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Adolescent weight status and receptivity to food TV advertisements

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INTRODUCTION

Food advertisements comprise a large proportion of television (TV) advertisements, accounting for 23% to 57% of all TV commercials, depending on the time of day and the channel.^{1–5} Content analyses of food advertisements reveal that most TV advertisements are for foods of minimal nutritional value.^{1, 5–11} Prior studies indicate that food advertisements are highly prevalent during child-targeted programming^{2, 4, 5, 9} suggesting that children may be highly exposed to TV advertising involving foods of minimal nutritional value. The Institute of Medicine (IOM) has recommended that TV food advertisements targeted to youth include a greater proportion of healthier foods.¹²

Several studies have demonstrated a link between TV food advertisements and child food-related behavior, including increased requests, preferences, selection, and/or consumption of advertised foods.^{13–16} Overall TV viewing time has been associated with increased caloric intake,¹⁷ decreased diet quality,^{18, 19} and child adiposity.¹² One study estimated the hypothetical impact of a ban on food TV advertising on childhood obesity based upon the assumption that exposure to food advertisements are associated with the risk of obesity.²⁰ However, no previous studies have assessed whether TV food advertisements influence the risk of obesity in children.

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Institutional Review Board: The study was approved by the Committee for the Protection of Human Subjects at Dartmouth College.

Applied advertising research has historically applied the following three steps associated with the communication/persuasion process: (1) exposure to the advertisement; (2) attending to the advertisement; (3) liking the advertisement.²¹ Therefore, having a preference for (having a “favorite”) a specific advertisement could be considered a measure of receptivity. Behavioral research studies have applied this paradigm to determine adolescent receptivity to health risk behaviors such as tobacco^{22, 23} and alcohol.²⁴ These studies have demonstrated a clear link between receptivity to tobacco advertisements and smoking initiation^{22, 23} and alcohol advertisements and alcohol use.²⁴

Reasoning that because most food TV advertisements are for foods of minimal nutritional value, and that because adolescent preferences for food advertisements over non-food advertisements could be considered an indicator of receptivity to food advertising, the hypothesis was that adolescent receptivity to food advertisements would be a predictor of adolescent overweight.

METHODS

Participants and Recruitment

The data for the current study are from a longitudinal study investigating the association between parenting factors, movie viewing, and health behaviors in adolescents. The questionnaire data were collected through a baseline survey and a follow-up survey. The baseline survey included two components: (1) an in-school, self-administered written survey completed by students and (2) a telephone survey completed by the students and one of their parents. The follow-up telephone survey was completed by the students and the same parent. The study was approved by the Committee for the Protection of Human Subjects at Dartmouth College (full review).

Students were recruited through New Hampshire and Vermont public schools. These schools were randomly selected from a list of all New Hampshire and Vermont schools containing grades 4 through 6 (N=559 schools), stratified by state and number of students enrolled. Twenty-six schools from 25 different communities were enrolled. Each participating school was offered a \$500–\$750 stipend. Most (72%, N=18) of the communities represented had less than 10,000 residents. In all but one school, passive consent was used, whereby parents received an advance letter informing them of the survey and instructing them to call the school if they did not want their child to participate. At one school, active consent was used whereby parents mailed in a signed consent form. For the telephone surveys, verbal parental consent and verbal child assent were obtained before surveying adolescents and parents by phone. The sample recruitment design and informed consent process has been described in more detail elsewhere.²⁵

A total of 3,705 adolescents ages 9–12 years were enrolled in the baseline written survey (October 2002 through December 2003). Of these, 2,566 adolescents and one of their parents (94.6% of whom were mothers, step-mothers, or foster mothers) completed the baseline telephone survey on average 1.1 (sd = 2.7) months later. The follow-up survey was completed an average of 11 (sd=2.7) months later, by 2,431 adolescents and the same parents (March 2004 through April 2005). Adolescents and parents were surveyed separately. The baseline written survey, baseline telephone survey, and follow-up telephone survey each took approximately 30 minutes to complete.

