

# Increasing food acceptance in the home setting: a randomized controlled trial of parent-administered taste exposure with incentives<sup>1–3</sup>

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## ABSTRACT

**Background:** The use of rewards to encourage children to eat healthily is controversial. However, researcher-led interventions have shown that incentives combined with taste exposure can increase both intake and liking. To date, this has not been tested in the home setting.

**Objectives:** The objectives were to test the hypothesis that parent-administered repeated taste exposures to an initially disliked vegetable combined with reward will increase children's liking and intake and to compare the effects of tangible and social rewards.

**Design:** In this randomized controlled trial, families with children aged 3–4 y ( $n = 173$ ) were randomly assigned to exposure + tangible reward (sticker), exposure + social reward (praise), or no-treatment control conditions after a pretest assessment in which a target vegetable was selected for each child. In the intervention groups, parents offered their children 12 daily tastes of the vegetable, giving either praise or a sticker for tasting. No specific advice was given to the control group. Assessments of intake and liking of the target vegetable were conducted by researchers immediately after the intervention period and 1 and 3 mo later.

**Results:** Children who received exposure + tangible rewards increased their intake ( $P = 0.001$ ) and liking ( $P = 0.001$ ) of their target vegetable significantly more than did children in the control group. Differences were maintained at the 3-mo follow-up (intake:  $P = 0.005$ ; liking:  $P = 0.001$ ). Increases in intake and liking in the exposure + social reward group were not significantly different from the control group.

**Conclusion:** The findings of this home-based study support parental use of tangible rewards with repeated taste exposures to improve children's diets. This trial is registered as ISRCTN42922680.

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## INTRODUCTION

Although the use of incentives to influence children's food choices is controversial, several studies targeting intake of less well-liked foods (usually vegetables) have found positive effects (1–5). In one of the largest randomized controlled trials, 12 daily sessions in which either social rewards (SRs; praise) or tangible rewards (TRs; stickers) were paired with exposure to the taste of an initially disliked vegetable achieved significantly greater increases in children's liking for, and intake of, an initially disliked vegetable than did the control condition. Treatment effects were maintained for 3 mo after the intervention (6). However, in this study, the procedure was administered by researchers in a school setting, and it cannot be assumed that the

effects would generalize to the home environment, where there are multiple competing influences on children's intakes (7–13). Praise has also been shown to be less effective when given by a familiar adult than by a stranger (14, 15). The primary aim of the current trial was to evaluate whether parental delivery of an established intervention consisting of exposure to tiny tastes of an initially disliked vegetable, combined with reward, would be effective in the home setting. The secondary aim was to compare the efficacy of SRs and TRs.

## SUBJECTS AND METHODS

### Study design and sample size

Using a randomized controlled study design, we compared 3 conditions: 1) 12 daily parent-administered taste exposure sessions with TRs (stickers), 2) 12 daily parent-administered taste exposure sessions with SRs (praise), and 3) a no-treatment control condition. Outcomes (liking and intake in a behavioral test) were assessed at the participant's home by trained researchers, at baseline, immediately after the intervention period, and 1 and 3 mo after the intervention (maintenance phase). Power calculations based on results from the previous study (6) indicated that 55 participants per group would provide 85% power to detect the observed effect size of either intervention condition compared with a no-treatment control condition.

### Participants, recruitment, and study group allocation

Children aged 3–4 y and their primary caregivers were recruited through nursery schools in North London, United Kingdom. This age group was targeted for 2 main reasons. First, because parents report most feeding problems during the pre-school years and second, because a sample not yet attending school full-time would present less scheduling problems for researchers making home visits. Recruitment was done in 3 waves in 2010. At each wave, teachers distributed consent forms

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and information letters about the “Tiny Tastes” study, and families were asked to return their contact details in a prepaid envelope if they were interested in taking part. Potential participants were then contacted by telephone. A total of 212 families expressed interest; home visits were arranged with 173 families (Figure 1). The study was approved by the University College London Research Ethics Committee.

