, 2009). The present study also provides new evidence of broader health-related effects of existing food-branded advergaming. As with previous studies of television advertising, advergaming affected ad libitum food consumption, a measure of behavior directly related to caloric intake that, over time, would lead to higher rates of obesity. Likewise, effects were not product- or brand-specific but transferred to other healthy and unhealthy foods available. This study also demonstrates that, as found with generic nutrition-related computer games (Pempek & Calvert, 2009), food company advergaming can affect both healthy and unhealthy nutrition outcomes depending on the type of food featured.

Interestingly, playing advergaming did not affect consumption of foods the children considered to be moderately healthy (i.e. fruit snacks and goldfish crackers). This unique finding suggests that the games may trigger "reminders" to eat fruits and vegetables as well as "permission" to eat the unquestionably unhealthy snacks, but not increase generalized snacking behaviors. Additionally, as there was no significant relationship between healthy and unhealthy food consumed, it appears that these mechanisms operate independently of each other and that increasing healthy food consumption does not necessarily reduce unhealthy food consumption or vice versa.

Our examination of potential moderating effects of children's age and previous advergaming play also provides new insights into how these games may affect different children. As Mallinckrodt and Mizerski (2007) found with somewhat younger children (5–8 years), age did not significantly moderate the effects of the games; therefore, age alone did not better equip children to defend against this form of marketing. However, previous advergaming play did moderate the effects of unhealthy advergaming on unhealthy food

consumed as only children who play advertising games were affected: playing unhealthy advertising games (as reported by parents) almost tripled children's consumption of unhealthy snack foods as compared to playing control games or healthy advertising games (138 additional kcal). This finding conforms to previous research (Owen et al., 2010) and supports the hypothesis that experience with advertising games enhances their effectiveness by increasing perceptual fluency of branding within the games. This explanation is also consistent with an automatic effect that occurred outside of children's conscious awareness; previous research demonstrates that the automatic perception-behavior link increases with individuals' ability to perceive the environmental stimulus (Chartrand & Bargh, 1999). This moderation effect does differ from previous research on television food advertising that found no individual differences of advertising effects (Harris, Bargh, & Brownell, 2009). However, it may reflect a primary difference between advertising games and television advertising: television commercials specifically focus children's attention on the product being promoted and therefore all children may perceive the message similarly, whereas children's individual interactions with advertising games can vary widely and thus differentially influence their perceptions of the branded message. With repeated exposure, as game play becomes more automatic, the advertising message within the games may become relatively more prominent and thus more effective.

This study provides evidence that food-branded advertising games may contribute to increased consumption of nutritionally poor foods in children, which over time can lead to obesity. The study does have some limitations. We identify a potential direct causal effect of advertising games on healthy and unhealthy food consumption but these effects may not generalize to children's actual game-playing behaviors. The children in this experiment played games that were selected for them and for a short time. In the real world, children actively seek out advertising games and play them for an unlimited amount of time; therefore, the effects could be even stronger. Our results could also be subject to demand effects if children guessed that the purpose of the study was to measure how much food they consumed. However, food consumption measures are less subject to demand effects than measures that have a "correct" answer (e.g. healthy vs. unhealthy food choice). Additionally, the sample sizes for some child characteristics were small and not representative for racial and ethnic minorities, and parent-reported media usage was somewhat lower than average (Rideout et al., 2010). Further studies are needed to replicate these findings in a naturalistic setting, to examine individual differences with larger samples, and to measure effects of repeat exposure.

Conclusion

Together, these studies confirm widespread exposure to US food company advertising games among children and the likelihood of harmful effects from this exposure. More than one million children visit food company websites with advertising games every month, and they spend as much as one hour per month on some sites. This form of marketing appeals disproportionately to children; and advertising games have the potential to negatively affect snack food consumption in a similar manner to television advertising. Additionally, the evidence suggests that older children may be affected as much as younger children and that repeated advertising game play may increase these negative effects. Advertising games that promote fruit and vegetable consumption do have the potential to improve children's eating behaviors: however, we found just one example of a food company website that

contained primarily healthy advergames and had a measurable number of child visitors. Unfortunately, the majority of food company-sponsored advergames continue to promote less nutritious products, including candy, high-sugar cereals, and fast food.

