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Parents' experiences of introducing toddlers to fruits and vegetables through repeated exposure, with and without prior visual familiarization to foods: Evidence from daily diaries☆

Carmel Houston-Price[a,*], Laura H. Owen[a], Orla B. Kennedy[b], Claire Hill[a]

[a] School of Psychology and Clinical Language Sciences, University of Reading, Early Gate, Whiteknights, Reading RG6 6AL, UK
[b] Hugh Sinclair Human Nutrition Unit, Department of Food and Nutritional Sciences, University of Reading, PO Box 226, Whiteknights, Reading RG6 6AP, UK

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ABSTRACT

While repeated exposure is an established method for inducing food acceptance in young children, little is known about parents' experiences of repeatedly offering new or disliked foods at home. In this study, parents kept structured diary records during a 15-day period in which they offered their 2-year-old child daily tastes of one fruit and one vegetable. We explored how children's acceptance of foods (measured in terms of willingness to taste, liking and intake) and the ease and enjoyment of the process for parents changed from the early (days 1–5) to middle (days 6–10) to later (days 11–15) phases of exposure. In addition, we explored whether prior visual familiarization to foods affected children's behavior and/or parents' experiences during exposure. Families were randomly assigned to look at a picture book about one to-be-exposed food for the two weeks prior to the exposure phase ('fruit book' and 'vegetable book' groups) or to a control group, who did not receive a book. Measures obtained from parents' diary records revealed increases in willingness to taste and intake of vegetables and increased liking of both fruits and vegetables with greater exposure. Prior visual familiarization to vegetables further boosted children's willingness to taste and liking of vegetables, and the ease and enjoyment of introducing these for parents. Children's acceptance of foods and parents' positivity during exposure predicted children's liking and intake of foods 3 months later. Results confirm the potential for vegetable picture books to support parents in engaging with repeated exposure regimes and in successfully introducing vegetables into toddlers' diets.

1. Introduction

Giving pre-school children repeated opportunities to taste new or disliked foods is an established technique for increasing their liking and consumption of fruits and vegetables (for recent reviews of this literature, see Appleton et al., 2016; Holley, Farrow & Haycraft, 2017; Nekitsing, Hetherington & Blundell-Birtill, 2018). The effectiveness of repeated taste exposure is robust across a variety of contexts: positive outcomes have been reported to result from exposures delivered by researchers in laboratory settings (Birch & Marlin, 1982; Birch, McPhee, Shoba, Pirok, & Steinberg, 1987), by teachers and caretakers in nurseries and schools (Ahern, Caton, Blundell & Hetherington, 2014; Bouhlal, Issanchou, Chabanet & Nicklaus, 2014; Caton et al., 2013, 2014; de Wild, de Graaf & Jager, 2013, 2017; Hausner, Olsen & Moller, 2012; Wardle, Herrera, Cooke & Gibson, 2003) and by parents in the home (Fildes, van Jaarsveld, Wardle & Cooke, 2014; Wardle, Cooke et al., 2003). Moreover, simply providing repeated taste opportunities is often as effective as manipulations that combine repeated exposure with other strategies hypothesized to boost liking of a food, such as flavor-flavor learning or flavor-nutrient learning (Bouhlal et al., 2014; Caton et al., 2013; de Wild et al., 2013; Hausner et al., 2012). Offering a food repeatedly therefore appears to be a straightforward answer to the question of how to increase young children's fruit and vegetable consumption.

Why, then, have efforts to improve the quality of children's diets met with such limited success? Among preschoolers, vegetable intake in particular continues to fall well short of healthy eating guidelines (e.g. National Diet & Nutrition Survey, 2014). As gatekeepers to the foods available to young children, parents are responsible for providing children with sufficient opportunities to taste healthy foods. Their failure to do so might result from a lack of awareness of the need to provide repeated exposures. Although recent health campaigns

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* Corresponding author.
E-mail address: c.houston-price@reading.ac.uk (C. Houston-Price).

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encourage parents to offer toddlers a wide variety of fruits and vegetables (e.g. *5 A Day*, NHS, 2003; *Change 4 Life*, Public Health England, 2009; *Healthy Start*, Department of Health, Social Services & Public Safety, 2011; NHS choices, 2018), the message that disliked foods are likely to become accepted if they are offered repeatedly is typically not highlighted in such guidance. Alternatively, parents might be aware of, but unable to meet, recommendations to offer repeated exposures. Some studies suggest that 10 or more exposures may be needed before a food will be accepted (e.g. Birch & Marlin, 1982; Birch et al., 1987; Remington, Añez, Croker, Wardle & Cooke, 2011); the persistence needed to offer a disliked food this many times may be too much to ask of parents (Carruth & Skinner, 2000). Indeed, Carruth, Ziegler, Gordon and Barr (2004) found that only 5% of parents of children under 2 years provided the recommended 10+ opportunities to taste new foods. In the same study, the majority of parents offered a new food only three to five times before deciding that their child did not like it, while around a quarter gave up after offering a food only once or twice. Work by Caton and colleagues is encouraging in reporting increased intake of an unfamiliar vegetable among toddlers after only five exposures (Caton et al., 2013, 2014). Nevertheless, most children are unlikely to receive sufficient exposures to new foods for these to be accepted.