The 173 participants who agreed to be visited were randomly allocated to 1 of the 3 conditions by using blocked randomization; for every block of 30 participants, 10 were allocated to each condition. All 3 conditions were conducted concurrently during each study wave. Before a home visit, researchers carried with them an opaque envelope containing a slip of paper on which was written 1 of the 3 conditions. At the child’s home and after the baseline assessments, the researcher opened the envelope out of sight of the participants. Researchers were therefore blinded to group allocation at baseline, but unavoidably were “unblinded” during subsequent visits because they had to demonstrate the allocated exposure plus reward technique to the parents.

### **Procedure**

At baseline, the children were presented with 6 different vegetables and were asked to name them and to say whether they had ever tried them. The names were provided when the children were unsure. The 6 vegetables [carrot, cucumber, white cabbage, red pepper (capsicum), celery, and sugar snap peas] were selected because they were readily available in shops and required minimal preparation, which reduced the burden of participation for parents. The children were invited to taste a small piece (~2.5 g) of each of the 6 vegetables and to then rank them from 1 (most liked) to 6 (least liked); the rank of “4” was selected as the “target,” which allowed for both negative and positive shifts in liking to be observed.

### **Intervention conditions**

After the baseline assessment and the randomization procedure were conducted, the researcher explained the allocated exposure and reward techniques to parents.

#### *TR condition*

The parents were asked to offer their child a small piece (~2.5 g) of their target vegetable every day for 12 weekdays and to tell them that they could choose a sticker if they tried it. No tastings were done over the weekends. The tasting procedure was demonstrated by the researcher, and the parents were shown the appropriate amount to offer. The parents were also given a diary to record whether each day’s trial was performed, whether the child tried the vegetable, and whether the reward was given; space was allowed for comments. A selection of stickers was provided to the parents, who were encouraged to ensure that the child understood that the sticker was a reward for tasting the vegetable.

#### *SR condition*

Parents were asked to offer the vegetable as described above and to praise their child with phrases such as “brilliant, you’re a great vegetable taster” if they tasted it. The parents were to emphasize that the praise was being given for tasting the veg-

etable. As with the TR condition, the procedure was demonstrated, and the parents were given a diary to record their sessions.

#### *Control condition*

Families assigned to the control group did not perform any daily tastings and were given no instructions or materials for the intervention period, but were told that they would be taught a special technique to help their child to eat more vegetables after the last visit.

In our previous school-based intervention (6), children were scheduled to receive 12 taste exposures over a 3-wk period (excluding weekends, when the children did not attend school). This number of exposures had been chosen because of the strong existing evidence that a minimum of 10 taste exposures are required to reliably alter food preferences in children of this age group (eg, age 5; 16), and 12 d would allow for occasional absences from school. To precisely replicate the procedure in the previous school-based study, parents in the current study were asked to attempt 12 daily tastings, with a break on weekends. The TR (ie, stickers) and SR (ie, praise) used in the current study were also identical to those used in our school-based intervention (6).

### **Outcome measures**

The primary outcomes were liking and intake of the target vegetable, which were assessed at baseline, immediately after the intervention, and 1 and 3 mo later. Liking was assessed by using Birch et al’s (17) faces scale: 3 cartoon faces with a broad smile, a neutral face, and a deep frown, which were described as “yummy” = 3, “just ok” = 2, and “yucky” = 1. After the rating was made, the child was given a bowl containing ~10 small pieces of the target vegetable and invited to eat as much as they wanted. Intake (in g) was recorded by weighing the bowl containing pieces of the target vegetable before and after consumption with a digital scale (Mettler Toledo). This procedure was repeated at 3 further visits: at the end of the intervention (3 wk from baseline) and 1 and 3 mo later. The full trial protocol is available from the authors. To check that the numbers of taste exposures achieved by children in the 2 intervention groups were similar, parents were asked to record their progress in a diary, which was collected at the postintervention session.

