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See and Eat! The impact of repeated exposure to vegetable ebooks on young children's vegetable acceptance

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ABSTRACT

Vegetable consumption in young children in the UK is well below the recommended five child-sized portions per day. Effective and practical strategies are therefore needed to encourage vegetable consumption in young children. In this exploratory study, we examine the effects of visual familiarization to foods via *See & Eat* ebooks, which show vegetables on their journey from 'field to fork'. As part of a larger study, in which 242 British families completed a range of measures about their family's eating habits, child's food preferences and potential parent and child predictors of these (Masento et al., 2022), parents were invited to download a *See & Eat* ebook about a vegetable their child did not eat. Thirty-six families participated in the intervention, looking at the ebook with their child for two weeks and reporting on their child's willingness to taste, intake and liking of the vegetable targeted by the ebook and a matched control vegetable before and after the intervention period. Results showed significant increases in parental ratings of children's acceptance of the target vegetable. Willingness to taste and intake ratings improved for the target vegetable, but not the control vegetable, while liking was reported to increase for both vegetables. These results corroborate previous research demonstrating the benefits of familiarising children with vegetables before they are offered at mealtimes and suggest that ebooks can be added to the set of tools parents can use to support children's vegetable consumption.

1. Introduction

Research suggests that preschool children in the UK and across Europe do not consume the recommended five daily portions of fruit and vegetables (Angelopoulos et al., 2009; Huybrechts et al., 2008; Manios et al., 2009). Repeated taste exposure is an effective approach to increase acceptance of vegetables into a child's diet. However, up to 10 to 15 taste exposures may be necessary for a food to be accepted (Birch et al., 1982; Wardle, Cooke, et al., 2003,b) and parents tend to offer their child a food only three to five times before giving up (Carruth et al., 2004). Therefore, alternative strategies are required to support parents in increasing children's vegetable intake.

An alternative to repeated taste exposure is the use of repeated *visual* exposure (Birch, McPhee, Shoba, Pirok, & Steinberg, 1987). Based on the principle of mere exposure, whereby visual familiarity with a stimulus increases its appeal (Zajonc, 1968), studies have shown that increasing children's familiarity with vegetables by exposing them to vegetable picture books can bring about positive changes in children's vegetable acceptance. Looking at a vegetable picture with a child for a few minutes every day for a two week period has been found to increase children's willingness to taste (WTT) and intake of the depicted vegetable, both in the immediate short term and for at least 3 months afterwards (Heath et al., 2014; Houston-Price et al., 2009b; Owen et al., 2018).

This exploratory study investigated whether ebooks might play a similar role in shaping children's attitude and acceptance of vegetables. It is not yet known whether printed books and ebooks generate different learning and affective experiences for young children and their parents. 'Smart' electronic devices such as tablets and smartphones are increasingly used to access digital resources by all age groups; as adults often take smartphones with them wherever they go, this might increase the opportunity for children to access ebook resources. Digital formats also often attract young children, and ebooks have the advantage that they can be edited and personalised, which has been shown to promote

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learning in young children (Kucirkova et al., 2014). Another advantage of using ebooks for health promotion purposes is that the distribution costs are minimal. In contrast, printed books are a more familiar format for young children and their parents, and some parents are wary of encouraging their child to spend time engaging with digital devices. This study therefore investigated whether ebooks familiarising children with a vegetable's 'field to fork' journey serve to support vegetable acceptance in a similar way to printed books. We hypothesised that ebooks would prove to be a useful additional tool in parents' efforts to increase children's vegetable consumption, given the advantages conferred by their accessibility, interactivity and potential to be customised (Dulay et al., 2020).

This study examined whether repeatedly looking at a vegetable ebook for a two-week period affected preschool children's acceptance of the vegetable, indexed by their willingness to taste it (WTT), the amount of it they consumed (intake portion size and frequency) and their liking of it, as reported by parents. We hypothesised that the visual exposure provided by the ebook would increase children's acceptance of the vegetable in the book relative to a matched control vegetable with which children were not familiarised.

