

The Impact of Exposure to Cartoons Promoting Healthy Eating on Children's Food Preferences and Choices

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ABSTRACT

Objective: This study explored whether a cartoon show with healthy eating messages positively affected children's food choices and food preferences.

Design: Experimental between-subjects design.

Setting: Four elementary schools in Portugal were investigated.

Participants: Children (aged 4–8 years; $n = 142$) were randomly assigned to 1 of 2 groups: a comparison group ($n = 73$) was exposed to cartoons with no reference to food and an intervention group ($n = 69$) was exposed to cartoons with healthy eating messages. After viewing, each child was given the opportunity to eat *ad libitum* for 10 minutes from a small selection of snack foods.

Main Outcome Measure: Number of healthy and unhealthy food items chosen. Food preferences were measured using an adapted version of the Leeds Food Preference Checklist.

Analysis: Generalized linear models were used to test for differences between groups. Results were considered significant at $P \leq .05$.

Results: Children in the experimental group chose significantly more healthy food items than did those in the comparison group ($B = -.600$; $SE = .19$; $P < .05$).

Conclusions and Implications: Future studies may address the effect of prolonged exposure to healthy eating cartoons. Cartoons can be used to promote healthy food choices and can be a part of health promotion campaigns.

Key Words: cartoon show, children, food choices, food preferences, healthy eating promotion (*J Nutr Educ Behav.* 2018;50:451–457.)

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INTRODUCTION

Children spend a substantial portion of their lives in front of a screen, from TVs and laptops to smartphones and tablets. Food advertising on TV that targets children ranges from 11% to 29% of all advertisements, with unhealthy foods present in 53% to 87% of food advertisements and higher percentages found during children's peak viewing periods.¹ According to

previous systematic reviews,^{2,4} food promotion directly affects children's nutrition knowledge, preferences, purchasing behavior, consumption patterns, and diet-related health. In addition, food advertising on TV has a critical indirect influence on children's food choices. A recent meta-analysis⁵ of the effect of food advertising exposure on food intake showed that acute exposure to unhealthy food advertisements increased

food intake among children even with short-term exposure.⁶ Although the effect of food advertising in unhealthy food choices and preferences is well established, few studies evaluated the effects of advertisements of healthy food on food choice. Dixon and colleagues⁷ studied 10- to 11-year-olds and found that advertising for nutritious foods promoted positive attitudes and beliefs regarding the foods advertised. Bannon and Schwartz⁸ designed a study to test the influence of nutritional message framing on young children's snack choices and concluded that children who viewed nutritional message videos (ie, a nutritional message related to the positive benefits of eating apples) chose more apples than did children in a control condition. However, Dovey and colleagues⁹ studied 5- to 7-year-olds and found that after exposure to healthy food advertising, although some children consumed fewer chocolate items, they did not increase their intake of healthy snacks.

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Research also focused on the influence of media characters (eg, cartoon characters) on food preferences and choices. For instance, Kotler and colleagues¹⁰ examined 2- to 6-year-olds and showed that the association between cartoon characters and healthy or unhealthy food items did not significantly change children's food choices; however, children were significantly more willing to try foods in the same category when the foods were branded with cartoon characters. Kraak and Story¹¹ concluded that cartoon characters used in branding can have a positive influence on fruit and vegetable choices when compared with no branding. However, this effect is larger with regard to children's preferences and choices when cartoon character branding is used for unhealthy foods.

According to the developmental systems perspective,¹² the development of food choices and preferences can be understood in terms of exposure, social learning, and associative learning. Developmental models of food choice highlight the central role that learning has through the observation of important models. On the other hand, according to the Theory of Planned Behavior,¹³ an individual's behavioral intention is a result of his or her attitudes toward the behavior and the perceived social pressure (subjective norm) to perform that behavior.

Another line of research suggests that children develop parasocial relationships with media characters, creating an emotional relationship that can facilitate learning messages conveyed by their favorite characters and drawing attention to the potential use of cartoons and cartoon characters in promoting healthy eating messages.¹⁴ Although the literature has established the effect of food advertising on food preferences and choices, less research has focused on the role that healthy food advertisements and entertainment characters have in healthy food choices. This novel study tested whether healthy eating TV cartoon characters, which are widely available and can be delivered over a large scale, can be effective in conveying healthy eating messages and affecting children's food preferences and choices. Therefore, this study aimed to

evaluate the effect of healthy food messages delivered by cartoon characters on the food preferences and choices of 4- to 8-year-olds using a randomized controlled trial with a between-participants design. It was hypothesized that children who viewed the cartoons promoting healthy eating would (1) choose healthier food items and (2) prefer more healthy foods than would children who viewed cartoons with no nutritional content.

