Measuring the Impact of Advertisement on Children Diet Choice in the Pediatric Population.

José Antonio Ponce-Blandón

Escuela Enfermeria De La Cruz Roja

Macarena Romero-Martín (✉ mromero@cruzroja.es)

Juan Gómez-Salgado

Universidad de Huelva

Nerea Jiménez-Picón

Escuela Enfermeria De La Cruz Roja

Lucía Ramírez-Baena

Escuela Enfermeria De La Cruz Roja

María de las Mercedes Lomas-Campos

Universidad de Sevilla

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Abstract

Background: The aim of this study was to evaluate the test–retest reliability of the paired selection method for measuring the impact of food advertising on the consumption preferences of children. **Methods:** In this study, 52 children aged 4 to 6 years participated in watching an advertisement style video showing four foodstuffs with low nutritional value. Two pollsters were introduced at two instances showing pairs of pictures of the advertised foodstuffs right next to similar products, so that children could express their preferences. The test–retest reliability was measured through the concordance and interclass co-relation between both answers. **Results:** Kappa concordance indices of 0.71 (0.46–0.97), 0.88 (0.62–1.15), and 0.90 (0.64–1.16) were obtained for the three foodstuff pairs. The interclass correlation coefficient for the sum of manifested preferred scores was 0.72 ($p = 0.0000$). **Conclusions:** The paired selection method has been demonstrated to be efficient with good or very good reliability, making it useful for measuring the impact of food advertising on this age group. **Keywords:** food advertising; food habits; childhood obesity; television advertising; assessment.

Background

Childhood obesity is a predictive factor of adult morbidity and mortality. In order to gain perspective, criteria established by the World Health Organization are the most widely used, including studies by Sanchez Cruz et al. [1] in 2012, which showed that 31% of children between 8 and 13 years old in Spain were overweight and 15% were obese, and by Aladino [2], which showed that 23% of children 6 to 10 years old were overweight and 18% were obese.

A direct relationship is acknowledged between the increasing obesity figures and exposure to advertising of foodstuffs with low nutritional value to children watching television [3]. Reducing TV habituation is among the basic recommended measures, since, according to the majority of pediatricians, advertising constitutes an important barrier to the prevention of childhood obesity [4].

Several studies conducted in Spain [5–7] and other countries [8–11] have analyzed the nutritional characteristics of foodstuffs advertised during children's programs, finding that most are hypercaloric and not part of a healthy diet, since they tend to have excessive amounts of refined sugars, salt, and fat. Children easily develop consumption patterns associated with processed food of low nutritional value, as reflected in the works included in a review carried out by the World Health Organization [12].

There are studies showing the differences between ads for healthy and nonhealthy foods with regard to nutritional information, with low levels of scientific-technical information, or about health benefits of nonhealthy products. Such ads aimed at children were found to contain fantasy elements and offer gifts [13, 14].

In this sense, it is interesting to study the direct influence of advertising on the eating habits and consumption preferences of children, and most such studies show that exposure to food ads promotes the consumption of those foods [15, 16]. Some experiences have been developed to evaluate this relationship, such as the work of Halford et al. [17], which verified the ability of children exposed to advertising to recognize the advertised foods and showed that children who were obese recognized significantly more food advertisements than those who were not.

However, few studies have used experimental methodologies [12, 18, 19] to measure the causal relationship that might be established between exposure to advertisements and the consumption preferences of children; some have focused on measuring children's short-term preferences after controlled exposure [20–24]. In this line of work, the study by Borzekowski and Robinson [25] stands out. In that study, in order to determine whether the display of food ads influenced their preferences in the very short term, children were interviewed after being exposed to children's programs with commercial breaks in which index cards with pairs of products were shown, including the ones advertised, so that they could express their preferences, leading to the conclusion that children exposed to the ads were more likely to select the advertised foods.

