The Effectiveness of "Emolabeling" to Promote Healthy Food Choices in Children Preschool Through 5th Grade

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Abstract: Obesity has become a growing global concern. Evidence indicates that ecological factors are most predictive of obesity among children, and that a new strategy, referred to as emolabeling, may effectively address ecological factors, although the extent to which it can influence food choice is not yet known, but tested here. Specifically, we tested the hypothesis that children aged 3 to 11 years will use emolabels, or emotional correlates of health (i.e. healthy-happy, unhealthy-sad), to make healthy food choices. A cross-sectional design was used with two phases. In Phase 1, children were taught how to use emolabels with a "faces of health" lesson. In Phase 2, children made choices between containers that were laid out on a large table in pairs and varied by taste (tastes good, no information), social norms (popular, not popular), branding (image of a minion, no image), or preference (told what food was in each container). A control pair was labeled with only emoticons. The order and presentation of the containers were counterbalanced for each variation. Results showed that a significant proportion of children in the pre-literacy and the early literacy grades used emoticons to specifically make healthy food choices in each variation ($p < .05$ for all tests), except when children were told what foods were in the containers. In all, emolabeling effectively influenced food choices for healthy foods among children aged 3 to 11 years, more so than labeling for taste, social norms, and branding, but not preference.

Keywords: Emoticons, Emolabeling, Food Choice, Health, Literacy, Childhood.

Obesity is a major public health concern that is now prevalent and growing in developed, high-income countries [1, 2], and less developed, low-income countries [3], and is closely linked to increased rates of morbidity and mortality in the U.S. [4]. Of particular concern here is the growing rate of children who are overweight or obese. The rates of overweight/obesity have more than doubled since 1980 from 5% to 10.4% among preschool children ages 2 to 5 years [5], and from 7% to 16% among elementary school children ages 6 to 11 years [6], with no clear sign that the rates of overweight/obesity are slowing among children in these age groups.

While genetic and biological factors are associated with childhood obesity risks [7, 8], environmental factors, such as the family, school, community, and other factors are known to impact childhood obesity [9], with recent efforts targeting environmental strategies for the prevention of childhood obesity [10]. Of particular interest is a recent analysis of data for 2,100 children showing that ecological factors could account for a large proportion of variance in explaining childhood obesity [11]. Specifically, factors related to the child, family, school, and community accounted for the greatest proportion of variance in the analysis, suggesting that strategies targeting these factors to prevent or intervene in childhood obesity could potentially have a substantial impact in slowing the growing rates of obesity among children.

One potential new strategy to address the growing rates of childhood obesity is to effectively educate children about health, thereby impacting their food choice. However, for children to be educated about health, current assumptions require that they possess a basic skill set generally called *health literacy* [12]. According to the American Medical Association (AMA), Institute of Medicine (IOM), and the U.S. Department of Health and Human Services (HHS), health literacy requires a set of skills (e.g., basic reading and math/counting skills) needed to acquire knowledge about health and make appropriate health-related decisions [13-15]. This definition implies that it is not possible to educate children about health to effectively impact their healthy food choices because they have limited ability to read and perform basic math skills.

Recent evidence challenges the premise of this definition by showing a method by which children can correctly identify the healthfulness of foods [16]. The method used was to teach children to relate emotional correlates of health (happy-good, healthy; sad-not good, not healthy) to the actual healthfulness of foods. Privitera *et al*. [16] showed that 3-year-old children could correctly identify healthy and unhealthy foods if emoticons were used to convey emotional correlates of health. Beginning at preschool ages, children have the ability to understand emotion [17], and even make

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E-ISSN: 1929-4247/14

appropriate emotion-related decisions [18], meaning that they can demonstrate "literacy" of emotion. The method used by Privitera *et al*. [16] showed a way in which children who were too young to read or perform basic math skills (i.e., they lacked the skill set "required" for health literacy) could use their "literacy" of emotion to correctly recognize healthy and unhealthy foods, even when shown foodstuffs that were unfamiliar to them.