METHODS

Participants

A total of 142 children were recruited from 4 different elementary schools in the northern region of Portugal. The inclusion criterion was being age 4–8 years. The researchers contacted school directors and obtained permission to conduct the study. Researchers distributed informed consent forms and sociodemographic questionnaires in a sealed envelope to responsible teachers in the classes, who then delivered them to parents for completion. Parents who agreed to allow their children to participate returned the informed consent documents and questionnaires to the responsible teacher in the class. Anonymity was ensured for all participant data collected. An identification code was

given to all participants; no other information (eg, school) was recorded. Children provided verbal assent before any study procedure was undertaken.

Exclusion criteria included the inability to speak Portuguese fluently or understanding it. In addition, participants were excluded if they had been referred to a special educational needs and disabilities team or early intervention team because of cognitive developmental problems. Inclusion and exclusion criteria for the study were communicated to the responsible teacher in each class, who then referred participants for study enrollment according to these criteria and parental consent. Participants were randomly assigned to an intervention ($n = 69$) or comparison group ($n = 73$) using a computer-assisted program (www.randomizer.org; Research Randomizer, version 4.0, 2013).

Procedures

The ethics committee of each institution (the Portuguese Educational Board and the University of Minho) involved approved the study protocol. A trained researcher tested children individually to complete the questionnaires (Figure).¹⁵ After completing the questionnaires, children viewed cartoons in small groups of 4 or 5. Children in the comparison group viewed 2 se-

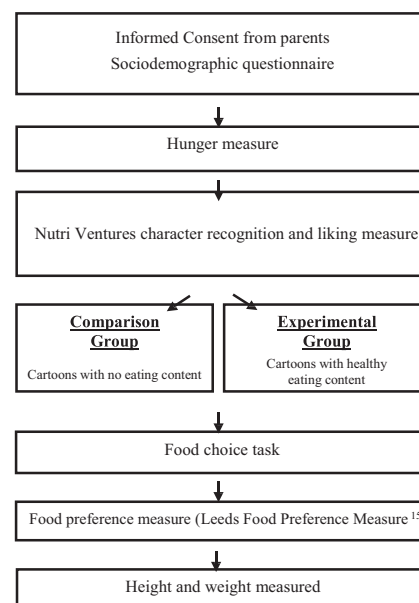


Figure. Schematic representation of experimental procedure for testing the effect of healthy eating cartoons viewing in food choices and preferences.

quential 10-minute episodes of cartoons without content regarding eating or food. Children from the intervention group viewed 2 sequential 10-minute episodes of Nutri Ventures (NV), which included healthy eating content and messages promoting healthy eating.

After watching the videos, each child was individually invited to a separate room where 4 bowls containing different food items (healthy foods such as grapes and baby carrots as well as less healthy foods such as chips and chocolates) were available. Four researchers simultaneously conducted the experimental task with the children. Over 10 minutes, the child was allowed to choose and eat *ad libitum*. Food quantities were controlled (10 chips, 20 chocolates, 15 grapes, and 6 baby carrots) and the exact quantity of food items ingested was calculated. No information was provided regarding snacks. Children were informed that they would answer some questionnaires and that they could eat whatever they liked from the bowls. The bowls were refilled if needed without explanation or commentary. The researchers counted and registered the exact number of food items eaten (eg, 5 grapes and 10 chocolates). This procedure was conducted as discreetly as possible so that children were unaware. Researchers maintained neutral body language during the task and conducted the experiment without making comments about the food or giving feedback regarding the type or quantity of food chosen or the quantity of food ingested.

After the food choice task, children were invited to complete a food preferences questionnaire. All questionnaires were verbally administered to children. Finally, the children's height and weight measurements were recorded using a wall-mounted tape measure and calibrated weighing scales (Seca 899, Seca Medical Measuring Systems and Scales, Hamburg, Germany). The Figure shows a representation of the experimental procedure.

Stimuli and Measures Used in the Study

Cartoons with healthy eating content. Nutri Ventures is a children's cartoon series developed by the Nutri

Ventures Corporation (www.nutri-ventures.com; Lisbon, Portugal) to entertain children while promoting healthy eating through stories about 4 heroes. The premise of the series is that the NV heroes live in a gray city where food does not exist. To restore food diversity to the world, the 4 little heroes start a journey to the 7 kingdoms of nutrition in search of the missing foods. Two episodes were developed by blending material to include 2 kingdoms to promote fruit and milk consumption.