This type of experiment, with a similar methodology, has also been used in other studies evaluating the effectiveness of advertising [22, 26–28], not necessarily of food products, both in child and adult populations, corroborating the usefulness of the method.

However, it is evident that preschool-age children (4 to 6 years old) are a group especially vulnerable to the presentation of consumption patterns in advertisements, and for this reason advertisers use specific persuasive strategies aimed at these children [29–31]. Thus it is necessary to gain a better understanding of the influence of these specific strategies on consumer preferences at a stage of psycho-evolutionary development where many lifelong eating habits are acquired.

The objective of this paper is to evaluate the test–retest reliability of the paired selection method in the 4-to-6-year-old age group, as a way to measure the outcomes of studies analyzing whether exposure to commercial advertising of food products exerts any effect on short-term consumption preferences at these ages.

Methods

A cross-sectional study was proposed, to evaluate the test–retest reliability of the paired selection method to measure the influence of advertising on the participants' consumption preferences.

The study population was children 4 to 6 years old from the Escuela Infantil Santa Infancia in downtown Seville, which was randomly selected among the centers registered with the Ministry of Education of the Junta de Andalucía for the academic year 2011–12, which had authorized in that course 2 units of first and second cycle of early childhood education (3–6 years) for 42 and 35 school posts, respectively (77 eligible subjects in total).

A convenience sampling was selected from 52 participants of these ages in the second year of elementary education, in attendance during June 2012.

As general demographic descriptive variables, sex and age were considered, and were used as independent variables in the analysis of factors associated with consumption preferences in the first measurement. As dependent variables, the consumption preferences manifested by the participants after the use of the paired selection method were established.

The intervention consisted of exposing the group to an episode of the cartoon series "Caillou," trying not to make any reference to food consumption in its content. During the broadcast of the episode, a commercial break was included with 4 advertisements of various food products selected from ads studied in the work of Ponce-Blandón et al. [13], chosen by a group of experts using the following criteria: advertisements aimed at children, products

regularly consumed by children with high fat content and/or refined sugars, and/or that offer a gift and/or use the testimony of a famous person. Ads for these products were ultimately chosen:

- 1.
1. Puleva cocoa milkshakes
- 2.
2. Bollycao chocolate stuffed pastries
- 3.
3. Miel Pops cereal
- 4.
4. Príncipe Double Choc chocolate cookies

In order to measure the outcome, after viewing the video, each child was led individually to a separate room, where a brief survey was conducted by a pollster who asked the child to choose between photographs shown in pairs, with one of the items from the commercial break shown next to a similar product. Table 1 shows the products used during the procedure.

Table 1
Products utilized for paired selection method.

Advertised product	Paired product
Breakfast cereals	
<i>Miel Pops</i> corn cereal with honey	<i>Frosties</i> sugary wheat cereal
Chocolate cream–filled cookies	
<i>Príncipe Double Choc</i> chocolate cream–filled cookies	<i>Tosta Rica Choco Guay</i> chocolate cream–filled cookies
Chocolate milkshakes	
<i>Puleva</i> chocolate milkshakes	<i>Pascual</i> chocolate milkshakes
Chocolate stuffed pastries	
<i>Bollycao</i> chocolate stuffed pastry	<i>Tentación</i> chocolate stick

The child's response to each of the 4 advertised products was recorded on a data collection sheet. In case the child did not respond or made contradictory responses, it was marked as not valid and that participant was excluded from the study.

This procedure was applied 2 times (test–retest method) and by 2 pollsters instructed about the procedure, in order to evaluate interobserver reliability and repeatability [32]. The first measurement was made at the end of exposure to the video by one pollster, and the second was made 15–30 minutes later by a second pollster. Both

were unaware of the products advertised during the commercial breaks, so that they could not influence the participants' preferences.

Subsequently, the data relative to the rest of the variables of the study were collected, facilitated by the participants' tutor through the student center records.

