



Influence of Cartoon Media Characters on Children's Attention to and Preference for Food and Beverage Products

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ARTICLE INFORMATION

Article history:

Submitted 23 December 2015

Accepted 17 August 2016

Available online 25 October 2016

Key words:

Front-of-pack

Food marketing

Children

Licensed characters

Visual attention

Supplementary materials:

Figure 1 is available at www.andjrn.org

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<http://dx.doi.org/10.1016/j.jand.2016.08.012>

ABSTRACT

Background Over-consuming unhealthful foods and beverages contributes to pediatric obesity and associated diseases. Food marketing influences children's food preferences, choices, and intake.

Objective To examine whether adding licensed media characters to healthful food/beverage packages increases children's attention to and preference for these products. We hypothesized that children prefer less- (vs more-) healthful foods, and pay greater attention to and preferentially select products with (vs without) media characters regardless of nutritional quality. We also hypothesized that children prefer more-healthful products when characters are present over less-healthful products without characters.

Design On a computer, participants viewed food/beverage pairs of more-healthful and less-healthful versions of similar products. The same products were shown with and without licensed characters on the packaging. An eye-tracking camera monitored participant gaze, and participants chose which product they preferred from each of 60 pairs.

Participants/setting Six- to 9-year-old children (n=149; mean age=7.36, standard deviation=1.12) recruited from the Twin Cities, MN, area in 2012-2013.

Main outcome measures Visual attention and product choice.

Statistical analyses performed Attention to products was compared using paired-samples *t* tests, and product choice was analyzed with single-sample *t* tests. Analyses of variance were conducted to test for interaction effects of specific characters and child sex and age.

Results Children paid more attention to products with characters and preferred less-healthful products. Contrary to our prediction, children chose products without characters approximately 62% of the time. Children's choices significantly differed based on age, sex, and the specific cartoon character displayed, with characters in this study being preferred by younger boys.

Conclusions Results suggest that putting licensed media characters on more-healthful food/beverage products might not encourage all children to make healthier food choices, but could increase selection of healthy foods among some, particularly younger children, boys, and those who like the featured character(s). Effective use likely requires careful demographic targeting.

J Acad Nutr Diet. 2017;117:265-270.

AMERICANS OVER-CONSUME FOODS HIGH IN CALORIES, saturated fat, sodium, and added sugar¹; such poor-quality diets (ie, those that disproportionately contain nutrient-poor foods) increase risk of overweight/obesity² and health problems, including type 2 diabetes³ and heart disease.⁴ The high prevalence of obesity among children (16.9%) and increase in type 2 diabetes are especially concerning.^{5,6} Many factors encourage poor-quality diets among children, including stronger preferences for sweet and salty flavors compared with adults, likely because of both biological drives and frequent exposure.^{7,8} Dietary preferences and choices are also influenced by food

marketing,⁹⁻¹² which is pervasive in the United States. For instance, Nielsen Media Research estimates that 6- to 11-year-olds see more than 4,750 food advertisements annually, with 44% of these for energy-dense, nutrient-poor foods such as sweets, snacks, and fast food.¹³ Major reports from the Federal Trade Commission and Institute of Medicine have concluded that food marketing influences children's preferences for and consumption of unhealthy foods.^{14,15}

One important way in which companies market their products is with food and beverage packaging. Common techniques used by food, beverage, and restaurant companies are to either license entertainment companies' media

characters (eg, Dora the Explorer [owned by Viacom/Nickelodeon]) or use their own brand mascots (eg, Tony the Tiger [owned by Kellogg Co]) to induce children to notice and like their products.^{16,17} The rationale from socio-cognitive theories and a parasocial interactions model is that positive associations children have with these familiar and likable characters will transfer to the brand or product, producing increased trust, loyalty, recognition, and preference.^{18,19} A systematic review of character marketing's effects on children's cognitive, behavioral, and health outcomes¹⁹ concluded that 3- to 6-year-old children preferred products with (vs without) characters, and that children prefer energy-dense foods with a character over fruits and vegetables bearing the same characters. At the same time, these data also suggest that licensed media characters can enhance the attractiveness of more-healthy food. For this reason, Sesame Street Workshop offered to freely license its characters for 2 years to fruit and vegetable producers.^{20,21} However, the few studies that have examined such characters' influence on older children (7 to 9 years old) suggest less influence among this age group.^{22,23} In addition, data are lacking regarding the mechanisms through which these characters influence children, although Kraak and Story's¹⁹ synthesis of existing models provides a conceptual framework for inquiry on the topic.¹⁹ One proposed mechanism is that cartoon characters capture children's attention,²⁴ but only one study has examined the amount of attention cartoon characters in food marketing receive among older children.²⁵