Cartoons without eating content. Two episodes of a popular cartoon show in Portugal were specially selected so that they included no reference to food or healthy eating.

Measures

Hunger. Ratings of hunger were recorded based on the question *How hungry are you at this moment?* using a visual analogue scale ranging from hungry (5) to full (1).

Nutri ventures character recognition and liking measure. Because NV materials were already available in Portugal, the researchers assessed recognition of these cartoons to control for prior knowledge with regard to affecting responsiveness. Children were asked whether they recognized the NV characters (yes or no). Another question assessed how much the children liked the NV characters, using a 5-point Likert scale ranging from *like a lot* to *hate*.

Adaptation of the Leeds food preference measure. The Leeds Food Preference Measure is a food preference checklist of 32 nonbranded food items. The version used was described by Hill and colleagues.¹⁵ Participants make a mark next to an item if they would like to eat that specific food item at that particular moment. The list is composed of 8 high-fat items (eg, large chocolate bar), 8 high-carbohydrate items (eg, roast potatoes), 8 high-protein items (eg, roasted chicken breast), and 8 low-energy density items (eg, strawberries). Food preference checklists are long-established tools used in human appetite research and have been validated with regard to actual food preferences and selection in children.¹⁶

This measure was also used previously to demonstrate the short-term effects of TV advertisement exposure on food preferences in young children.¹⁷ The questionnaire was translated and back-translated into Portuguese by 2 Portuguese nutritionists who were fluent in English. The items were selected from commercially available foods in Portugal and portioned so that the items had energy and nutritional content similar to the original checklist.

Body mass index percentile and weight status. Measurements of height (in meters) and weight (in kilograms) were used to calculate the body mass index (BMI) of each child (in kg/m²), converted into a BMI percentile. Children were placed into a particular weight status percentile category (normal weight, overweight, or obese) according to the World Health Organization.¹⁸

Sociodemographic questionnaire (parental completion). A set of questions regarding family income, occupational status, and occupation was used to classify children according to sociodemographic status.

Data Analysis

The researchers conducted an exploratory analysis. Data were tested for normality using the Kolmogorov-Smirnov test. When variables were not normally distributed, nonparametric tests were used. If parametric and nonparametric testing presented the same results, parametric tests were presented based on the suggestion of Martins.¹⁹ To analyze differences between the intervention and comparison groups regarding age, BMI percentile, and hunger, the researchers used *t* tests for each variable. To investigate whether between-group differences were present with regard to sex or previous knowledge of the cartoons, chi-square tests of independence were conducted. Spearman's rho correlation was used to investigate group and sociodemographic status.

The effect of watching cartoons on children's food choices was tested using a generalized linear model, with group as the factor variable and healthy and unhealthy food choices

as the response variables. Because both response variables were assessed through the number of food items ingested, the negative binomial family was selected to create the corresponding models. Negative binomial regression is a generalization of the Poisson regression because it has the same mean structure as well as an extra parameter to model over-dispersion. These models then assessed the significant effects of BMI percentile and age. To investigate the effect of watching cartoons on food preferences, a different generalized linear model was

used in which group was the factor variable and food preference was the response variable. In addition, age and BMI percentile were used as covariates and included in the model. The model was tested using a Poisson distribution. Power analysis was conducted using G-Power software (release 3.1.9.2; Faul, Erdfelder, Lang & Buchner; 2014). A conservative effect size of .25 and power of .95 were computed for each variable. The minimum sample size required was 80 participants. All analyses were conducted using Statistical Package for Social Sci-

ences software (version 24.0, SPSS, IBM Corp, Armonk, NY, 2016).

RESULTS

Participant Characteristics

Most students were of Portuguese nationality (98%). Approximately half of the sample (52%) was above the BMI percentile for overweight or obesity, which corresponds with the prevalence of obesity in northern Portugal.²⁰ Table 1 describes the sociodemographic and anthropometric characteristics of the sample, with differences between

Table 1. Sociodemographic and Anthropometric Characteristics of Participants and Hunger Level at Pretest (n = 142)