All data in the data collection sheets were recorded with the Epi Info tool version 7.1.2.0 for further statistical analysis through the same application.

A descriptive analysis of the data was conducted, calculating the most representative frequencies of the qualitative variables, with confidence intervals of 95%. The quantitative variables were numerically summarized by calculating the main measures of central tendency and dispersion. In the same way, for the analysis of the relationships between sociodemographic variables and preferences in the first measurement, the association between variables was estimated (odds ratio and relative risk, correspondingly) and the chi-square test was applied, establishing $p\text{-value} < 0.05$ as the level of significance.

With regard to the consistency analysis of the paired selection method (test–retest and interobserver reliability), the concordance between the 2 preference measurements for each product pair was studied. To do this, we calculated the observed concordance ratio P_o and the expected concordance ratio P_e , as well as the kappa index and its 95% confidence interval. We established the following as reference values: ≤ 0.20 = very weak concordance, $0.21–0.40$ = weak concordance, $0.41–0.60$ = moderate concordance, $0.61–0.80$ = good concordance, and ≥ 0.81 = very good concordance, accepting the outcome measurement tool for kappa index values above 0.60 (good or very good) [32].

The sum of the scores obtained by the preferences of each participant was calculated, with the preferences recoded as numerical variables with 2 possible values, 1 or 0, according to whether the preference was for the advertised product or not, generating a new variable for the sum of the scores of preferences expressed by participants, with values from 0 to 4. The interclass correlation coefficient was calculated to assess the numerical concordance between the first and second measurement. Their reference values were as follows: ≤ 0.30 = bad or no concordance, $0.31–0.50$ = mediocre concordance, $0.51–0.70$ = moderate concordance, $0.71–0.90$ = good concordance, and ≥ 0.90 = very good concordance, accepting it as valid if the score of this coefficient exceeded 0.70 (good or very good concordance) (32). The level of statistical significance accepted for the calculation of these coefficients was established at $p < 0.05$.

The research was authorized by the University of Seville's Ethics Committee of Experimentation, by the Ministry of Education's Provincial Delegation of Seville, Junta de Andalucía, and by the Integral Plan of Childhood Obesity of Andalusia. The right of the participants' parents not to expose their children to the experiment was preserved; they were provided with an informed consent document for their children's participation, and children whose parents did not sign the document were not included in the study.

Results

The results were obtained after the final participation of 52 boys and girls out of the 77 eligible subjects, adjusted for losses, dropouts, and eliminations. The participants' flow through the study is represented in Fig. 1.

With regard to the sociodemographic characteristics of the participants in this field trial, 61% (47.0–74.7) were girls (n = 32), and the remaining 38% (25.3–53.0) were boys (n = 20).

Regarding the ages, 42.3% (28.7–56.2) of the participants were 4 years old (n = 22), and 57.7% (41.3–69.5) were 5 or 6 years old (n = 30). The mean age was 4.6 years (SD = 0.5, (4.4–4.7)). In the first measurement, 56.7% of preferences (42.9–69.1) were for advertised products, compared to 43% of preferences for the compared products (29.1–50.8). This difference did not turn out to be significant, as happened with the differences found in the preferences for each product pair shown separately, as seen in Table 2.

Table 2
Distribution of preferences for product pairs.

Product pair	Advertised products			Compared products			OR (95% CI)	p
	n	%	95% CI	n	%	95% CI		
Sugary cereals	31	59.6	(45.1–72.1)	21	40.4	(27.0–54.9)	1.47 (0.67–3.20)	0.324
Chocolate cookies	22	42.3	(28.7–56.8)	30	57.7	(42.3–1.3)	0.73 (0.33–1.58)	0.431
Chocolate milkshakes	31	59.6	(45.1–72.9)	21	40.4	(27.0–54.9)	1.47 (0.67–3.20)	0.324
Stuffed pastries	34	65.4	(50.9–78.0)	18	34.6	(21.9–49.0)	1.88 (0.85–4.15)	0.112
TOTAL	118	56.7	(42.9–69.1)	90	43.3	(29.1–50.8)	1.31 (0.89–1.92)	0.168
CI = confidence interval; OR = odds ratio.								