This study extends existing research by examining the influence of licensed media characters' (henceforth referred to in this study simply as "characters" for brevity) influence on younger and older children's attention as well as behavioral intentions (ie, what the child would prefer to eat). *Attention* was chosen as an outcome measure based on evidence strongly connecting it with behaviors,²⁶ and *food/beverage preferences* based on the widely used theory of planned behavior, which identifies behavioral intentions as key proximal predictors of behavior.²⁷

We hypothesized that, in a simulated task in which participants had to select a preferred food, children: H1) pay more attention to products with (vs without) characters; H2) have a preference for less-healthy (vs more-healthy) products when a character appears on both products or does not appear on either product; H3) demonstrate a preference for products with (vs without) characters; and H4) prefer more-healthy products with a character vs less-healthy products without a character. We also explored whether the specific cartoon character shown or child age and sex moderated associations between character preference and food choice.

METHODS

Participants

A convenience sample of Minneapolis/St Paul, MN—area children (n=149) participated in a "computer game" assessing food and beverage preferences. Children were eligible if they were between 6 and 9 years old and if an English-speaking parent or guardian could accompany them. Participants were recruited using a variety of print, online, and in-person techniques in 2012 and 2013. Children

saw two products side-by-side on a computer screen in an on-campus laboratory and were told to press the button on the left-hand side of a videogame controller if they would prefer to eat the product on the left-hand side of the screen, and to press the button on the right if they would prefer to eat the product on the right. The University of Minnesota Institutional Review Board approved the study protocol; participants' parents provided written informed consent, and participants provided written assent.

Procedure

The computer game was created and presented using SR Research's Experiment Builder²⁸; attention was tracked with an EyeLink 1000, high-speed, desk-mounted eye-tracking camera (SR Research, Ottawa, Ontario, Canada). A chin rest ensured the highest levels of accuracy (0.25 degrees) and resolution (0.01 degrees).

A bank of 30 matched food/beverage pairs available in the US marketplace was created consisting of a more-healthy and a less-healthy version of a product from a shared category (eg, dried fruit vs fruit snacks, respectively) that either did or did not have a cartoon character on its package.* Examples of food categories included yogurt, corn chips, bread, and cereal. NuVal scores were used to determine which of two paired products would be considered more- and less-healthy.²⁹ These proprietary scores, licensed by many large national supermarket chains, range from 1 (least healthy) to 100 (most healthy) based on the Overall Nutritional Quality Index, an algorithm designed by nutrition scientists. NuVal scores were obtained from supermarket shelf tags. In the present study, the more-healthy food in each pair received a NuVal score, on average, 26.7 points (55.7%) higher than its less-healthy counterpart.

Each child completed 60 trials that required them to view product pairs (eg, dried fruit vs fruit snack) within a given food/beverage category and chose which product in the pair they wanted to eat. For each food pair, we varied whether each food was more or less healthy and whether each food displayed a character. Children saw six possible combinations (Table) of less- or more-healthy foods with or without characters across 10 randomly selected food/beverage pairs. For example, for the category of fruit, six trials compared raisins and fruit snacks. A child might first see both foods without a character, then both foods with characters, then raisins with a character and fruit snacks without a character, then the reverse, then raisins with and without a character, and finally fruit snacks with and without a character. Children saw all six comparison types for each pair of matched products. Products with each attribute combination (more/less healthy, character/no character) were counterbalanced to appear equally often on the left-hand and right-hand side of the screen.

We used the following three characters in this study: Lightning McQueen (owned by the Walt Disney Company), SpongeBob SquarePants (owned by Viacom/Nickelodeon), and Dora the Explorer, which all appeared frequently on

*The corresponding author is able to provide these stimulus images upon request.