Variables	Total Sample (n = 142), n (%)	Comparison Group (n = 73), n (%)	Experimental Group (n = 69), n (%)	Statistics
Age, y				
4–5	35 (25)	19 (26)	16 (23)	
6–8	107 (75)	54 (74)	53 (77)	
Mean (SD)	6.44 (1.21)	6.33 (1.20)	6.57 (1.22)	$t_{140} = -1.16; P = .25^a$
Sex				
Girl	72 (51)	37 (51)	35 (51)	
Boy	70 (49)	36 (49)	34 (49)	$\chi^2(1) = 0.00; P = .99^b$
Educational level				
Preprimary	42 (30)	25 (34)	17 (25)	$r_{pb} = -0.08; P = .36^c$
Primary (1st y)	26 (18)	13 (18)	13 (19)	
Primary (2nd y)	74 (52)	35 (48)	39 (57)	
Body mass index percentile				
Low weight	2 (1.4)	1 (1.4)	1 (1.4)	
Normal	66 (47)	39 (53)	27 (39)	
Overweight	30 (21)	13 (18)	17 (25)	
Obesity	44 (31.0)	20 (27)	24 (35)	
Mean (SD)	73.46 (25.79)	69.49 (27.42)	77.65 (23.41)	$t_{140} = -1.90; P = .06^a$
Level of hunger				
I'm full	41 (28.9)	20 (27.4)	21 (30.4)	
I'm almost full	24 (16.9)	14 (19.2)	10 (14.5)	
Neither hungry nor full	28 (19.7)	13 (17.8)	15 (21.7)	
Getting hungry	24 (16.9)	8 (11)	16 (23.2)	
Hungry	24 (16.9)	18 (24.7)	6 (8.7)	
Mean (SD)	2.76 (1.47)	2.86 (1.55)	2.65 (1.37)	$t_{139} = 0.88; P = .38^a$

^aT test statistics for differences between comparison and experimental group for age, body mass index percentile, and level of hunger. ^b χ^2 independence test for group and sex. ^cPoint biserial (pb) correlation for group and educational level. Note: Portuguese children were aged 4–8 years. Level of hunger was measured by asking *How hungry are you at the moment?* Answers ranged from *I'm full* = 1 to *hungry* = 5.

Table 2. Differences in Means of Food Items Eaten During Food Choice Task by Experimental and Comparison Groups After Cartoon Viewing

Food Choices	Control (n = 73)		Experimental (n = 69)		Statistics		
	Mean (SD)	Range	Mean (SD)	Range	B	SE	P
Less healthy	6.3 (5.65)	0–31	6.9 (7.10)	0–29	-.101	.18	.57
Healthy	2.6 (3.81)	0–25	4.7 (4.41)	0–17	-.600	.19	.002

Note: n = 142. Food choices represent the number of healthy and less healthy foods within items chosen during a food choice task by Portuguese children aged 4–8 years after they viewed cartoons with healthy eating content or cartoons with no eating content. Generalized estimation equations model statistics for healthy and less healthy food choices. All models were tested adding age and body mass index percentile as covariables. $P \leq .05$ was significant.

Table 3. Differences in Food Preferences Measure for Experimental and Comparison Group After Cartoon Viewing

Food Preferences Category	Comparison Group (n = 72)		Experimental Group (n = 69)		Statistics		
	Mean	SD	Mean	SD	B	SE	P
Rich in fat	11.8	2.08	12.23	2.42	-.035	.049	.47
Rich in protein	12.0	2.69	12.51	2.80	-.045	.048	.35
Low energy content	11.2	2.31	11.14	2.02	.008	.050	.87
Rich in carbohydrates	11.9	2.01	12.42	2.33	-.045	.048	.35

Note: n = 141. Portuguese children were aged 4–8 years. Generalized estimation equations model statistics. $P \leq .05$ was significant. Food preferences were according to the Leeds Food Preference Measure macronutrient category.

the comparison and intervention groups.

Effects on Food Choices of Watching Healthy Eating Cartoons

A significant effect of group was found with regard to healthy food choice (mean [SD]): (B = -.600 [.19]; $P < .05$) (Table 2). When they were added to the model, no significant effect was found for BMI percentile (B = .003 [.004]; $P = .44$) or age (B = .128 [.08]; $P = .13$). No significant group effect was found for less healthy food choices. Table 2 presents the mean numbers (and SDs) of healthy and less healthy food items chosen by the comparison and intervention groups.

Effect on Food Preference of Watching Healthy Eating–Promoting Cartoons

A nonsignificant effect was found with regard to food preference, suggesting that no between-group differences

existed regarding preferences (Table 3). Table 3 shows a detailed description of the effect on children's food preferences of viewing cartoons promoting healthy eating.