Regarding the analysis of relationships between sociodemographic variables and preferences, no significant differences were found in preferences according to sex or the two age groups (4-year-olds and 5- and 6-year-olds), as can be seen in Table 3.

Table 3
Analysis of relationships between variables age group, sex, and consumption preferences.

Product	Advertised or not	No. girls (%)	No. boys (%)	RR (95% CI)	p	Children < 5 y/o (%)	Children 5 & 6 y/o (%)	RR (95% CI)	p
Sugary cereals	Advertised	10 (31.2%)	11 (55.0%)	0.56 (0.29–1.08)	0.089	13 (59.1%)	18 (60.0%)	1.02 (0.52–1.99)	0.947
	Not advertised	22 (68.7%)	9 (45.0%)			9 (40.9%)	12 (40.0%)		
Chocolate cookies	Advertised	15 (46.9%)	7 (35.0%)	1.33 (0.66–2.70)	0.399	12 (54.5%)	10 (33.3%)	1.63 (0.86–3.08)	0.126
	Not advertised	17 (53.1%)	13 (65.0%)			10 (45.5%)	20 (66.6%)		
Chocolate milkshakes	Advertised	20 (62.5%)	11 (55.0%)	1.13 (0.70–1.83)	0.591	14 (63.6%)	17 (56.7%)	1.12 (0.71–1.75)	0.612
	Not advertised	12 (37.5%)	9 (45.0%)			8 (36.4%)	13 (43.3%)		
Stuffed pastries	Advertised	20 (62.5%)	14 (70.0%)	0.89 (0.60–1.32)	0.580	13 (59.0%)	21 (70.0%)	0.84 (0.55–1.28)	0.414
	Not advertised	12 (37.5%)	6 (30.0%)			9 (41.0%)	9 (30.0%)		

Table 4 shows the comparison of the two measurements of preferences by the paired selection method. For the first pair of products, sugary cereals, in the first measurement, 59.6% (45.1–73.0) of the children chose the advertised product, Miel Pops, and in the second measurement, 61.5% (47.0–74.7) chose this product. For the second pair of products, chocolate cookies, 42.3% (28.7–56.8) chose the advertised product, Principe Double Choc, and in the second measurement, 46.1% (39.5–67.2) chose it. For the third pair of products, chocolate milkshakes, in the first measurement, 59.6% (45.1–73.0) preferred the advertised product, Puleva, and in the second measurement, 63.5% (49.0–76.4) chose it. For the fourth pair of products, filled pastries, in the first measurement, 65.4% (50.9–78.0) of the children preferred the advertised product, Bollycao, and in the second measurement, 75% (61.1–86.0) chose it. The kappa indices obtained for the four pairs of products between the two measurements showed values of 0.71 (0.46–0.97) for the first pair, 0.77 (0.51–1.02) for the second pair, 0.88 (0.62–1.15) for the third pair, and 0.90 (0.64–1.16) for the fourth pair.

Table 4
Concordance between the two preference measurements expressed by paired selection.