2. Methods

2.1. Participants

Participants were recruited through University mailing lists (the School's Child Development Group database, the University's Parent and Family Network), social media advertisements, and University-run events held between September 2019 and December 2020. Families were eligible to participate if they had a child aged between 18 and 48 months and had access to an electronic tablet with an Android or IOS operating system. Information about the study was provided and consent collected via a dedicated research website and survey platform, and measures were collected via questionnaires accessed through the same platform.

In total, 242 parents of preschool children in UK consented to participate in a study of the factors that influence children's vegetable consumption levels and completed a set of baseline questionnaires, as part of a larger pan-European project. Seventeen families were excluded because their child fell outside the age range for inclusion (within ± 1 month of 18–48 months, to account for study duration), leaving 225 sets of eligible baseline data. A full analysis of this data is reported elsewhere (see Masento et al., 2022). A subgroup of these families (N = 36) went on to take part in the intervention reported in this article, which involved downloading and looking at an ebook for two weeks and then completing a second set of questionnaires. Of these families, 30 provided complete data for both the target and a matched control vegetable, but all available data are included in analyses to maximise power. The large majority of participants (N = 35) were mothers; one was a father. The large majority (N = 35) lived in the UK; one family lived in Australia. The mean age of the children who took part in the intervention was 30.8 months (*SD* = 9.3 months).

Families who completed the initial questionnaires but did not participate in the intervention or complete the post-intervention questionnaires were invited to tell us why they elected not to do so. A subsample (N = 49) responded, giving the following reasons: technical issues with receiving automated emails about the study (N = 29); device incompatibility (ebooks required tablets to run Android v8 or iOS v12 or later) (N = 15); personal circumstances such as family illness (N = 5). To establish whether the families who took part in the intervention were representative of the larger sample who had completed the baseline questionnaires, we compared participants and non-participants in the intervention on each of the demographic measures collected (see Table 1). The two groups did not differ on any measure (child age, child gender, child ethnicity, whether child was firstborn in family, number of children in home, whether child attended day care, number of meals taken in day care, education level of both parents).

Table 1
Demographic characteristics of participants.

	N	%
Child Age in months, Mean (SD)	30.8 (9.3)	
Child's Gender		
Female	15	41.7
Male	21	58.3
Child's Ethnicity		
English/Welsh/Scottish/Northern Irish/British	33	91.7
White and Asian	1	2.8
White -Other	1	2.8
Prefer not to say	1	2.8
First Child		
Yes	23	63.9
No	13	36.1
Children in the home		
0	1	2.8
1	15	41.7
2	19	52.8
3	1	2.8
Daycare attendance		
Yes	25	69.4
No	11	30.6
Daycare meals per week		
0	2	5.6
1	1	2.8
2	10	27.8
3	6	16.7
4	2	5.6
5	5	13.9
Parent 1 Level of Education		
GCSE or equivalent	1	2.8
Vocational qualification	3	8.3
A-Level or equivalent	1	2.7
Bachelors Degree/Equivalent	12	33.3
Higher degree/Equivalent	19	52.8
Parent 2 Level of Education		
GCSE or equivalent	1	2.8
Vocational qualification	4	11.1
A-Level or equivalent	6	16.7
Bachelors Degree/Equivalent	14	38.9
Higher Degree/Equivalent	10	27.8
Not reported	1	2.8

2.2. Materials

The *See & Eat* ebooks created for this study were based on the vegetable picture books previously used in experimental studies by our group (Heath et al., 2014; Owen et al., 2018). Each book comprises 12 pages that portray the 'field to fork' journey of one vegetable; each page presents a high quality image and a short sentence describing a step in the vegetable's journey (growing, harvesting, shopping/purchase, preparation, serving options, eating) (for more detail, see Dulay et al., 2020, or visit our ebook library at www.seeandeat.org). The ebooks could be accessed on iPad or Android tablet devices via the *Our Story 2* app (Open University), which was available to download free of charge from the Apple and Google Play app stores. The *Our Story* 2 app allowed for customization of the See & Eat ebooks through the addition or editing of text, pictures, audio and video. Participants were initially assigned to one of two groups, with one group receiving instructions about how to customize the books and encouragement to make the books personal for their child, but as a negligible number of families reported that they used the customization features, the two groups were combined for analysis.