The evidence of a method by which pre-literacy-aged children can learn about health demonstrates a potential strategy for communicating health to children that can empower children to make healthier food choices. However, to date, this method has only been shown to impact the ability of children to recognize healthy and unhealthy foods; it is still unclear whether children will use information about health to actually make healthy food choices. If so, then this method could address major ecological factors known to be associated with risks of childhood obesity [11]. Specifically, teachers and parents could use emoticons to teach children about health, and children could then use the emoticons to potentially guide their food choices.

In the present study we therefore tested if labeling foods with emotional correlates of health, which we refer to as *emolabeling*, can influence food choice among pre-literacy (Pre-k to 1st grade) and early literacy (2nd grade to 5th grade) children. Specifically, we tested two research questions. First, will children use happy emoticons to make healthy food choices? Second, of the children who use emoticons to make food choices, will most of them use the emoticons to make healthy, and not unhealthy, food choices? To further test possible limitations, we tested if other information that is typically included on a food package, such as information about taste, social norms, branding, and preference, could interfere with the effectiveness of emolabeling to influence food choice.

METHOD

Participants

A total of 75 children (45 girls, 30 boys) from preschool (Pre-k) to 5th grade were sampled from a small private school in the Western New York region, USA. Informed consent was given by the school administrators, teachers, and parents to conduct this study. All parents of children in the pre-kindergarten through 5th grade were asked to allow their children to participate. As shown in Table **1**, response rates were high. The sample constituted 74% of the entire school population for the grades observed, and 81% of the population of children in kindergarten through 5th grade at the school.

Table 1: Sample and Population Size at the School where Children were Observed

	Grade	Sample Size	Population Size	Proportion Sampled
Pre-Literacy Age	Pre-k	6	17	0.35
	K	9	10	0.90
	1st	13	14	0.93
Early Literacy Age	2nd	13	16	0.81
	3rd	11	15	0.73
	4th	13	14	0.93
	5th	10	16	0.63
	TOTAL	75	102	0.74

The data are split in two groups: Pre-literacy age, and early literacy age. Three in every four children in the school population were sampled in this study.

Table 2: Mean Participant Characteristics in each Literacy Age Group

	N	Height (m)	Weight (kg)	BMI (kg/m^2)	BMI %ile	Age Range (years)
Pre-Literacy	28	1.2(0.1)	22(5.4)	16.5(3.2)	51.1	3-6
Early Literacy	47	1.4(0.1)	31(7.5)	17.2(2.8)	53.1	6-11

Standard deviations are given in parentheses. BMI percentiles were computed with adjustments made for age and sex based on CDC normative data [19].

The age, weight, height, and BMI of each child are given in Table **2**. BMI percentiles were computed using Centers for Disease Control and Prevention (CDC) normative data [19]. Based on CDC growth charts, a healthy BMI range for children is between the 5th and 85th percentiles. In total, 74% of children sampled fell within the healthy BMI range (71% of pre-literacy children; 77% of early literacy children), with 14.5% falling in the overweight/obese range (14% of pre-literacy children; 15% of early literacy children). These percentages match closely with national averages for the percent of children that would be expected to fall into each respective BMI category in the United States [5, 6].