Sugary cereals	First measurement	Second measurement		Total
		Kellogg's Frosties	Miel Pops	
	Kellogg's Frosties	17	4	21
	Miel Pops	3	28	31
	Total	20	32	52
	P ₀ , P _e , kappa index	P ₀ : 0.8653	P _e : 0.5221	Kappa: 0.72 (95% CI: 0.46–0.97)
Chocolate cookies	First measurement	Second measurement		Total
		Príncipe Double Choc	Tosta Rica Choco Guay	
	Príncipe Double Choc	22	0	21
	Tosta Rica Choco Guay	6	24	31
	Total	28	24	52
	P ₀ , P _e , kappa index	P ₀ : 0.8846	P _e : 0.4926	Kappa: 0.77 (95% CI: 0.51–1.02)
Chocolate milkshakes	First measurement	Second measurement		Total
		Puleva	Pascual	
	Puleva	30	1	31
	Pascual	2	19	21
	Total	32	20	52
	P ₀ , P _e , kappa index	P ₀ : 0.9422	P _e : 0.4774	Kappa: 0.89 (95% CI: 0.62–1.15)
Stuffed pastries	First measurement	Second measurement		Total
		Bollycao	Tentación	
	Bollycao	35	0	35
	Tentación	5	12	17
	Total	40	12	52
	P ₀ , P _e , kappa index	P ₀ : 0.9038	P _e : 0.0221	Kappa: 0.90

Finally, regarding the sum of preference values, a value of 2.27 (DS = 0.86 (2.03–2.50)) was obtained in the first measurement, and 2.54 (SD = 0.84 (2.31–2.76)) in the second measurement. Figure 2 shows a bar graph comparing the frequencies obtained in the two measurements; in the first measurement, 48.1% of the participants scored two points, and in the second measurement 34.6% obtained two points. The variance of the two measurements was 0.749 and 0.841, respectively, with an interclass correlation coefficient of 0.73 ($p = 0.0000$).

Discussion

The test–retest reliability of the paired selection method to measure the influence of advertising on the food preferences of children 4 to 6 years old could be said to have been more than acceptable, taking into account that the kappa indices obtained for the four pairs of products between the two measurements were categorized as having good concordance for the first two pairs and very good concordance for the last two pairs, and that the interclass correlation coefficient for the sum of scores for the two measurements showed good concordance [32], which were consistent when preferences were categorized as nominal variables and were converted to a numerical scale.

Previous validations of similar procedures for pair product selection by Cornwell et al. [33], who obtained a Cronbach's alpha of 0.86, and Kopelman et al. [34], with a test–retest reliability result of 0.70, serve as comparison. The validity of the tool used could be considered very high, if we compare it with the validity of the tool employed by Gwozdz and Reisch [35], who obtained internal consistencies with Cronbach's alpha values oscillating between 0.29 and 0.47.

Questionnaires were not used in this study, because the available tools were designed to be answered by parents of very young children (4 to 6 years old) and are more focused on measuring the frequency of eating habits. For example, the Food Frequency Questionnaire [36, 37], the Children's Social Desirability for Food Scale [38], and other self-administered questionnaires such as the Youth Healthy Eating Index [39] and the one validated by Robinson et al. [26] are designed for older children rather than younger children, such as those in this study.

For populations with similar age characteristics and, more importantly, to measure their short-term consumption preferences, an extensively used technique is to measure the quantities of products consumed during the experiment or immediately after, offering participants various food products including those advertised in the commercial breaks of the experimental videos. This technique, used by different studies [22, 24], seems to be effective at measuring the outcome, but it does have difficulties, because it was necessary to film and photograph the selections to ensure the correct measurement of the outcome [28] or their purpose was more to measure the quantities ingested of the products announced in the experiment [22, 27].

The use of paired images of similar products, as in this study, was also employed by Reisch et al. [19], who showed 10 pairs of similar food products for which children expressed preferences by assigning an image of a smiley or sad face, indicative of desired or undesired products. It was also used with good internal and external validity by Kopelman et al. [34], who used paired cards with images of food products to check whether children exposed to advertisements were able to recognize logos and brands. Cornwell et al. [33] also successfully employed this technique, showing pairs of cards with images of fast foods to evaluate the recognition of brands,

as did Borzekowski and Robinson [25], who handled pairs of cards showing sugary juices, donuts, sweets, chicken appetizers, sugary breakfast cereals, and peanut butters to assess the impact of advertising after 30 seconds in a group of preschoolers.