2.3. Measures

2.3.1. Demographic questionnaire

During the pre-intervention data collection period, a wide range of questionnaires were collected to capture demographic information,

parent feeding style, and child eating behaviour measures (for the full list of measures collected and analysis of these, see Masento et al., 2022). Only the demographic measures are reported in this manuscript; these included child's gender, ethnicity and date of birth, birth order and number of children in the home, country of residence, whether the child attended day-care, and whether the child had any diagnosed developmental, cognitive or physical conditions. Parent/s' level of education was also collected.

2.3.2. Vegetable selection, WTT, intake and liking

Parents were asked to select two vegetables that they would like their child to eat from a list of 24 foods; they were encouraged to select foods that their child had not wanted to eat when they had been offered them previously. Parents were asked to report their reasons for choosing their selected vegetables by selecting as many answers as applied from among four options. The reasons given for choosing foods (and the frequency of their selection) were as follows: *My child refuses to eat this food* (61%); *My child dislikes this food* (36%); *I want my child to eat this food more often* (51%); *Others in the family eat this food regularly* (57%). One of the two vegetables selected was randomly designated the 'target' vegetable, the other the 'control' vegetable; families were provided with an ebook about their target vegetable. Table 2 provides details of the vegetables selected by parents and how these were assigned to condition.

The primary measures used to evaluate the effects of the ebook intervention were parent-report measures of children's vegetable acceptance collected pre- and post-intervention. Parents were asked to rate children's willingness to taste (WTT), intake (in terms of both portion size & frequency of consumption) and liking of the target and control vegetable. Measures used were adapted from scales previously used to gather parental ratings of children's food acceptance.

WTT *and* ***Intake (Portion Size)*** were assessed using parent-report forms of measures originally developed to provide experimenter ratings of children's willingness to try a food. Heath et al. (2014) found a high level of agreement between observer ratings on these measures and the ratings of a second experimenter who independently coded video recordings of 20% of the sample (Cohen's Kappa ranged from 0.72 to 1.00). Measures were subsequently adapted for use by parents (Houston-Price et al., 2019; Owen et al., 2018); the scale descriptions for each item were found to be sufficiently informative and precise for parents to use. In the current study, parents rated their child's ***WTT*** of the target and control vegetable on a six-point Likert scale (0 – I have not offered it yet; 1 – Refused to touch food; 2 – Touched food but did not put in/near mouth; 3 – Put food on lips but not in mouth; 4 – Put food in mouth but spat out/did not eat; 5 – Ate food). ***Intake (Portion Size)*** was reported in terms of the amount of the target and control vegetable eaten on a five-point Likert scale (0 – Has not eaten any; 1 – A tiny taste (a nibble); 2–1 teaspoon (a bite); 3–1 dessert spoon (several bites); 4 – A child-sized portion or more (lots of bites)).

Intake (Food Frequency) was measured using an adapted short-form version of the Child Food Frequency Questionnaire (Livingstone, 2010). Parents were asked to state how often their child had eaten the target and control vegetable during the previous two weeks using a five-point Likert scale (0 – Never; 1 – Once; 2 – A few times; 3 – Many times; 4 – Everyday).

Liking. The child's liking of the target and control vegetables was rated using the relevant items from the Fruit & Vegetable Familiarity & Liking Questionnaire (Heath et al., 2014). Heath et al. established the validity of this instrument by comparing parents' reports of the foods that were liked or disliked by their child with experimenter observations of children's behaviour towards these foods in a laboratory taste test, finding a high degree of correspondence. In the current study, liking of each vegetable was reported on a six-point Likert scale (0 – Has not tried it; 1 – Disliked it a lot; 2 – Disliked it a bit; 3 – Neither liked nor disliked it; 4 – Liked it a bit; 5 – Liked it a lot).

Table 2
Selection of vegetables by parents and allocation of these as target and control foods.