### **Statistical analysis**

The analyses were conducted by using SPSS software (version 17.0; SPSS Inc). Data were positively skewed, so values were square-root transformed for analysis. The transformed data met the normality distribution assumption; therefore, the ANOVA was considered appropriate. Chi-square and Mann-Whitney *U* tests were used to compare the distribution of target vegetables across the 3 groups and the number of days the target vegetable was offered and tried in the intervention groups. The treatment effect for intake and liking was tested by using repeated-measures ANOVA, with time as a within-subject factor, group and sex as between-subject factors, and age as a covariate. Interactions were analyzed with planned post hoc tests adjusted for baseline scores and multiple comparisons by using Bonferroni corrections.

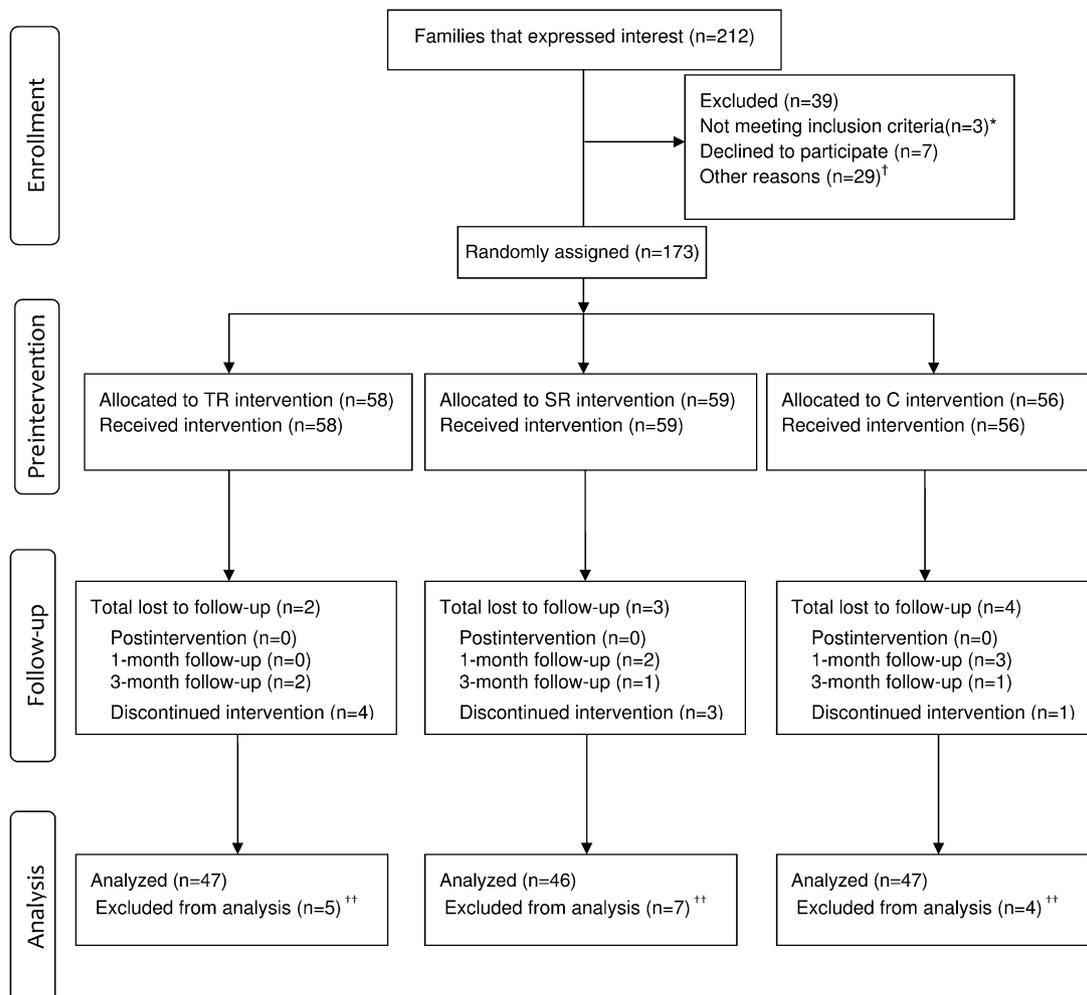
## RESULTS

Of the 173 participants who completed baseline assessments, 8 families withdrew because of difficulty scheduling subsequent sessions. Seven children were excluded from the analyses because they were ill during the intervention period and 9 children because parents told us that they had failed to follow the intervention procedures (eg, changed target vegetable, changed the reward). The sample available for analysis of the intervention phase, therefore, was 149. There were also 9 missing outcomes from the follow-up assessments; therefore, the longitudinal multivariate analyses across all time points had a sample size of 140. The flow of participants throughout the trial is shown in **Figure 1**, and the characteristics of the sample are summarized in **Table 1**. The distribution of the selected target vegetable across groups was not significantly different, and no differences in the number of days that the child was offered or tried the target vegetable were found between the intervention groups (all  $P > 0.05$ ). No group differences in liking or intake at baseline were found (both  $P > 0.05$ ) (**Table 2**). Girls ate more than boys

at baseline ( $P < 0.05$ ), and older children liked the target vegetable less than did the younger children ( $P < 0.05$ ); therefore, age was included as a covariate and sex was included as a factor in all analyses.