Procedures

Faces of Health Lesson

The teacher at each grade level gave students the "faces of health" lesson [16] the morning of the study within approximately two hours of when children were tested in the next phase. The teacher (not a researcher) at each grade level gave the lesson to make the lesson feel like a natural curriculum for the children. Before the faces of health lesson, children were first given a pretest to determine how well they related emoticons with health. In the pretest, children were shown two food pictures with emoticons next to each food, and were asked to circle the healthy food (i.e., the food with the happy emoticon) for one trial and to circle the food that was not healthy (i.e., the food with the sad emoticon) in a second trial. The pretest scores were recorded, and no grade level scored 100% on this pretest. For the lesson, each child was first taught that healthy food is "good for your body" and that a food that is not healthy is "not as good for your body." The phrase *not healthy* was used because younger children have not yet been taught prefixes (*un*-healthy) and show difficulty understanding the meaning of prefixes [20]. Also, each child was never told that unhealthy food is "bad for your body" because the word "bad" can have moral (as opposed to strictly factual) undertones [21]. Next, each child was taught that being happy is "good" and being sad is "not as good." Third, children were taught that if being happy and eating healthy are both good, then we can use a happy face to show or represent a healthy food; likewise if being sad and eating foods that are not healthy are not good, then we can use a sad face to show or represent a food that is not healthy. In a posttest, children were given the same test given before the lesson. The lesson ended when all children scored 100% on the posttest, which occurred on the first posttest for all children.

Emolabeling Food Choice Test

One at a time, children were brought into a separate classroom at the school to a large table (length × width × height: 0.8 × 2.4 × 0.9 meters) with 12 round food storage containers (88 mm high, 76 mm radius) displayed in pairs on the table. Children could not see in the containers. Upon arriving at the table, each child was told, "Thank you for coming. We are trying to pick foods to include in the cafeteria for snacks, and we would like your help choosing foods." This cover story was used to make the choices more meaningful to the children to strengthen the experimental realism of the design [22]. Children were then brought to each pair of containers on the table, and one at a time made a total of 12 choices in six variations repeated two times.

The general structure and setup of each variation displayed on the table is shown in Table **3**. In each variation children were asked to choose one container based on the information provided on the container about that food. In all variations except one, the children were not told what food was in the container. In truth, no containers had food in them. All containers were labeled with an emoticon, and one other label depending on the variation. The labels on containers

Table 3: The Order that Pairs of Containers were Displayed on the Table in each Variation of the Study

D	**BASELINE** **1** Happy emoticon only **2** Sad emoticon only	**PREFERENCE** **1** Happy+Told "It's pizza" **2** Sad+Told "It's corn on the cob"	**BRANDING** **1** Happy+No sticker **2** Sad+Minion sticker	**NEG. SOCIAL NORM** **1** Happy+Blank sticker **2** Sad+"Least Popular" sticker	**POS. SOCIAL NORM** **1** Happy+Blank sticker **2** Sad+"Most Popular" sticker	**TASTE** **1** Happy+Blank sticker **2** Sad+"Tastes Great" sticker	C
A	**TASTE** **1** Happy+"Tastes Great" sticker **2** Sad+Blank sticker	**POS. SOCIAL NORM** **1** Happy+"Most Popular" sticker **2** Sad+Blank sticker	**NEG. SOCIAL NORM** **1** Happy+"Least Popular" sticker **2** Sad+Blank sticker	**BRANDING** **1** Happy+Minion sticker **2** Sad+No sticker	**PREFERENCE** **1** Happy+Told "It's corn on the cob" **2** Sad+Told "It's pizza"	**BASELINE** **1** Happy emoticon only **2** Sad emoticon only	B

were used to mimic labeling that could be found on standard food packaging.

The order that pairs of containers were displayed in each variation of the study was counterbalanced. Referring to Table **3**, the counterbalancing procedure resulted in the following: one-fourth of children (N = 19) started at side A, then moved around the table counterclockwise until all variations were complete; one-fourth of children (N = 19) started at side B, then moved around the table clockwise; one-fourth of children (N = 19) started at side C, then moved around the table counterclockwise; one-fourth of children (N = 18) started at Side D, then moved around the table clockwise. Nested within this counterbalancing procedure was the side that the food containers were displayed in each variation. About half the children in each order sequence (N = 38 total) had container 1 on the right and container 2 on the left side; the other half in each order sequence (N = 37 total) had container 2 on the right and container 1 on the left side.