For this analysis, 150 child-parent pairs were excluded for the following reasons: 25 nine-year olds and four 14-year olds were dropped because those age groups were not well represented, and 121 were dropped due to missing covariate data (missing data on parent income, parent education, having a TV in the bedroom) or for having weight status values

that the Centers for Disease Control and Prevention categorizes as “biologically implausible values.”²⁶ Thus, the final sample for this analysis includes 2,281 adolescent/parent pairs.

Measures

Primary outcome: Adolescent overweight—The primary outcome for this study was adolescent overweight based on parental reports of their child's height and weight assessed at follow-up. Body-mass-index-for-age and gender (BMI) was calculated using the SAS program for the Centers for Disease Control and Prevention (CDC) growth charts.²⁶ “Overweight” was defined as greater than the 85th percentile and “obese” as greater than the 95th percentile.^{27, 28}

Primary exposure: Adolescent receptivity to food advertisements—The receptivity measure was based upon the persuasive communication theoretical framework, whereby greater receptivity to a product is indicated by having a favorite advertisement or willingness to use the product.²¹ This measure of receptivity has been used predominantly in tobacco and alcohol-related studies.^{22, 24, 29} Following the example of these published studies, moderate receptivity to advertisements was defined as having a favorite advertisement.^{22, 24, 29} Receptivity to food and non-food advertisements was determined during the follow-up telephone survey by asking adolescents the following open-ended questions, “What is your favorite television commercial?” and “What product is it advertising?” Interviewers recorded the responses verbatim. Responses ranged from one to a few words, such as, “McDonalds®” or “McDonald's® with chicken strip” to a longer phrase describing the advertisement, such as, “McDonald's® commercial when they're playing basketball on rollerblades.” Answers to the open-ended questions were coded using inductive methods³⁰ as follows: the first author reviewed the responses and coded them into one of two categories: food or non-food. She then further coded food advertisements into specific types of food as they emerged (e.g., beer, candy, milk). She then referred to published content analyses of food advertisements^{1, 2, 5–7, 31–33} to apply a standardized naming convention of overall food categories. Sugar-sweetened

beverages (SSBs) were defined based upon previously published definitions: non-diet sodas, non-diet iced teas, punches, fruit drinks, lemonade, Kool-Aid®, sports drinks, and other sweetened drinks.^{34, 35} Fast food was defined according to the Institute of Medicine definition, which is described as, “any food designed for ready availability, use, or consumption and sold at eating establishments for quick availability or takeout”.¹² Any mention of a brand name was also noted separately.

The overall food categories were:

beverages – sugar-sweetened (e.g., regular soda, sports drinks, Sunny Delight®, Ovaltine®), alcohol (e.g., beer, hard lemonade), coffee, juice, water;

breakfast foods – high sugar cereals/breakfast foods (e.g., Kellogg's® Frosted Flakes®, Pop Tarts®), low-sugar cereals/breakfast foods (e.g., Kellogg's® Corn Flakes®, Kellogg's® Eggo® Waffles);

chips and crackers (e.g., potato chips, Goldfish® Crackers);

dairy (e.g., milk, cheese, yogurt);

fast food restaurants (e.g., McDonald's®, Burger King®, SUBWAY®, Pizza Hut®, local pizza);

non-discernible (e.g., the respondent said, “food commercial” or “commercials about food”);

other (e.g. Splenda®, coffee cream, Velveeta®, sour cream);

other restaurants (e.g., Chili's Grill and Bar®, Applebee's®);

processed meats (e.g., hot dogs, bologna, SPAM®);

sweet snacks or desserts – candy (e.g., Starburst®, Skittles®, M&Ms®, chocolate, gum), other sweet snacks (e.g., cookies, ice cream, donuts);

unprocessed meats and nuts (hamburger, peanuts).