Table. The influence of cartoon media characters on 6- to 9-year-old children (n=149): Percentage of food/beverage products chosen across all forced choice trials for each comparison type^a

Comparison number	Product healthfulness + presence/absence character	% (SD) ^b of trials product chosen	Product healthfulness + presence/absence character	% (SD) of trials product chosen
1	More healthful+character present	38.7 (20.0)	Less healthful+character present	61.3 (20.0)
2	More healthful (character absent)	36.9 (22.6)	Less healthful (character absent)	63.1 (22.6)
3	More healthful+character present	38.9 (31.5)	More healthful (character absent)	61.1 (31.5)
4	Less healthful+character present	36.5 (29.8)	Less healthful (character absent)	63.5 (29.8)
5	More healthful+character present	37.0 (19.8)	Less healthful (character absent)	63.0 (19.8)
6	More healthful (character absent)	39.8 (21.3)	Less healthful+character present	60.2 (21.3)

^aEach participant saw 10 trials of each comparison type, depicting 10 randomly selected product pairs out of 30 total pairs.

^bSD=standard deviation.

food/beverage packages at local grocery stores when the study commenced (spring 2012).

Measures

Demographic Information. Parents reported child race, ethnicity, sex, and household income. Child height and weight were measured by study staff.

Attention. Visual attention to each product was operationalized in two ways: First, a dichotomous yes/no variable was created to indicate whether a product received at least one viewing/fixation. Fixations of less than 50 msec were discarded because they are considered too brief to constitute actual processing.^{30,31} These yes/no variables were used to calculate the proportion of times that a product received a fixation out of the total number of times the product appeared. We calculated and compared the proportion of products that received a fixation when characters were present (regardless of the comparison type) vs the proportion of products that received a fixation when characters were absent (again, regardless of the comparison type). We also calculated and compared the mean time that participants viewed each product (ie, dwell time) when a character was present vs absent.

Product Choice. For each trial, children chose which product in the pair they would want to eat, and these choices across 60 trials were transformed into a continuous score (ie, percentage of trials in which a specific product type [eg, more-healthy product with character] was selected). The Table shows the percentage of trials that products were chosen for each comparison type that varied product healthfulness and the presence or absence of a character. The comparison types included in the choice score varied based on the hypothesis being tested. For H2 (children prefer less-healthy foods over more-healthy foods), continuous scores were based on 20 trials that presented products that were matched on character status and only varied in terms of food healthfulness (ie, two more- or less-healthy products with characters and two more- or less-healthy products without characters). For H3 (children prefer products with characters), continuous scores were based on 20 trials that presented products that were the same healthfulness status but varied in terms of presence of the cartoon character (ie, two healthier products with or

without characters and two less-healthy products with or without characters). For H4 (children would prefer more-healthy products with a character than less-healthy products without a character), scores were based on 10 trials that presented more-healthy products with a character vs less-healthy products without a character.

Power Analyses

Post hoc power analyses were conducted using G*Power (version 3.1.9.2),³² and indicated excellent power to detect large Cohen's *d* effects (.80), ($1-\beta > .99$) and medium effects (.50; $> .99$), but lacked adequate power to detect small effects (.20; .58-.68). All other statistical analyses are described in Figure 1 and were conducted using SPSS.³³

RESULTS

Forty-nine percent of participating children were girls, 82.6% were white, and 24.2% had a body mass index above the 85th percentile. The household income for the participant's families was \$25,000 or less for 12.8% of participants, \$25,000 to \$50,000 for 18.1%, \$50,000 to \$75,000 for 22.8%, \$75,000 to \$100,000 for 23.5%, and \$100,000 or greater for 23.5%. The sample's median income fell between \$50,000 and \$75,000, and the median income for the state of Minnesota during the study was \$59,000 to \$60,000.³⁴

Hypothesis 1: Children Pay More Attention to Products with (vs without) Characters

Results for both attention outcomes (proportion of fixations and dwell time) supported hypothesis 1. Children on average viewed products with characters more often (at least one fixation on 93.4% of packages with characters; standard deviation [SD]=8.2%) vs those without characters (88.8%; SD=10.9%), $P<0.001$). Children also viewed products with characters for more time (mean=829.7 ms, SD=353.7) vs products without characters (mean=717.5 ms, SD=319.2), $P<0.001$.