Children were run through each of six variations for two trials. For each variation, there were four possible outcomes: Using the numbers in Table **3**, children could choose container 1 on the first trial, then container 1 on the second trial (alternative 1-1); they could choose container 2 both times (alternative 2-2); they could choose container 1, then container 2 (alternative 1-2); they could choose container 2, then container 1 (alternative 2-1). The first outcome (alternative 1-1) indicated that the children used the emoticons to make healthy choices on both trials; the second outcome (alternative 2-2) indicated that the children used the emoticons to make unhealthy food choices; the interpretation for the last two outcomes depended on where they started at the table, and both indicated that the children did not use the emoticons to make food choices.

For the 1-2 and 2-1 alternatives, the interpretation depended on which variation was tested. To clarify further, the following explains the interpretation in each variation assuming a child started at side A, then moved around the table counterclockwise until all variations were completed (this was one of the counterbalanced orders). In the *taste* variation, alternative 1-2 indicated that children used the "tastes great" sticker to make choices, and alternative 2-1 was a random choice (no meaningful interpretation). In the *positive social norm* variation, alternative 1-2 indicated that children used the "most popular food choice" sticker to make choices, and alternative 2-1 was a random choice. In the *negative social norm* variation, alternative 1-2 indicated that children used the "least popular food choice" sticker to make choices, and alternative 2-1 was a random choice. In the *branding* variation, a sticker of a minion was used as "branding" for a product. For this variation, alternative 1-2 indicated that children used the minion sticker to make choices, and alternative 2-1 was a random choice. In the *preference* variation, children were told in trial 1 that the container with the happy emoticon had corn on the cob in it and the container with the sad face had pizza in it. In trial 2, children were given the opposite information. For this variation, alternative 1-2 indicated that children chose based on a preference for corn on the cob, alternative 2-1 indicated that children chose based on a preference for pizza; so there was no random choice in this variation. Finally, in a *baseline* phase, only emoticons were used as labels. Thus, both alternatives (2-1 and 1-2) were a random choice for the baseline variation. The proportion of children choosing each alternative (1-1, 2-2, 1-2, and 2-1) for each variation was recorded. The university's Institutional Review Board approved all procedures for this study.

Data Analyses

Children were separated into two groups: a pre-literacy group (pre-k through 1st grade; N = 28) and an early literacy group (2nd through 5th grade; N = 47). Chi-square goodness-of-fit tests were then computed for each variation for each age group. In all, two research questions were tested. First, will children use happy emoticons to make healthy food choices? The null hypothesis was that, by chance, 25% of children would choose the container with the happy emoticon on both trials (alternative 1-1); 75% would choose any of the other three alternatives.

Second, of the children who used the emoticons on both trials, will most of them use the emoticons to make healthy, and not unhealthy, food choices? Hence, to test this research question, the sample was restricted to only those children choosing alternative 1-1 (happy-happy) or alternative 2-2 (sad-sad) for each variation (the N for each variation is given in Table **5**). The null hypothesis was that, by chance, 50% of children would choose the happy emoticon on both trials (alternative 1-1); 50% would choose the sad emoticon on both trials (alternative 1-1).

Also, each variation, except for preference, had a random choice in which no meaningful interpretation could be made. This occurred when children chose

Table 4: Proportion of Children Choosing Happy-Happy Compared to any other Alternative

	N	Taste	Pos. Norm	Neg. Norm	Branding	Preference	Baseline
Pre-Literacy	28	0.57*	0.50*	0.71*	0.57*	0.29	0.71*
Early Literacy	47	0.60*	0.60*	0.49*	0.62*	0.19	0.79*

Results show that children used the happy emoticons to make healthy food choices beyond chance in each variation, except for the preference variation. * Indicates significance of at least $p < .01$.

happy on one trial and sad on the second trial. As a third analysis, we also checked to see if the number of random choices in each variation exceeded the statistical expectation that, of the four choices, 25% of children would choose a random choice by chance.