Food advertisements were classified as representing less healthy products if they primarily contained energy dense and/or nutrient poor food³⁶: sugar-sweetened beverages, alcoholic beverages, coffee, candy, sweet snacks or desserts, fast food restaurants, high sugar cereals/breakfast foods, processed meats, and chips and crackers.

The non-food advertisement category included a wide range of products and services ranging from airlines and amusement parks to electronic media, household products, services, station programming, and stores. It also included the response category of “none.”

Covariates—A number of relevant covariates known to be related to adolescent overweight and adolescent television exposure were measured, including sociodemographics, adolescent physical activity, TV viewing frequency, and having a TV in the adolescent's bedroom.²⁵ These measures have been used in previously published studies.^{25, 37} The specific measures used, sources of data (adolescent or parent surveys), and time of data acquisition (baseline or follow-up) are described below.

Sociodemographics—Adolescents reported their age and gender in the baseline survey, and in the follow-up survey they reported their date of birth (DOB). Age at follow-up was calculated using their DOB or was imputed based on their baseline age if DOB was not available. Parents reported their highest level of education and their annual household income in the baseline survey.

Adolescent physical activity—At follow-up, parents were asked, “Aside from physical education or gym at school, how often does <adolescent name> engage in physical activity: less than once a week, 1–3 times a week, 4–6 times a week, every day, don't know.” Responses were collapsed into a 3-category variable indicating whether adolescents engaged in physical activity 3 or less times/week, 4–6 times/week, or every day. None of the respondents responded “don't know.”

Media Exposure—Adolescents were asked in the baseline survey, “Do you usually watch TV or movies before school/after school/after supper?” Responses to these three questions were combined to indicate the number of TV watching sessions per day (range: 0–3). The presence of a TV in the bedroom was ascertained by asking adolescents in the baseline survey, “Do you have a TV in your bedroom that you can watch television or movies on?” (Yes/No).

Data Analysis

Categorical data were initially analyzed using Chi-square tests. Generalized Estimating Equation models were used, assuming a Poisson distribution and a log link and controlling for clustering by school, to model the relationship between identifying a food advertisement as their favorite and being overweight. Relative risks and 95% confidence intervals (CI) from these models are presented. Data were analyzed using SAS (SAS version 9.1, SAS Institute Inc., Cary, NC, 2002–2003) and SPSS (SPSS version 16.0.1 for Windows, SPSS Inc., Chicago, IL, 2007).

RESULTS

Food advertisement receptivity

Of the 2281 adolescents, 1601 (70.2%) named some type of advertisement. Less than one-fifth named a food advertisement as their favorite (16.1%, N=367). Most of the food advertisements were for less healthy foods (89.6%, N=329 of 367 advertisements) (Table 1). The most common food brands named were McDonald's® (N=32), Pepsi® (N=29), and Budweiser®/Bud Light® (N=28).

Adolescents were more likely to name a food advertisement if they were older, if their families had a higher household income, and if they did not have a TV in their bedroom (Table 2). Among adolescents who named a food advertisement, males were more likely to mention a beer advertisement compared to females (18.3%, N=35 versus 3.4%, N=6, respectively $p<0.001$). Females were more likely to mention a candy advertisement compared to males (21.3%, N=37 versus 5.8%, N=11, respectively, $p<0.001$) (data not shown).

Adolescent overweight

About one-third of adolescents 35.9% (N=818) were overweight. Adolescents were more likely to be overweight if they were male, did less physical activity, watched more TV, had a TV in their bedroom, and if their parents had less education and a lower household income (Table 3).