	N times parents selected veg	% parents selecting veg	N times allocated as target veg	N times allocated as control veg
Peppers	12	33.3	8	4
Broccoli	10	27.8	4	6
Tomato	7	19.4	5	2
Courgette	6	16.7	2	4
Cucumber	6	16.7	3	3
Sweet Potato	5	13.9	3	2
Carrots	5	13.9	3	2
Mushrooms	5	13.9	1	4
Cauliflower	3	8.3	2	1
Beetroot	2	5.6	1	1
Spinach	2	5.6	1	1
Leeks	2	5.6	1	1
Broad beans	1	3.8	0	1
Butternut Squash	1	2.8	0	1
Peas	1	2.8	0	1
Sweetcorn	1	2.8	1	0
Lettuce	1	2.8	0	1
Asparagus	1	2.8	0	1
Parsnip	1	2.8	1	0
Artichoke	0	0	0	0
Brussels Sprouts	0	0	0	0
Cabbage	0	0	0	0
Green Beans	0	0	0	0

Ethical approval

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval to conduct the study was granted by the University of Reading's Research Ethics Committee (approval number SREC: 2019-018-CHP). Consent was provided by the parent respondents via submission of an online form prior to completion of questionnaires and collection of data.

2.4. Procedure

Participants who read the information sheet and consented to participate were invited to complete a set of baseline questionnaires about their family's eating habits and child's food preferences and to select two vegetables that they would like their child to eat. On completion of these questionnaires, respondents received an email assigning the child a target vegetable, instructions on how to download and use the ebook for that vegetable, a link to the download page for the *Our Story 2* app, and a link to the relevant ebook in the *See & Eat* online library (www.seeandeat.org).

Participants were asked to look at their ebook with their child for a few minutes every day for two weeks. One week after receiving the ebook, participants were reminded via email to continue looking at the ebook for the remainder of the two-week period. After two weeks, participants were sent a link to a post-intervention questionnaire. If participants reported that they had spontaneously offered their child the target or control vegetable during the book reading phase of the study, they were asked to complete the parent-report measures of their child's food acceptance (WTT, intake and liking) at that point. If they had not done so, they were invited to offer the target and control vegetables to their child and were sent a link to the post-intervention questionnaire about the child's acceptance of the vegetables two weeks later.

2.5. Approach to analysis

The study design and approach to analysis were pre-registered at the Open Science Framework website: https://osf.io/qjsdp. G*Power calculations for 2 × 2 repeated-measures ANOVA at a level of 0.80 yielded

sample size estimates between 52 (for WTT and liking) to 200 (for intake measures). All measures were assessed for normality to determine whether parametric or non-parametric analyses were appropriate. Repeated measures ANOVAs were conducted to investigate differences between conditions over time. Wilcoxon signed rank tests were used to confirm the locus of effects within interactions.

3. Results

Thirty-six families provided post-intervention data, 30 of whom provided complete data sets for both the target and control vegetable. A summary of the demographic characteristics of the participating families is provided in Table 1.

We hypothesised that the intervention would lead to significant increases in parent-reported measures of acceptance of the target vegetable, but not the control vegetable, which would be shown in interactions between condition and time for each measure. We therefore explored our data using 2 (condition) x 2 (time) repeated measures analyses of variance. However, as our measures of willingness to taste, intake (portion size & food frequency) and liking were all non-normally distributed, confirmed by Kolmogorov-Smirnov tests, we explored the locus of effects within interactions using Wilcoxon signed-rank tests. A summary table of the measures collected (WTT, intake & liking) pre- and post-intervention is provided in Table 3.

3.1. Willingness to taste (WTT)

The 2 × 2 ANOVA for ratings of WTT found a significant main effect of condition, $F(1,29) = 5.10$, $p = .032$, $\eta p^2 = 0.15$, and a significant main effect of time, $F(1,29) = 12.12$, $p = .002$, $\eta p^2 = 0.30$. The interaction did not reach significance, $F(1, 29) = 2.93$, $p = .098$, $\eta p^2 = 0.092$. However, Wilcoxon tests confirmed that while WTT ratings increased from pre-to post-intervention for the target vegetable ($Z = -3.51$, $p < .001$), there was no significant change over time for the control vegetable ($Z = -1.85$, $p = .06$). In addition, while there was no difference in WTT for the two vegetables before the intervention ($Z = -1.25$, $p = .21$), children were significantly more willing to taste the target vegetable than the control vegetable post-intervention ($Z = -2.42$, $p = .02$) (see Fig. 1).