DISCUSSION

The current study tested the effect of watching healthy eating–promoting cartoons on the food preferences and choices of children. This study found that viewing these cartoons had a positive effect on food choice, and that children who viewed the cartoons promoting healthy eating chose more healthy food items than did children in the comparison group. The results of this study corroborate those of previous studies.^{8,21}

These results did not reveal differences between children who were exposed to cartoons promoting either healthy eating or comparison cartoons regarding their food preferences. Research showed that the use of cartoon characters in advertising increases children's preferences for these foods and their liking of the foods

advertised.²² The lack of an effect in this study might be explained by the use of different methods to measure food preferences (eg, *How good or bad do you think this product is?* vs *Would you like to eat this food at this moment* [LPFM]). Boyland and colleagues¹⁷ found that acute experimental exposure to less healthy food messaging in food advertising affects children's food preferences; however, those authors did not find an effect with regard to low-energy food preferences (using the LPFM), which is in line with current results.

Another reason for the difference in the results might be that most research on food advertising focused on the effects of the consumption of less healthy foods or preferences for them.^{16,17,23} Less research focused on the effect of food advertising in promoting healthy eating. Dovey and colleagues⁹ concluded that healthy food advertising appeared to affect food intake among children. However, those authors claimed that such advertising might not have the same strength as advertising for less healthy

food and therefore might not be sufficiently effective to overcome the innate and reinforced food preferences (via commercial food promotion) of children for less healthy foods. The lack of a food preference effect in the current study is partially explained by the fact that it is more difficult to change food preferences toward healthy food items such as fruits and vegetables, it requires more exposure, and they are less preferred by children.²⁴ In addition, this study assessed food preferences after the food choice task, which might have influenced the results. Moreover, food preferences develop early in life seem to be maintained during the life course²⁵ and are difficult to change.²⁶

This study's results showed that children who were exposed to cartoons promoting healthy eating chose more healthy food items than did those in the comparison group. However, no between-group differences were found regarding the number of less healthy food items chosen. These results might be explained by the fact that the themes of cartoon episodes with healthy eating content included the 2 NV kingdoms of fruit and milk. No content was presented with regard to other food groups, ie, the bad kingdoms of sugars and fats. Exposure to this content might have discouraged the choice of unhealthy food items. Another possible explanation for these results is that the presence of the research team, the nature of the task (watching cartoons), and the presentation of food in the classroom by the research team might have created a party environment, allowing the children to eat less healthy foods such as chocolates and chips.

The current study had limitations. One was the absence of data regarding children's family eating behaviors (ie, food habits), which might have informed the researchers better about variables that might have affected these results (eg, food preferences).²⁷ In addition, the food preference measure was not validated in Portuguese, which should be considered when interpreting the results. In this study, participants were exposed only to healthy messages during a single 20-minute exposure, which might have contributed to the

lack of an effect on food preferences. Another limitation was the lack of control regarding the time of the day when the experimental food task choice was conducted, owing to practical reasons (ie, so as not to interfere with academic activities or the time needed to recruit the sample). Although the hunger level before the experimental task was controlled, the time of the day when the food choice task was conducted might have influenced the results. Another limitation is that the energy ingested by children in both groups was not calculated. Researchers involved with implementing the experiment were not blinded to the objectives of the study, although all procedures were conducted so that no interference would occur with the eating choice task. Despite the care taken by the research team, a social desirability bias might have influenced the results. Moreover, although not significantly different, the intervention group had a higher percentage of participants who were overweight or obese, which might have influenced the results. Therefore, these results should be generalized with caution.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The current study has important implications for the promotion of healthy eating among children because it revealed that entertainment media characters and cartoons have the power to promote healthier food choices. Future studies may consider including content that frames unhealthy eating in a negative way to test the potential of cartoons to reduce the likelihood of choosing less healthy food items. In addition, it is important to study the effect of cartoons promoting healthy eating using an experimental design that tests the effect on children's eating behavior of prolonged exposure to positive nutritional messages. In future studies, the use of different food preference measures would be important to better compare the current results with other studies. Furthermore, it is important to study the effect of watching cartoons alone with regard to food preferences and choices.

In addition, neophobia may be examined in future studies as a moderating variable of the number of less healthy food items chosen by children in the food choice task. The current results highlighted the potential effect of cartoons to promote healthy eating and might have implications for the large-scale delivery of healthy eating promotion strategies to children. Future research will test intervention educational programs that promote healthy eating using cartoon characters and cartoons.

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