Food advertisement receptivity and overweight status

Compared to non-overweight adolescents, overweight adolescents were significantly less likely to be receptive to food advertisements (unadjusted model; RR = 0.77, 95% CI 0.65, 0.91) (Table 3). Accounting for clustering by school and adding the covariates of age and sex to the model did not change this relationship (RR = 0.77, 95% CI 0.65, 0.91). The fully-adjusted model – which included school, age, sex, parent education, household income, physical activity, number of TV sessions watched, and having a TV in the bedroom – did not appreciably change the RR of adolescent risk of overweight (RR = 0.83, 95% CI 0.70, 0.98). When assessing the same variables in relation to obesity (using a BMI cutoff at the 95th percentile), the fully-adjusted RR remained similar (RR = 0.76, 95% CI: 0.58, 0.99). In addition, there were no statistically significant interactions between food advertisement receptivity and sex, household income, physical activity, or having a TV in the bedroom in relation to overweight.

DISCUSSION

Not surprisingly, the types of food advertisements that adolescents mentioned were predominantly for less healthy food products. However, only a minority of adolescents named a food advertisement as their favorite. Contrary to what was predicted, adolescents who were receptive to food advertisements were less likely, rather than more likely, to be overweight.

Several possible explanations for finding an inverse association between food advertising receptivity and overweight exist. Perhaps youth with fewer risk factors for being overweight are the most likely to be receptive to food advertising. If adolescents with a healthy weight have more food restrictions in the home compared to overweight adolescents, those restrictions may make advertised foods seem more attractive. If some healthy-weight adolescents idealize food, they may be more likely to have an affinity for food advertisements. Studies have indicated that people with severe food deprivation (i.e., severe

hypoglycemia, anorexia, chronic dietary restraint) attend to food more than those without, as demonstrated by studies examining preferential processing of food-related stimuli,³⁸ and recall of food-related words.^{39–41} Future research could investigate if similar cognitive processes would also occur in less extreme circumstances, and if these processes translate to receptivity to food advertising. Another possibility is that if the advertised foods are abundant in the homes of overweight adolescents, the advertisements for those foods would be less novel or attractive. Finally, messaging present in food advertisements such as healthful living or physical activity may be more attractive to healthy-weight adolescents. These are all areas for potential future research. Another line of research has shown that all children increased their food intake in response to exposure to food advertisements, but that obese and overweight children increase their food intake at a higher rate than normal weight children.⁴² Future research should investigate if this relationship is modified by exposure to advertisements for which children are highly receptive, and if, over the long-term, normal weight children eventually become overweight due to food advertising receptivity. It would also be helpful to uncover specific reasons behind normal versus overweight or obese adolescent's preferences for specific food advertisements.

This study adds to a growing body of literature which suggests that lower-risk youth are more likely to be vulnerable to some types of behavioral health-risk exposure compared to youth with higher risk factors. For example, several studies have shown that adolescents at low risk for smoking are the most vulnerable to the influence of tobacco exposure in movies.^{43, 44 45} Similarly, it could be that non-overweight adolescents are more susceptible to exposure to food TV advertisements.

Limitations

This study was limited in that adolescent overweight was based on parent report of adolescent height and weight, rather than actual measurement, which may have introduced measurement error. Parental report of adolescent weight status has been used in other behavioral health studies and has been found to be accurate, with a greater tendency to underestimate rather than overestimate.^{46, 47} If parents of adolescents who cited food advertisements as their favorite underestimated their child's weight, it could explain some of the observed relationship. However, there is not a reason to believe that parents would have offered differential responses to their child's height and weight based on their child's receptivity to food advertisements. The sensitivity analysis using a BMI cutoff at the 95th percentile revealed consistent findings. Future studies are needed to confirm the finding that overweight adolescents are less receptive to food advertisements.