In almost all studies performing similar experiments, children have been exposed to a greater number of advertising messages and the outcome has been measured with a larger set of product pairs, but a methodological recommendation is mentioned to simplify the experimental procedure [19, 25, 33]. For this reason, in this paper it was decided to limit the pairs of products to four, in order to reduce the children's exposure to commercial messages, given their young age. Despite all efforts to avoid classification bias during the process, certain limitations must be assumed given the age characteristics of the population under study. In particular, a child's assignment of preference was sometimes difficult, since at this age it is very easy to influence their opinion if the pollsters do not adopt an absolutely neutral stance, even in their nonverbal language. Thus, useful measures from other studies were adopted [25, 33, 34], such as pollsters having previous training to remain neutral, or the blindness technique, so that the pollsters' prior knowledge about the products could not influence the children's responses. Even so, doubtful response from three children were considered and discarded from the definitive sample, in order to guarantee maximum accuracy of the results.

Regarding the results analyzing the preferences and their differences according to the children's age and sex, it can be affirmed that the results were not conclusive. Two aspects cast shadows on this part of the experiment: the size and representativeness of the sample, and the absence of a real experimental methodological process, since there was no control group.

Indeed, the experimental method of exposing study subjects to children's programs with advertising breaks and randomly assigning participants to groups exposed to advertisements of food products versus control groups is common and proven to be able to evaluate the effect of advertising on children's consumption preferences. Including a control group that is shown the same animated video with breaks that include advertisements for nonfood products was done by some of the reviewed trials with similar hypotheses [17, 20, 40, 41], with one control group shown advertisements of products such as toys, clothing, and other products, while another control group is shown the same video without ads.

Regarding the size and representativeness of the sample, the sample size of this study is large compared to most of the similar experimental studies reviewed, as verified in 2006 by the WHO [12], which reviewed 20 experiments with much smaller sample sizes of 36 to 131 children. Also, the systematic review carried out by Gregori et al. [42] shows the difficulty of working with large sample sizes in these experiments; of the seven trials reviewed, the sample sizes were between 22 and 121 children.

Regarding the ethical aspects, and in view of similar experiences [12, 41], it is important to recognize that the intervention performed does not seem to pose any risk to the psychological integrity of the study subjects, since it does not go beyond what the studied population receives in terms of daily influence. In fact, viewers of Andalusia's main TV channels are exposed to almost seven ads for food products every hour and more than 30 general ads for each hour of programming, on average, and almost half of the ads for food and beverages are specifically targeted to children [13].

Conclusions

In conclusion, measuring the influence of advertising on short-term consumption preferences for processed food products by children aged 4 to 6 through the method of paired selection has proven to be effective, obtaining good or very good reliability for all measured preferences. Other experimental methodologies with the controlled and randomized exposure of children to advertising messages and the subsequent measurement of outcomes with paired selection could be recommended to contrast with the hypothesis of the association between exposure to advertising and short-term preferences.

This research will help develop measures to exercise control, of both the time children spend watching television and the persuasive and biased information often offered by advertisers, as well as to promote educational strategies for children to learn how to identify the more deceptive aspects of advertising in order to progressively choose healthier foods.

Declarations

Ethics approval and consent to participate

The research was authorized by the University of Seville's Ethics Committee of Experimentation. The right of the participants' parents not to expose their children to the experiment was preserved; they were provided with an informed consent document for their children's participation, and children whose parents did not sign the document were not included in the study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Not applicable.

Author's contributions

JAPB and MMLC designed the study and participated in the data collection. JAPB and MRM analyzed the data and wrote the first version of manuscript. NJP and LRB assisted in the data interpretation. MMLC and JGS revised critically the draft of the manuscript, with a key intellectual contribution to the final version. All authors read and approve the manuscript.

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Figures

Figure 1

Flowchart of participants flow through the study.

Figure 2

Comparison of frequencies obtained in the sums of values of preferences expressed in the two measurements in the paired selection method.

Supplementary Files

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