Our analysis of advergame websites was conducted following implementation of the CFBAI and thus reflects improvements that have been made by participating companies as part of this initiative. These results highlight two significant limitations in companies' self-regulatory pledges regarding Internet marketing. First, the CFBAI sets nutrition criteria for foods that can be promoted in "advertising primarily directed to children under 12," typically defined as advertising that appears in media with a 35–50% or higher child audience composition (Peeler et al., 2009). This definition appears to be meaningless when applied to the Internet since the highest child audience composition in our analysis was 34.5% (pfgoldfish.com). Even clearly child-targeted websites such as millsberry.com and clubbk.com had child audience compositions lower than 20%. As a result, participating companies can market to children through advergames and continue to comply with their pledges. Given the evidence of disproportionate appeal to children, advergames should be considered advertising primarily directed to children regardless of where they appear; similar to restrictions on the use of licensed characters (Peeler et al., 2009). Second, although the Pop-Tarts game used in our experiment technically promoted a "better-for-you" product (Peeler et al., 2009), it increased unhealthy snacking by children and had the opposite effect of games that promoted fruit and vegetable consumption. This finding reinforces many public health advocates' concern that promoting somewhat less unhealthy food in children's advertising will not reduce the negative impact of food advertising on children's eating habits (Harris, Pomeranz, et al, 2009).

Although many food companies have pledged to improve their marketing to children and some have reduced child-targeted television advertising, researchers must continue to monitor children's exposure to less visible forms of marketing to ensure improvement in the entire food marketing environment that surrounds youth. Additional research is also required to measure the impact of nontraditional forms of marketing on children's health-related behaviors. Advergames are just one form of marketing that has received little research attention; as food companies continue to introduce sophisticated new forms of digital marketing, the marketing landscape will continue to change rapidly, and continued research about the potential impact on children's health is necessary to inform public policy.

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Jennifer L. Harris, PhD, MBA, is Director of Marketing Initiatives at the Rudd Center for Food Policy and Obesity at Yale University. She received her MBA in marketing at the Wharton School and worked as a marketing executive and consultant before obtaining her doctoral degree in social psychology at Yale University. Her work examines the effects of marketing on health-related beliefs and behaviors and young people's exposure to food marketing of all forms. Correspondence to: Jennifer L. Harris, Rudd Center for Food Policy and Obesity, Yale University, 309 Edwards Street, New Haven, CT 06520, USA. Tel.: 203-432-4613; E-mail: Jennifer.harris@yale.edu

Sarah E. Speers, BA, is a Research Assistant at the Rudd Center for Food Policy and Obesity at Yale University where she is part of a team studying how food marketing impacts youth. She graduated summa cum laude from Syracuse University with a BA in Psychology and Advertising. Ms Speers' interests include how marketing affects children's health behaviors and attitudes, especially with regards to diet and physical activity.

Marlene B. Schwartz, PhD, serves as Deputy Director for the Rudd Center for Food Policy and Obesity at Yale University. She received her PhD in Psychology from Yale University. Prior to joining the Rudd Center, she served as Co-Director of the Yale Center for Eating and Weight Disorders. Dr Schwartz's research focuses on how home environments, communities, and school landscapes shape the eating attitudes and behaviors of children and the effects of food marketing directed at children.

Kelly D. Brownell, PhD, is Professor in the Department of Psychology at Yale University, where he also serves as Professor of Epidemiology and Public Health and as Director of the Rudd Center for Food Policy and Obesity. He has published 14 books and more than 300 scientific articles and received numerous awards and honors for his work. Dr Brownell has advised the government and world health and nutrition organizations on issues of nutrition, obesity, and public policy.

APPENDIX

Description of games played in each condition

Condition	Brand	Website	Game Name	Description
Unhealthy Advergames	Oreos	Nabiscoworld.com	Oreo Double Stuff Race	Untwist two Oreo cookies, lick off the icing, and dunk them in a glass of milk faster than the computer opponent
	Pop-Tarts	Kids.poptarts.com	Out on a Limb	Catch falling Pop-Tarts characters in a toaster and avoid falling coconuts
Healthy Advergames	Dole	Dole.com/superkids	Catapult Game	Use a catapult to shoot foods on a conveyor belt into the appropriate barrel (trash, super food, or vitamin)
	Dole	Dole.com/superkids	Superfoods Mighty Gobble Chomp	Maneuver "Snack Man" through a maze eating the fruits and vegetables and avoiding the junk foods
Control Games	n/a	n/a	Jewel Quest	Match three jewels in a row until the entire board turns to gold
	n/a	n/a	Tumblebugs	Shoot bugs side-by-side and match them by color to free them from captivity