### Effects on intake

Consumption of the target vegetable increased over the study period ( $F_{[3,399]} = 2.81$ ,  $P = 0.039$ ). As predicted, a significant group-by-time interaction was observed ( $F_{[6,399]} = 3.05$ ,  $P = 0.006$ ). No other main effects or interactions were statistically significant. Planned post hoc comparisons (adjusted for multiple comparisons) showed that the TR group consumed significantly more of the target vegetable than did the control group after the test (mean difference = 1.27; 95% CI: 0.47, 2.01;  $P = 0.001$ ) and at 3-mo follow-up (mean difference = 1.15; 95% CI: 0.28, 2.01;  $P = 0.005$ ). The SR group's mean intake was in between that of the TR group and the control group and was not significantly different from either (**Figure 2**).



\*Special needs, clinically feeding problems

† Unable to contact participants or schedule visit

\*\* Parents did not follow procedures/child ill during intervention

**FIGURE 1.** Flow of participants throughout the trial. C, control; SR, social reward; TR, tangible reward.

**TABLE 1**  
Child and parent characteristics by experimental group<sup>1</sup>

	Tangible reward ( <i>n</i> = 58)	Social reward ( <i>n</i> = 59)	Control ( <i>n</i> = 56)
Children's age (y)	3.96 ± 0.5 <sup>2</sup>	3.99 ± 0.5	3.90 ± 0.5
Children's sex [ <i>n</i> (%)]			
Male	30 (52)	27 (46)	25 (45)
Female	28 (48)	32 (54)	31 (55)
Respondent's age (y)	37.44 ± 6.6	37.35 ± 6.4	37.52 ± 6.6
Respondent's relation to the child [ <i>n</i> (%)]			
Mother	49 (84.5)	52 (88.1)	43 (76.8)
Father	3 (5.2)	2 (3.4)	2 (3.6)
Other primary caregiver	0 (0.0)	1 (1.7)	3 (5.3)
Missing	6 (10.3)	4 (6.8)	8 (14.3)
Respondent's ethnicity [ <i>n</i> (%)]			
White	39 (67.3)	43 (72.9)	33 (58.9)
Black (African/Caribbean)	1 (1.7)	1 (1.6)	3 (5.4)
South Asian (Indian/Pakistani/Bangladeshi)	2 (3.4)	5 (8.5)	3 (5.4)
Other	8 (13.8)	4 (6.8)	9 (16.0)
Missing	8 (13.8)	6 (10.2)	8 (14.3)
Respondent's home ownership status [ <i>n</i> (%)]			
Home owner	41 (70.7)	41 (69.5)	30 (53.6)
Renting	11 (19.0)	12 (20.3)	18 (32.1)
Missing	6 (10.3)	6 (10.2)	8 (14.3)
Respondent's educational level [ <i>n</i> (%)]			
Nongraduate	10 (17.2)	16 (27.1)	15 (26.8)
Degree level or higher	41 (70.7)	37 (62.7)	29 (51.8)
Other	0 (0.0)	1 (1.7)	1 (1.8)
Missing	7 (12.1)	5 (8.5)	11 (19.6)

<sup>1</sup> Chi-square tests and one-factor ANOVAs showed no significant differences in any of the variables between the experimental groups.