3.2. Intake

3.2.1. Portion Size

The 2 × 2 ANOVA for intake, as indexed by ratings of portion size consumed, found a significant main effect of condition, $F(1, 29) = 4.62$, $p = .04$, $\eta_p^2 = 0.14$, a significant main effect of time, $F(1, 29) = 29.13$, $p < .001$, $\eta_p^2 = 0.50$, and a significant interaction between condition and time, $F(1, 29) = 15.55$, $p < .001$, $\eta_p^2 = 0.349$. Wilcoxon tests confirmed that the portion size consumed increased from pre-to post-intervention for the target vegetable, ($Z = -4.41$, $p < .001$), but not for the control vegetable, ($Z = -1.39$, $p = .16$). In addition, while there was no significant difference between the amount of the target and control vegetable that was consumed prior to the intervention ($Z = -1.58$, $p = .11$), portion sizes consumed were significantly larger for the target vegetable than the control vegetable after the intervention ($Z = 2.95$, $p = .003$).

Table 3
Mean parental ratings of children's willingness to taste, intake and liking of the target and control vegetables.

		Target Vegetable		Control Vegetable	
		N	*M (SD)*	*N*	*M (SD)*
Willingness to Taste	Pre-intervention	36	2.86 (1.39)	36	2.58 (1.40)
	Post-intervention	36	4.11 (1.33)	30	3.13 (1.55)
Intake - Portion Size	Pre-intervention	36	0.53 (0.77)	36	0.58 (0.91)
	Post-intervention	36	2.03 (1.42)	30	0.90 (1.29)
Intake - Frequency	Pre-intervention	36	0.83 (1.03)	36	0.72 (0.94)
	Post-intervention	31	1.87 (0.85)	31	1.03 (0.98)
Liking	Pre-intervention	36	0.97 (1.00)	36	0.78 (1.05)
	Post-intervention	36	2.78 (1.83)	30	1.40 (1.65)

3.2.2. Frequency of consumption

The 2 × 2 ANOVA for ratings of intake, as indexed by frequency of consumption, also found a significant main effect of condition, $F(1, 30) = 7.55$, $p = .01$, $\eta_p^2 = 0.201$, a significant main effect of time, $F(1, 30) = 19.25$, $p < .001$, $\eta_p^2 = 0.391$, and a significant interaction between condition and time, $F(1, 30) = 13.49$, $p = .001$, $\eta_p^2 = 0.31$. Wilcoxon tests confirmed that frequency of consumption of the target vegetable increased significantly from pre-to post-intervention ($Z = -3.81$, $p < .001$), while there was no increase in the frequency of consumption of the control vegetable ($Z = -1.18$, $p = .24$). Prior to the intervention there was no significant difference in frequency of consumption of the target and control vegetables ($Z = -0.59$, $p = .055$), but post-intervention, children were reported to consume the target vegetable significantly more frequently than the control vegetable ($Z = -3.35$, $p = .001$).

3.3. Liking

The 2 × 2 ANOVA for ratings of children's liking of the foods similarly found a significant main effect of condition, $F(1, 29) = 5.98$, $p = .021$, $\eta_p^2 = 0.171$, a significant main effect of time, $F(1, 29) = 23.54$, $p < .001$, $\eta_p^2 = 0.448$, and a significant interaction between condition and time, $F(1, 29) = 8.69$, $p < .05$, $\eta_p^2 = 0.231$. Wilcoxon tests showed that children's liking increased from pre-to post-intervention for both the target vegetable ($Z = -4.14$, $p < .001$) and the control vegetable ($Z = -2.34$, $p = .02$). However, while there was no difference between ratings of liking of the target and control vegetables pre-intervention ($Z = -0.25$, $p = .79$), parents reported significantly greater liking of the target vegetable than the control vegetable post-intervention ($Z = -2.58$, $p = .01$).