The analyses reported here are based on data collected for a longitudinal study investigating the association between parenting factors, movie viewing, and health behaviors in adolescents. The primary variables of interest, adolescent overweight and advertisement receptivity, along with physical activity, were measured at follow-up. Most of the covariates were measured at baseline – gender, parents' highest level of education, annual household income, media exposure, and having a TV in the bedroom. Although many of the covariates were collected at baseline, the primary exposure and outcome measures were both collected at follow-up. Another limitation is that measures of dietary intake were not assessed so the relationship between receptivity to food advertisements and dietary intake could not be determined. It is possible that the respondent's second favorite advertisement may have been a food advertisement. Finally, only those respondents who were moderately receptive to food advertisements were described. Those who did not name a favorite food advertisement may also have had some degree of receptivity.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Attracting non-overweight adolescents to food advertisements is an ideal strategy for advertisers, in that non-overweight adolescents are probably consuming healthier foods compared to their overweight peers.^{48–50} A parallel strategy is cigarette advertising that entices non-smokers to begin smoking.²² Although a detailed content analysis of the advertisements adolescents mentioned was not conducted, some adolescents described physical activity themes in the food advertisements they mentioned. This observation is consistent with research that has demonstrated that many food advertisements contain physical activity messages.³ In 2005, the Ad Council Coalition for Healthy Children began an initiative promoting the message of healthy living, including physical activity, in corporate marketing.⁵¹ Whether the advertisements featured in this study were influenced by this messaging program is not known. If more athletically-minded adolescents are attracted to advertisements for unhealthy food because they feature positive messaging about physical activity, it raises the concern that they may be more inclined to purchase and consume those products over the long term. Future studies should carefully investigate the appropriateness of promoting physical activity messages in advertisements for less healthy foods.

Advertisements are ubiquitous to our lives. Multiple media streams increasingly reinforce messaging – food advertisements appear across different media forms to amplify the product exposure.⁵² For example, some TV advertisements encourage children to visit the product's website. Websites are interactive and sometimes include games or prizes for children to win. Schools offer food advertising both inside and outside buildings, such as on vending machines and athletic fields, as well as on materials used by students such as books.⁵² The more reinforcement that youth have to recall a product, the greater the likelihood it may influence them in the future. The IOM has recommended that researchers investigate the influence of food advertising by including not just television advertising, but other forms as well.¹² Future studies should include exposure to other forms of advertisements, including movies, the internet, storefronts, billboards, vending machines, mailings, clothing gear, and school campuses. Another impact of advertising which may be more complicated to assess are advertisements that are embedded in TV shows and other forms of media both visually and as part of the script, because the lines between what is a show and what is an advertisement are blurred.⁵³

In the same way that cigarette advertisements feature beautiful and glamorous models to promote cigarette smoking, healthy behaviors portrayed in food advertisements can be used to promote unhealthy foods. This study provides preliminary evidence that there should be concern about normal-weight adolescents being receptive to unhealthy food advertisements. Longitudinal studies are needed to evaluate whether consistent exposure to advertisements for unhealthy foods, particularly if they are promoted with healthy behaviors such as being physically active, influences adolescents' food choices, and ultimately their BMI, over the long term.

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Table 1

Adolescent food advertisement receptivity.

	N	Distribution across food advertisements (N=367)	Distribution by full sample (N=2281)
<i>Less Healthy Foods</i>	329	89.6%	14.4%
Beverages			
Alcohol	41	11.2%	1.8%
Coffee	14	3.8%	0.6%
Sugar-sweetened beverages	86	23.4%	3.8%
Breakfast - high-sugar cereals and breakfast foods	13	3.5%	0.6%
Chips and Crackers	8	2.2%	0.4%
Fast Food	61	16.6%	2.7%
Processed Meats	14	3.8%	0.6%
Sweet snacks			
Candy	67	18.3%	2.9%
Other sweet snacks	25	6.8%	1.1%
<i>Healthier Foods</i>	26	7.1%	1.1%
Beverages			
Juice	1	0.3%	0.0%
Water	1	0.3%	0.0%
Breakfast - low-sugar cereals and breakfast foods	8	2.2%	0.4%
Dairy	10	2.7%	0.4%
Restaurants	3	0.8%	0.1%
Unprocessed meats and nuts	3	0.8%	0.1%
<i>Miscellaneous Foods</i>	12	3.3%	0.5%
Non-Discernible	7	1.9%	0.3%
Other Foods	5	1.4%	0.2%

Table 2

Food advertisement receptivity by adolescent characteristics (N=2281).