<sup>2</sup> Mean ± SD (all such values).

### Effects on liking

Over the study period, liking for the target vegetable increased ( $F_{[3,399]} = 3.39$ ,  $P = 0.018$ ). As predicted, there was a significant group-by-time interaction ( $F_{[6,399]} = 3.29$ ,  $P = 0.004$ ). No other main effects or interactions were statistically significant. Post hoc tests indicated that, after the test, the TR group's liking was higher than that of the control group (mean difference = 0.52; 95% CI: 0.17, 0.88;  $P = 0.001$ ), whereas the SR group's liking was not significantly different from that of either the TR or the control group. At the 3-mo follow-up, liking remained higher in the TR group than in the control group (mean difference = 0.49; 95% CI: 0.16, 0.81;  $P = 0.001$ ), with no significant effect for the SR group (**Figure 3**).

### Parental feedback

Parents provided feedback on their experiences carrying out the intervention. Most of the parents had positive comments, such as "The tide has turned!", "She ate the whole piece and said 'I like celery.'", "She got her sticker. Then she asked for another piece and said she loved it. Wow." Another parent said, "It's the best piece of advice I've been given." Several parents said they would try the technique with other vegetables after having succeeded with the first.

## DISCUSSION

### Key findings and comparison with other studies

The results of this study indicate that parent-administered exposure plus reward is effective at increasing liking and intake

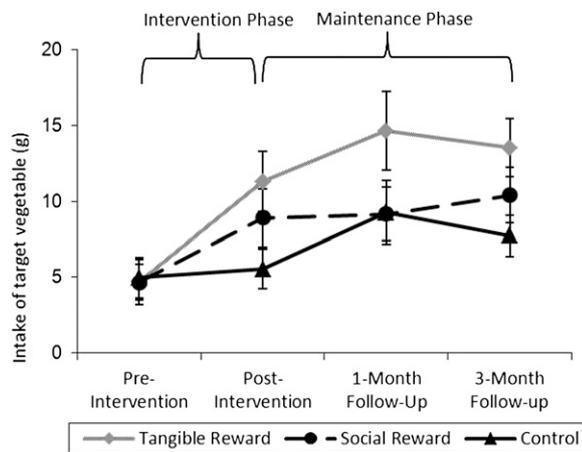
of a previously disliked vegetable and strengthening the evidence of positive effects of rewards in the feeding context. It also offers the promise of a simple procedure that parents can use to combat their children's reluctance to eat a healthy diet.

It has been suggested that even when rewards may have positive results in the short term, they might have undermining effects on liking in the long run. According to self-determination theory (18), external rewards compromise individual feelings of competence and autonomy, which results in a devaluation of the behavior and a reduction in its frequency. Although some early laboratory-based studies have tended to confirm this (19, 20), the results of the current study do not support this account. In a recent review of the effect of rewards on food acceptance, the authors

**TABLE 2**  
Target vegetable frequency distribution and baseline measures for each group at pretest

	Tangible reward	Social reward	Control
Target vegetable			
Carrot	6	5	4
Celery	10	12	10
Red pepper	8	8	6
Sugar snap peas	16	14	11
Cucumber	3	2	3
Cabbage	15	18	22
Pretest intake (g)	4.70 ± 1.5 <sup>1</sup>	4.68 ± 1.9	4.97 ± 1.3
Pretest liking rating	1.67 ± 0.1	1.86 ± 0.1	1.8 ± 0.1

<sup>1</sup> Mean ± SEM (all such values).