Hypothesis 2: Children Have a Preference for Less-Healthy (vs More Healthy) Products When a Character Appears on Both Products or Does Not Appear on Either Product

As expected, children were significantly more likely to choose the less-healthy product option in comparisons when

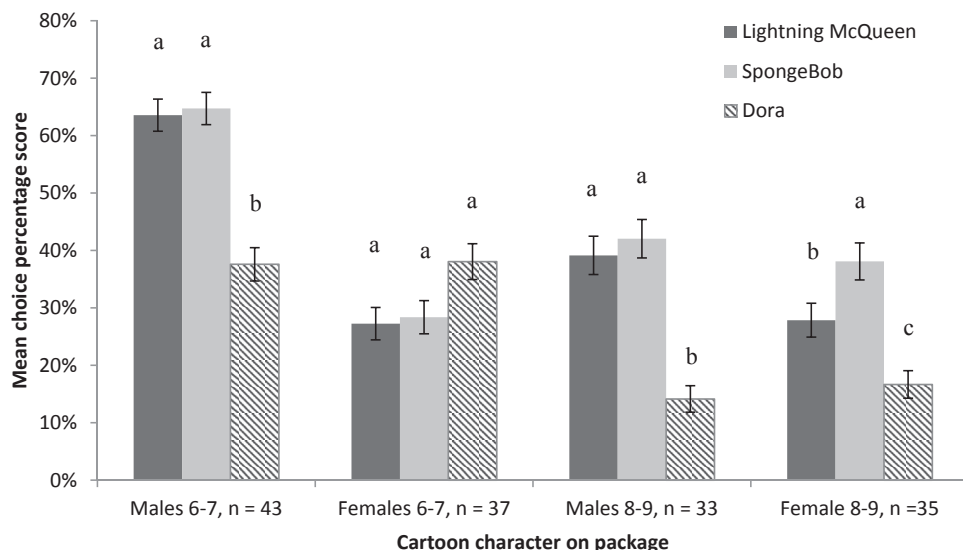


Figure 2. Six- to 9-year-old children's mean percentage scores for choosing a product featuring a character sorted by specific character on product package, child sex, and child age when product healthfulness is the same. Bars within each age/sex group denoted with the same superscript letter (^{a,b,c}) did not have statistically significant post hoc pairwise comparisons (following a repeated-measures analysis of variance).

characters were present or absent on both products, but a less-healthy product was being compared with a more-healthy product (Table; Figure 1).

Hypothesis 3: Children Demonstrate a Preference for Products with (vs without) Characters

Contrary to our prediction, we found that children were significantly more likely to choose the product *without* a character, regardless of whether both products were more- or less-healthy (Table; Figure 1). However, a repeated-measures analysis of variance indicated a moderating effect of character on food choice, such that products featuring Dora the Explorer were chosen less frequently, mean=27.5%, SD=30.2, than products featuring Lightning McQueen, mean=40.6%, SD=36.3, $P<0.001$, or SpongeBob SquarePants, mean=44.3%, SD=36.3, $P<0.001$. Significant interactions also were found between the specific character and participant sex and age (6- to 7-year-olds vs 8- to 9-year-olds); see Figure 1. The three-way interaction between character and child sex and age is depicted in Figure 2. Younger boys were more likely to choose a product of the same healthfulness that had a character on it when the character was SpongeBob SquarePants or Lightning McQueen. Although younger girls were more likely to choose products with Dora the Explorer than products with the other characters, they still chose products with characters less than products without characters. Furthermore, older boys and girls were both less likely to choose products with characters on them than those without, but this was especially pronounced when the character was Dora the Explorer.

Hypothesis 4: Children Prefer More-Healthy Products with a Character than Less-Healthy Products without a Character

Counter to our prediction, children chose less-healthy products without characters 62.3% of the time when paired with more-healthy products with characters.