Variable	N	Food advertisement receptivity N (Row %) ^a
Age (in years)		
10	421	47 (11.2)*
11	851	134 (15.7)
12	746	141 (18.9)
13	263	45 (17.1)
Sex		
Male	1149	192 (16.7)
Female	1132	175 (15.5)
Parent education		
High school diploma or less	717	108 (15.1)
Some college or Associate's degree	893	140 (15.7)
Bachelor's or graduate degree	671	119 (17.7)
Household income		
Less than \$40,000	783	107 (13.7)*
\$40,001 to \$65,000	684	99 (14.5)
More than \$65,000	814	161 (19.8)
Physical activity		
Three or less times a week	577	81 (14.0)
Four to six times a week	789	120 (15.2)
Every day	915	166 (18.1)
TV sessions		
None	126	20 (15.9)
One	369	69 (18.7)
Two	1036	155 (15.0)
Three	750	123 (16.4)
TV in bedroom		
No	1203	220 (18.3)*
Yes	1078	147 (13.6)

^aSignificant Chi-square comparisons for groups within each variable are indicated in this column with * for $p \leq 0.05$.

Table 3

Food advertisement receptivity as a predictor of adolescent overweight. (RRs (95% CI) for adolescent BMI cutoff at the 85th percentile.)

Predictor	Sample Size	N (%) overweight ^a	RR for overweight, fully adjusted ^b
A: TV advertisement receptivity			
None/Other	1914	713 (37.3)*	Reference
Food	367	105 (28.6)	0.83 (0.70, 0.98)
A: Age (in years)			
10	421	157 (37.3)	Reference
11	851	312 (36.7)	0.97 (0.85, 1.11)
12	746	263 (35.3)	0.92 (0.83, 1.02)
13	263	86 (32.7)	0.83 (0.74, 0.94)
A: Sex			
Male	1149	443 (38.6)*	Reference
Female	1132	375 (33.1)	0.83 (0.72, 0.95)
P: Parent education			
High school diploma or less	717	318 (44.4)**	Reference
Some college or Associate's degree	893	332 (37.2)	0.91 (0.81, 1.01)
Bachelor's or graduate degree	671	168 (25.0)	0.71 (0.60, 0.83)
P: Household income			
Less than \$40,000	783	334 (42.7)**	Reference
\$40,001 to \$65,000	684	254 (37.1)	0.94 (0.82, 1.08)
More than \$65,000	814	230 (28.3)	0.82 (0.69, 0.97)
P: Physical activity			
Less than 3 times per week	577	261 (45.2)**	Reference
4–6 times per week	789	269 (34.1)	0.81 (0.70, 0.95)
Every day	915	288 (31.5)	0.69 (0.59, 0.82)
P: Usual number of TV or movie sessions per day			
None	126	23 (18.3)**	Reference
One	369	95 (25.7)	1.33 (0.93, 1.89)
Two	1036	389 (37.5)	1.74 (1.20, 2.50)
Three	750	311 (41.5)	1.77 (1.24, 2.53)
A: TV in bedroom			
No	1203	361 (30.0)**	Reference
Yes	1078	457 (42.4)	1.18 (1.04, 1.33)

Abbreviations: RR, relative risk; CI, confidence interval; BMI, age- and gender-standardized adolescent body mass index; A, adolescent survey; P, parent survey.

^aSignificant Chi-square comparisons for groups within each variable are indicated in this column with * for $p \leq 0.05$ and ** for $p \leq 0.001$.

^b Adjusted for age, sex, socioeconomic status, physical activity, number of TV sessions watched, having a TV in the bedroom, and clustering by school.