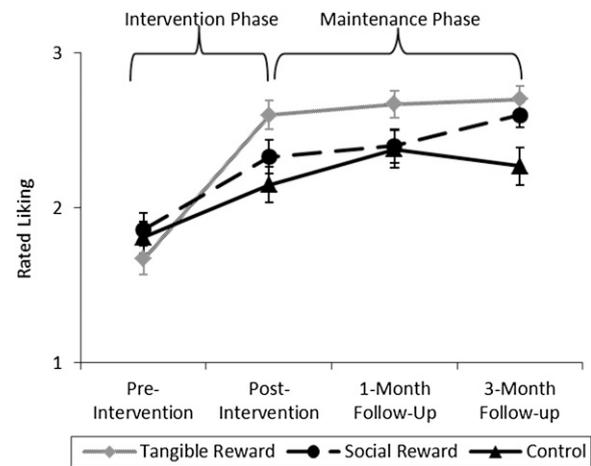
**FIGURE 2.** Mean ( $\pm$ SEM) intakes of target vegetables by trial phase and condition: tangible reward ( $n = 47$ ), social reward ( $n = 46$ ), and control ( $n = 47$ ). The figure is based on raw data. Repeated-measures ANOVA was conducted by using transformed data to allow for skewed distributions.

suggested that the positive or negative effect of rewards might depend, at least in part, on the initial liking of the food (21). Declines in intake and liking for initially well-liked foods (eg, sweet juices) have been observed in many previous studies; however, the children in the current study were rewarded for consuming a nonpreferred vegetable. It may be that it is only the rewarding of a behavior that is already enjoyed that will be undermined by the imposition of a contingency.

In contrast with results obtained after the same procedures were followed by researchers and both SRs and TRs increased acceptance (6), TRs were effective and SRs had little effect when they were delivered by the children's parents. Many studies have shown the benefits of praise and its ability to enhance intrinsic motivation (18, 22–26). However, praise may, in certain circumstances, be perceived as controlling or contrived (27). Explicit praise for eating their target vegetable may have been perceived by children as insincere in this instance. Another factor is the so-called “stranger effect” (14), ie, praise delivered by a stranger appears to be more influential than from someone familiar (15). Although we had previously suggested that praise would be a useful tool in the home environment (6), the current results suggest that small (nonfood) rewards may be more consistently effective.

### Strengths and limitations of the study

This study had some limitations. Although the researchers were blinded to group allocation during baseline assessments, they were unblinded thereafter because they had to teach parents the feeding techniques. As a result, they may have inadvertently given greater encouragement to intervention participants than to control subjects. However, the children's intake of their target vegetable was measured objectively. A second limitation is that the need for assessment at baseline and 3 further occasions meant that the control group received 4 exposures to the target vegetable, which may explain the small increase in acceptance, which reduces the observed treatment effect, as has been seen in other studies (5, 6). Third, the home setting diminished control over how the interventions were implemented, which may have diluted their effect, but it also enhanced ecological validity. Of the



**FIGURE 3.** Mean ( $\pm$ SEM) ratings for liking of the target vegetable by trial phase and condition: tangible reward ( $n = 47$ ), social reward ( $n = 46$ ), and control ( $n = 47$ ). Repeated-measures ANOVA was used for the statistical analysis.

212 parents or caregivers who expressed an initial interest in taking part in the study, 173 started the study and only 140 provided complete data for analysis. However, given that the protocol involved 4 home visits over ~4 mo, a total of 17 (<10%) who actively dropped out or who were unavailable for one or more follow-ups (rather than being omitted from analysis) is a relatively small number and testifies to the acceptability of this type of intervention. Finally, although TRs were effective with our preschool age sample, the findings require replication in other age groups.

### Conclusions and implications

These findings indicate that a parent-delivered program combining repeated taste exposures with small rewards increases the acceptance of an initially disliked vegetable. This represents the successful translation of findings from basic psychological science to the home setting. The “Tiny Tastes” program may provide a novel and practical strategy to help parents achieve a healthier diet for their children.

The authors' responsibilities were as follows—LC, HC, and JW: designed the trial protocol; AR and EA: collected the data and carried out the analyses; LC, JW, and AR: led the interpretation of the results and drafting of the manuscript; and EA and HC: contributed to the interpretation of the results and drafting of the manuscript. All authors had full access to the data and approved the final version of the manuscript. JW is the guarantor. None of the authors declared a conflict of interest.

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