RESULTS

A test of the first research question showed that children did use the happy emoticons to make food choices in all but one variation. The proportion of children using the happy emoticon on both trials in each variation is given in Table **4**. For pre-literacy groups, the proportion of children using the happy emoticon to make food choices exceeded statistical expectation in each variation, except preference: taste, $\chi^2(1) = 15.43$, $p < .001$, positive social norm, $\chi^2(1) = 9.33$, $p = .002$, negative social norm, $\chi^2(1) = 23.05$, $p < .001$, branding, $\chi^2(1) = 15.43$, $p < .001$, preference, $\chi^2(1) = 0.19$, $p = .66$, and baseline, $\chi^2(1) = 32.19$, $p < .001$. For early literacy groups, the proportion of children using the happy emoticon to make food choices also exceeded statistical expectation in each variation, except preference: taste, $\chi^2(1) = 29.97$, $p < .001$, positive social norm, $\chi^2(1) = 29.97$, $p < .001$, negative social norm, $\chi^2(1) = 14.36$, $p < .001$, branding, $\chi^2(1) = 33.77$, $p < .001$, preference, $\chi^2(1) = 0.86$, $p = .35$, and baseline, $\chi^2(1) = 72.35$, $p < .001$.

A test of the second research question showed that among the children who used the emoticons, most used the happy emoticon to specifically make healthy food choices, in all but one variation. The proportion of children using the happy emoticon (as opposed to the sad emoticon) on both trials in each variation is given in Table **5**. For pre-literacy groups, the proportion of children using the happy emoticon to make food choices exceeded statistical expectation in each variation, except preference: taste, $\chi^2(1) = 8.90$, $p = .003$, positive social norm, $\chi^2(1) = 4.26$, $p = .04$, negative social norm, $\chi^2(1) = 7.54$, $p = .006$, branding, $\chi^2(1) = 7.20$, $p < .007$, preference, $\chi^2(1) = 2.27$, $p = .13$, and baseline, $\chi^2(1) = 17.19$, $p < .001$. For early literacy groups, the proportion of children using the happy emoticon to make food choices also exceeded statistical expectation in each variation, except preference: taste, $p < .001$, positive social norm, $\chi^2(1) = 16.03$, $p < .001$, negative social norm, $\chi^2(1) = 11.57$, $p = .001$, branding, $\chi^2(1) = 26.13$, $p < .001$, preference, $\chi^2(1) = 0.60$, $p = .44$, and baseline, $\chi^2(1) = 28.90$, $p < .001$.

Table 5: The Proportion of Children Choosing the Happy-Happy Alternative Among the *N* Children in each Variation who Used Emoticons on both Trials

	Taste	Pos. Norm	Neg. Norm	Branding	Preference	Baseline
Pre-Literacy	0.84*, N = 19 (68%)	0.74*, N = 19 (68%)	0.77*, N = 26 (93%)	0.80*, N = 20 (71%)	0.73, N =11 (39%)	0.95*, N = 21 (75%)
Early Literacy	1.00*, N = 28 (60%)	0.85*, N = 33 (70%)	0.82*, N = 28 (60%)	0.80*, N = 30 (64%)	0.60, N = 30 (64%)	0.93*, N = 40 (85%)

The percentage of children among all children in each literacy group is given in parentheses. Results show that significantly more children used the emoticons to make healthy food choices in each variation, except for the preference variation. * Indicates significance of at least $p < .01$.

Table 6: Proportion of Random Choices in each Trial for each Variation

	N	Taste	Pos. Norm	Neg. Norm	Branding	Preference	Baseline
Pre-Literacy	28	0.07	0.25	0.04	0.00	N/A	0.25
Early Literacy	47	0.09	0.19	0.15	0.06	N/A	0.15

The proportion of random choices never exceeded the statistical expectation of 25%. No random choices were possible in the preference variation.

As shown in Table **6**, the proportion of random choices never exceeded the statistical expectation of 25%. Thus, the effects reported here show statistical significance for choices using the emoticons, while also showing that random food choices fell within statistical expectation of chance in all variations.