3.4. Effects of age and demographic variables

Given that the children who participated in this study ranged in age from 18 to 48 months, we explored whether the intervention outcomes were associated with child age using Spearman's correlation. There was no significant correlation between child age and any measure of pre-to post-intervention change in acceptance of the target vegetable (WTT, liking, portion size, or intake frequency) (all ps > .2). We also explored the relationships between the intervention outcomes and the other demographic measures collected, using non-parametric tests of comparison or correlation as appropriate. There were no significant associations between any demographic measures and the measures of change in acceptance of the target vegetable.

4. Discussion

The results of this study support the hypothesis that repeated exposure to *See & Eat* vegetable ebooks over a two-week period supports vegetable acceptance among preschool children. Children's reported willingness to taste, liking and intake of a vegetable, whether intake was measured in terms of portion size consumed or frequency of consumption, showed significant increases following the ebook reading period relative to the same measures of acceptance of a matched control vegetable. Effects were not associated with age or any other demographic measure collected, suggesting that ebooks can be used effectively across the age range included in this study (18–48 months) and across demographic groups. These findings add to the growing literature supporting visual familiarization via picture books as a means of increasing vegetable acceptance in young children (Heath et al., 2014;

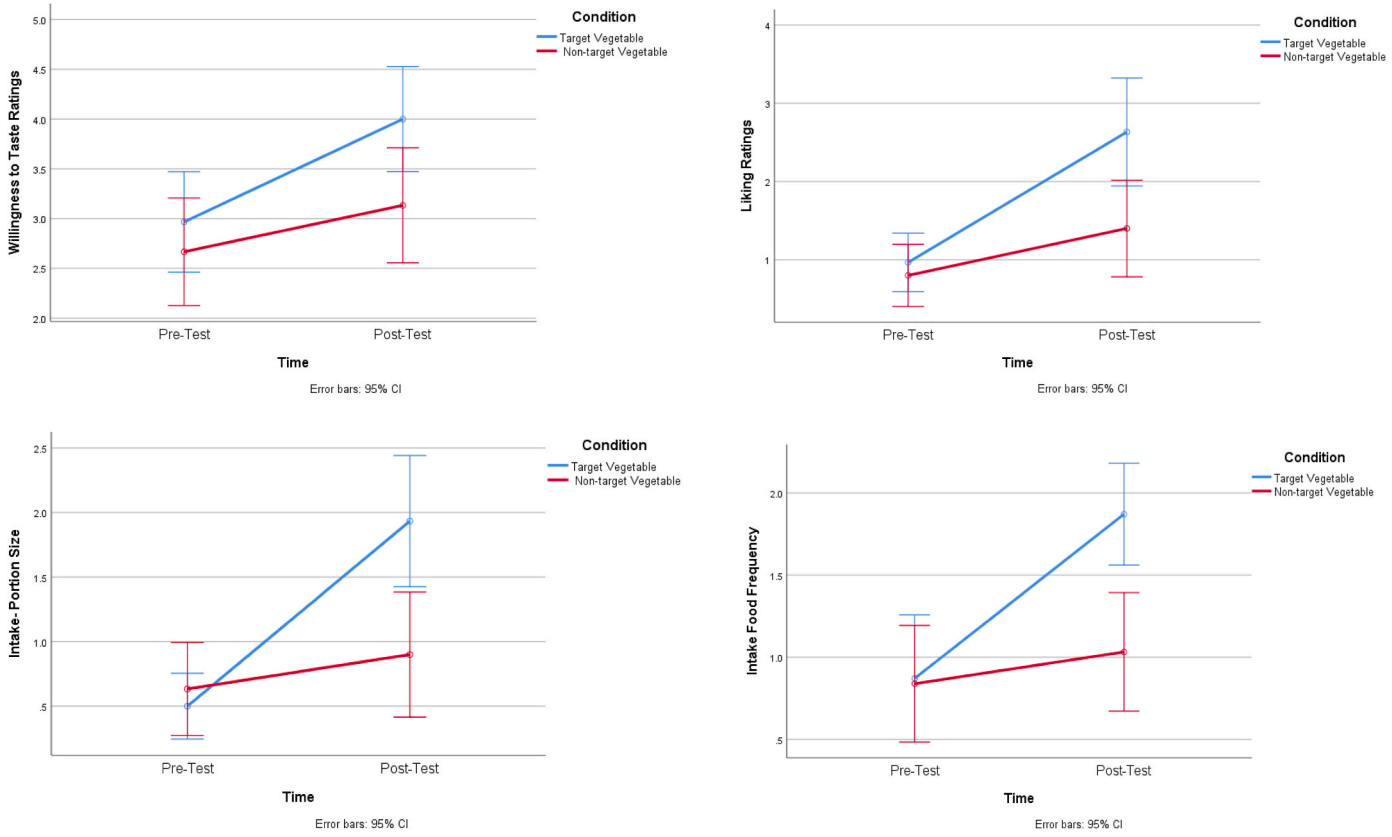

Fig. 1. Mean ratings of WTT (top left), Liking (top right), Intake - Portion size (bottom left), Intake - Frequency of consumption (bottom right) for the target and control vegetable pre- and post-intervention, with 95% confidence intervals.

Owen et al., 2018), and provide preliminary evidence that ebooks play a similarly positive role to printed books. Future studies might fruitfully compare the effectiveness of ebooks and printed books to compare the effectiveness of familiarization in each modality.

It is worth noting that, although the reported increases in acceptance were greater for the target vegetable than the control vegetable across all measures, in line with the hypotheses, parents also reported a significant increase in children's liking of the control vegetable following the intervention period. This finding parallels the results of a similar study conducted in an Italian sample (Caputi et al., 2021), and suggests that some generalization of the effects of the intervention may have occurred. Caputi et al. (2021) reported that ebook exposure had a broad positive effect on the measures of vegetable acceptance they collected from families in Italy, rather than an isolated effect on the vegetable targeted by the ebook. Given the potential to widen the range of foods that children are willing to accept into their diets, future research should seek to identify not only the mechanisms that underpin changes in acceptance of the targeted food but also those that support the generalization of these effects to other foods. Previous research suggests that similarity of appearance may play a role in generalization effects in the food domain. For example, de Wild et al. (2017) found that repeated taste exposure to green beans resulted in increased acceptance of both green beans and a visually similar green vegetable (spinach). Future studies might directly test the extent to which the positive effects of familiarization generalize to foods that differ in their visual similarity to one another.