DISCUSSION

The primary aim of this study was to determine whether the marketing strategy of adding front-of-pack licensed media cartoon characters to food and beverage products increases school-aged children's preferences for more-healthy foods/beverages over less-healthy ones. We gathered data on behavioral intentions and attention to determine whether attention might be one mechanism through which this marketing technique works and examined the degree of influence of the characters, depending on the specific character and children's age and sex.

First, licensed media characters were effective at capturing children's attention. Children viewed products with characters significantly more often and for more time than products without characters, but these differences were small. Small differences, magnified across a large population, can produce meaningful public health impacts.³⁵ In contrast to previous research, the presence of a character did not increase children's likelihood of choosing a more-healthy food.¹⁹ Instead, the character reduced the likelihood of a child choosing that product relative to the same product without a character. Although this finding was contrary to our hypothesis, ours is not the only study to report the counter-intuitive potential for (at least some) characters to negatively impact food choice.³⁶ However, when we further investigated the impact of characters on food choice, we found that this varied based on age, sex, and specific character. Consistent with prior work on licensed media characters,²² younger children (ages 6 to 7 years) were more attracted to products with characters than were older children (ages 8 to 9 years; H3a). Although on average children chose the more-healthy food less than 40% of the time, some characters (ie, Lightning McQueen and SpongeBob SquarePants) increased selection of healthy foods to approximately 64% among boys aged 6 to 7. Possibly the effect among girls is not as strong because only one character of the three was herself female.

Nonetheless, when children were choosing between more-healthy products with characters and less-healthy products without characters, the less-healthy products tended to be preferred. Similarly, Wansink and colleagues²³ found that children aged 8 to 11 years only chose an apple with *Sesame Street*'s Elmo (Sesame Workshop) on it approximately 36% of the time when it was up against a cookie without a character.

This study also shed light on the importance of targeted marketing efforts when using characters. Children showed increased selection of healthier products with characters when those items featured certain characters, but not others, possibly because of differential liking by the child or the child's peers. For example, Dora the Explorer was less appealing to the older participants, likely because the television show targets preschool children (ages 3 to 5 years), whereas the two characters featured in shows targeting older children (ages 6 to 9 years), Lightning McQueen and SpongeBob SquarePants, were more influential with older children. This age-based explanation of differential character impacts is consistent with results from focus group discussions indicating that younger children were enthusiastic about chicken nuggets packaged with characters from *Toy Story* (Walt Disney Pictures/Pixar Animation Studios), whereas older children were turned off by these characters because they were viewed as targeting younger children.³⁷ Similarly, among younger children in the current study, sex differences in character influence were seen based on characters that differentially target each sex.

STRENGTHS AND LIMITATIONS

This study has several limitations. First, children viewed product images on a computer screen and did not have access to actual products. Possibly, if children were making real food choices, their selections would have differed. Second, children were not asked to report their prior experiences with the foods or characters tested, so whether foods and characters were novel or familiar, or whether participants consumed any of these foods regularly, was unclear. Although our findings suggest that the effects of licensed media characters varies based on liking and familiarity, future studies should evaluate whether such characteristics moderate character effects. Third, having children complete 60 trials could have led to fatigue over time, leading ultimately to less-considered responses. An analysis of average response time did show faster responding in the final trials compared with the initial trials, but this difference also could be attributable to a practice effect early in the experiment.

This study also has a number of strengths. It is the first study to objectively measure both younger and older children's visual attention to licensed media characters on food packaging.²⁵ In addition, it included a wider age range of children and a wider range of packaged foods than previous studies.

CONCLUSIONS

Our results suggest that licensed media characters can draw children's attention, but their presence may not be sufficient to persuade children to choose healthier foods over less-healthy foods. We also find that licensed media character

marketing strategies seem to be more effective with younger, rather than older, children. The data suggest that not all characters will have the same impact on child food selections. The use of characters to market healthy foods also has practical challenges. First, parents tend to view products with licensed media cartoon characters as being less-healthy and natural,³⁸ a belief that might need to be addressed if characters were used on healthier foods. Second, many of the healthiest foods are fresh produce, which often do not come in packaging, although supermarkets could consider signage with characters to draw children's attention.