GENERAL DISCUSSION

The present study tested the hypothesis that children (1) can correctly identify healthy and unhealthy foods using emoticons, and (2) will use emoticons to make healthy food choices. The results support both hypotheses by showing in a "faces of health" lesson that all children were able to correctly identify healthy and unhealthy foods using the emoticons only after the lesson was given, as previously shown [16]. The novel outcome reported here is that a significant proportion of children used the emoticons to make food choices, and that their choices were specifically for healthy foods (those foods with a happy emoticon) in all variations except one. The overall pattern of results were similar for the pre-literacy and early literacy groups, suggesting that basic reading and math skills are not required to acquire knowledge about health and to make appropriate health-related decisions [13-15] when emoticons are used to relate health information. Hence, *emolabeling*—the use of emoticons to relate the healthfulness of a food—can effectively be used to promote healthy food choices among children.

The present study also tested if competing information often found on food packages may interfere with the effectiveness of emolabeling on food choice. The results show that information about taste, social norms, and branding had no effect on the effectiveness of emolabeling. In all variations, a significant proportion of children used the emoticons to make healthy food choices. In the preference variation, however, children did not use the emoticons. In that variation, children made food choices based on their preexisting preference for the food. Overall, 49 of 75 children (65%) chose one food or the other in both trials: 25 children chose the pizza in both trials, and 24 children chose corn on the cob in both trials. Thus, preference and not emoticons controlled food choice in this variation. Although we did not measure "preference," one possible explanation is that preferences may have been very strong for these foods. The stronger the preference for a food, the more we should expect that preference will control food choice [23, 24], but as the relative preference for a food diminishes, we should expect emoticons to regain control of food choice [25]. Such a possibility can and should be tested further.

Several other limitations can be identified here. First, the data were nonparametric due to the nature of the research design used in this study. Therefore, it was not possible to compare mean differences *between* groups, calculate effect size, or identify power using standard measures of variability. Future studies will want to adapt research designs that can be subjected to parametric tests to gain greater insights into these added calculations and comparisons. Second, although 74% of children at the small school were sampled, the sample size was small overall, especially considering the age range of children observed from 3 years to 11 years old. Future studies can use larger samples to allow for a larger population-based comparison of the effects reported here. Finally, additional analyses will want to be considered in light of the potential for the *emolabeling* strategy to address the serious concerns of childhood obesity [16]. For example, future studies can look at BMI as a potential moderating factor of the effects reported here to determine if *emolabeling* can effectively moderate food choice among children who are overweight/obese (i.e., a BMI score above the 85th percentile).

Overall, the results presented here extend previous findings by showing that children can use emolabels to make healthy food choices even when other information about taste, social norms, and branding are present. This study further shows that among children who used the emoticons, they largely used them to make healthy food choices, meaning that such a strategy can specifically promote healthier food choices among children aged 3 to 11 years. Emolabeling can address factors related to the child (children can use emoticons to make healthy food choices), family (emoticons can make it easier for parents to teach about health to children), and school (schools can adopt the "faces of health" lesson used here and in [16]), which are factors that account for the greatest proportion of variance in explaining childhood obesity [11]. Given that emolabeling can effectively address many of these ecological factors known to account for the greatest proportion of variance in predicting childhood obesity [9-11], more research should be done to determine the potential for this promising strategy to combat childhood obesity and to promote healthier food choices among children.

ACKNOWLEDGEMENTS

The authors dedicate this study in loving memory of Sharon "GaGa" Topley. We also sincerely thank the Board of Trustees and administrators at the elementary school for allowing us to conduct the study at the school. We further wish to thank the teachers for their participation in this study, and to the students and their parents who gave consent to be in this study. This research study was supported by a generous internal faculty research grant awarded to the first author.

COMPETING INTERESTS

The authors declare no competing interests.

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Received on 01-01-2014 Accepted on 20-02-2014 Published on 10-03-2014

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