We acknowledge that there are a number of limitations to the current study. We particularly highlight the need for caution in interpreting the findings given the small sample size. Despite the engagement of a very large number of respondents in the initial questionnaire phase of this study (N = 242), a disappointingly small number of families went on to complete the two-week intervention phase and post-intervention questionnaires. The reasons for the low engagement rate were several, but feedback particularly highlighted technical challenges as obstacles to participation. In an effort to streamline the project team's communications with the large number of families we expected to take part, contact was managed via a project-specific webpage with an in-built survey function; this was set up to automate several aspects of the study, from selection of the target vegetable to the issuing of email reminders about each phase of the study. Unfortunately, these automated emails were frequently caught by spam filters, meaning that participants did not receive the information they needed. Other participants reported difficulties in accessing the ebooks created for this study, due to the incompatibility of their device or operating system with the *Our Story 2* App that supported the ebooks.[1] Some participants did not complete the intervention phase due to personal circumstances, lack of time or interest; this is often the case for studies that run exclusively online or involve multiple stages of data collection. We had expected that it would be easier for families to engage with an online study for which all the materials could be accessed at home, particularly during a period of COVID-related restrictions. However, participants might feel a reduced sense of commitment to projects that do not involve personal contact with the research team, reducing their motivation to participate and engagement in multi-stage projects. Future investigations of this type should aim not only to recruit a large sample at baseline, to allow for a high attrition rate, but also to maximise opportunities for participants to engage with researchers, to support higher rates of retention.

We also acknowledge that our participants were generally highly educated, and that we should not assume that ebooks have similarly positive outcomes in less advantaged groups. It is reassuring to note that

[1] These issues are now resolved and ebooks can be downloaded from www.seeandeat.org to most Android/Apple tablet and smartphone devices.

the sub-sample of participants who elected to take part in the intervention phase of the study was representative of the larger cohort in terms of all the demographic measures collected; it was therefore not the case that only the more educated parents from the initial group felt able to participate in the intervention. Rather, the larger cohort of parents who took part in the wider study were not representative of the UK population (Masento et al., 2022); findings may have been different had we reached a wider participant pool. Similarly, the findings do not allow us to draw conclusions about the applicability of the intervention to other European populations (but see Caputi et al., 2021).