Use of characters to sell healthy foods is already underway in the US marketplace. Our research suggests that characters might be more influential in supermarket fruit and vegetable aisles where they are not competing side-by-side with less-healthy foods, and might be less impactful in situations in which children are simultaneously presented with healthier and less-healthy options. Future studies of the long-term effects of licensed media characters on children's eating behaviors across different settings are needed to understand the value of this marketing strategy for healthy foods.

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For more information on the subject discussed in this article, see the Sites in Review in this month's New in Review section.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

FUNDING/SUPPORT

This study was supported by The University of Minnesota's Obesity Prevention Center (T32 DK083250).

ACKNOWLEDGEMENTS

The authors wish to thank Melanie Jaeb, MPH, RD; Megan Mueller, MPH; and Brittany Niesen for their assistance with data collection.

Hypothesis	Hypothesis description	Independent variable (comparison type)	Dependent variable	Statistical test	Test statistics	Summary of result
H1	Children pay more attention to products with (vs without) characters	Characters present vs characters absent (all comparisons)	Proportion of products that received at least one fixation	Paired samples <i>t</i> test	$t(148)=9.48$ $P<0.001$, 95% CI _d [0.04, 0.06]	H1 supported: Children were both more likely to look at and spend more time looking at products with characters than products without characters.
			Mean dwell time (milliseconds) on each product		$t(148)=9.932$ $P<0.001$, 95% CI _d [89.9, 134.6]	
H2	Children prefer ^a less- (vs more-) healthful products	More-healthful products vs less-healthful products (comparisons 1, 2)	% of trials where less-healthful product was selected	Single sample <i>t</i> test (test value 0.50)	$t(148)=-7.74$, $P<0.001$, CI _d [0.09, 0.15]	H2 supported: Children were more likely to choose the less-healthful product option than the more healthful option (62.2% vs 37.8%)
H3	Children prefer ^a products with (vs without) characters	Characters present vs characters absent (comparisons 3, 4)	% of trials where product with character was selected	Single sample <i>t</i> test (test value 0.50)	$t(148)=-5.10$, $P<0.001$, 95% CI _d [-0.17, -0.08]	H3 not supported: Children chose the product that had a character present on the packaging 37.7% of the time vs when a character was not present 62.3%
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Figure 1. The influence of cartoon media characters on 6- to 9-year-old children (n=149): Description of statistical tests and results for each hypothesis. Sex was not reported for one child, so the analytic sample for analyses using sex is 148. All other analyses incorporated the full sample (n=149). CI_d=confidence interval of the difference between the two scores.

Hypothesis	Hypothesis description	Independent variable (comparison type)	Dependent variable	Statistical test	Test statistics	Summary of result
H3a	Children's preference for products with characters will vary depending on specific character and child demographics	Characters present vs characters absent (comparisons 3, 4)	% of trials in which specific character was displayed where product with character was selected	Repeated-measures analysis of variance	$F(2, 288)=26.57, P<0.001$	H3a supported: Products featuring Dora the Explorer were less likely to be chosen than products featuring Lightning McQueen, $P<0.001$, or SpongeBob SquarePants, $P<0.001$. There was no significant difference in choice between Lightning McQueen and SpongeBob SquarePants, $P=0.09$. See Figure 3 for moderation results.
				Moderator: sex	$F(2, 288)=16.26, P<0.001$	
				Moderator: age	$F(2, 288)=5.71, P=0.004$	
				Moderator: sex \times age	$F(2, 288)=5.44, P=0.005$	
H4	Children prefer ^a more-healthy products with characters over less-healthy products without characters	Characters present vs characters absent (comparison 5)	% of trials where product was selected	Single-sample t test (test value 0.50)	$t(148)=-8.05, P<0.001, 95\% \text{ CI}_d [-0.16, -0.10]$	H4 not supported: Children chose more-healthy products with characters only 37% of the time.

^aA particular product or character classification is operationally defined as "preferred" if it is selected significantly more often than chance (ie, 50% of the time).

Figure 1. (continued) The influence of cartoon media characters on 6- to 9-year-old children ($n=149$): Description of statistical tests and results for each hypothesis. Sex was not reported for one child, so the analytic sample for analyses using sex is 148. All other analyses incorporated the full sample ($n=149$). CI_d =confidence interval of the difference between the two scores.