Finally, in line with some previous investigations by our group, changes in children's vegetable acceptance in this study were monitored and reported by parents, who were themselves the agents of the intervention. We chose this approach because parents are the closest observers of children's behaviour in the home environment, and it is in this setting that genuine changes in food acceptance are most likely to be seen. Self-report measures can be subject to confirmation bias effects or demand characteristics when participants are aware of the research goals (Hebert et al., 1995; Kristal et al., 1994). However, recent studies suggest that parents are, in fact, reliable in their reports of children's eating behaviour (Heath et al., 2014; Rendall et al., 2020), and alternative approaches to assessing changes in food acceptance are equally beset by challenges. For example, while independent experimenter assessments of food intake in laboratory settings provide gains in objectivity, these might be offset by the loss of ecological validity and the inherent difficulty of extrapolating from behaviour in the laboratory to behaviour at home. Given that there are advantages and disadvantages to every approach to assessing children's food preferences, full confidence in research findings can be achieved only through the triangulation of evidence across studies drawing on a range of methodological approaches. On its own, the current study provides only preliminary evidence for the effectiveness of ebooks in supporting vegetable acceptance. However, as part of the wider evidence base on the effects of prior visual familiarization to vegetables, which is built on studies conducted in both experimental settings (Houston-Price et al., 2009a, 2009b; Heath et al., 2014) and in the home (Caputi et al., 2021; Houston-Price et al., 2019; Owen et al., 2018), we consider the current study to support and add strength to the literature.

The study suggests several further lines of enquiry to be explored, particularly in relation to parents' role in ensuring the effectiveness of the intervention. Little is known about how parents can engage children most effectively with picture books about foods, or how they should optimally use the books to support the introduction of the food at mealtimes. Further research is needed to establish the factors that best support effective prior familiarization to foods; helping parents to ensure that the introduction of a new food is a success is particularly vital in the context of families' growing concerns over the costs associated with food waste. We also think it important to consider the role played by parents' perceptions of their child's food likes and dislikes and their beliefs about the likely outcomes of engaging in interventions such as this. To date, the mechanisms that underpin the benefits of food familiarization and the role of parents' beliefs about the potential to change children's food preferences within this picture remain to be elucidated. It seems likely that parents' optimism about the outcomes of an intervention will not only influence the success of the intervention but will also determine whether parents go on to offer the targeted food to their child. If a parent believes that, after taking part in an intervention of this kind, their child will be more willing to try a food, will eat more of it and will enjoy eating it more, they will likely offer the food the food to the child more frequently. Considering that repeated opportunities to taste a food are well established as drivers of acceptance (Birch et al., 1982; Wardle, Cooke, et al., 2003, b), it is important to further our understanding of the role parents' beliefs play in bringing about these tasting opportunities, and the role that familiarization-based interventions can play in optimizing such beliefs.

5. Conclusions

See and Eat ebooks were reported to be effective at increasing vegetable acceptance in preschool children. In this exploratory study, parents who looked at a vegetable ebook with their child daily for two weeks reported that their children were more willing to taste the vegetable in the book, liked the vegetable more, consumed larger quantities of it and consumed it more frequently, compared to a matched control vegetable. Further investigations are needed to identify the mechanisms that lead picture books to bring about these positive effects on children's acceptance of healthy foods.

Author contributions

KMD, NM and APR contributed to data collection, analysis and drafting of the manuscript. NM, KMD, KH, DM and CHP collaborated on the design of the study. KMD, KH, and DM provided feedback on draft manuscripts. CHP led the research team in developing the research questions and drafted the final version of the manuscript.

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Ethical statement

The study was conducted in accordance with the Declaration of Helsinki. Ethical approval to conduct the study was granted by the University of Reading's Research Ethics Committee (approval number SREC: 2019-018-CHP). Consent was provided by the parent respondents via submission of an online form prior to completion of questionnaires or collection of any data.

Declaration of competing interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data availability

Data will be made available on request.

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