Parents clearly require support in providing repeated taste exposures in the home. Yet, little is known about parents' experiences of introducing new foods, or about why they might desist so readily. Indeed, no study to date has tracked parents' efforts to provide repeated exposures to new or disliked foods. The current study aimed to fill this gap, by collecting structured diary reports of parents' experiences of introducing their 2-year-old child to two disliked or unfamiliar foods – one fruit and one vegetable – at home. Every day during a taste exposure phase lasting 15 consecutive days, parents were asked to record whether they offered their child a taste of each food and, if so, whether their child was willing to taste the food, and how easy it was to persuade the child to taste it, how much the child liked the food, how much of it the child ate, and how much the parent enjoyed the taste session. Availability of the food was ensured by arranging regular home deliveries of both target foods. Parents' diary records provided rich information about their experiences of the exposure regime, enabling us to elucidate the trajectory of children's changing food acceptance over time.

The collection of these diary records formed part of a larger, longitudinal study (see also Owen, Kennedy, Hill & Houston-Price, 2018), allowing us to explore a second question of interest. Specifically, the design of the study enabled us to ask whether parents' and children's experiences of engaging in repeated exposure differed if, prior to introducing a food, they had spent a period looking at a picture book about it. Previous research has shown that visual familiarization to fruits and vegetables through picture books can increase toddlers' interest in looking at familiarized foods (Houston-Price, Burton et al., 2009; Heath, Houston-Price & Kennedy, 2010, 2014), their willingness to taste the foods (Houston-Price, Butler & Shiba, 2009) and their intake of the foods (Heath, Houston-Price, & Kennedy, 2014) when these are later offered in laboratory taste tests. The current study enabled us to explore whether prior visual familiarization to foods also supports parents in their efforts to offer repeated exposures to foods at home. To this end, families were randomly allocated to one of three experimental groups. Those in 'fruit book' and 'vegetable book' groups were sent a picture book about their child's target fruit or vegetable, respectively, and asked to look at this with their child for a few minutes every day during the fortnight prior to the taste exposure phase. A control group were not sent a book, but participated in the subsequent taste exposure phase alongside the two book groups. We examined whether parents' diary reports of the introduction process differed for children who were first visually familiarized to foods. We expected to see greater positivity in both children's behaviors and parents' experiences of exposure for foods to which children had been visually familiarized through picture books.

Our primary hypotheses, therefore, relate to the following two research questions:

1) What is the typical time course of acceptance/rejection of disliked or unfamiliar foods when toddlers are offered repeated exposures to these at home?

We hypothesized that children's acceptance of a food (indexed by their willingness to taste, liking and intake of the food) would become more positive with increasing exposure, and that these changes would be accompanied by higher levels of parent positivity towards taste sessions (indexed by the ease with which children were persuaded to taste foods and parent enjoyment). Based on the literature, we expected changes to be seen when children had tasted foods more than 10 times. However, in line with Caton et al.'s (2013, 2014) findings, we also explored evidence of changes after fewer exposures. We therefore divided the intervention into early (days 1–5), middle (days 6–10) and later phases (days 11–15), and compared the measures collected during these phases.

2) Does prior visual familiarization to a food support parents in introducing it?

Based on the findings of earlier studies, we hypothesized that children's acceptance of foods (willingness to taste, liking and intake) and parents' positivity towards taste sessions (ease of persuasion and enjoyment) would be greater if children had first seen the food in a book.

In addition to these primary questions, we explored whether any demographic or other background measures collected prior to the intervention predicted children's acceptance of foods or parents' experiences during the taste exposure phase. We hypothesized that more neophobic children, and fussy eaters, would show less acceptance of foods during the intervention, and that their parents would report less positive experiences. Finally, follow-up measures collected three months post-intervention allowed us to explore whether the diary measures collected during the taste exposure phase predicted longer-term changes in children's liking and intake of the targeted foods.

2. Methods

2.1. Participants

Families of 127 children (61 boys) aged 18–24 months (mean age at baseline = 21.6 months; SD = 1.6) were recruited from the University of Reading's database of parents who had expressed an interest in participating in research with their child (n = 103), from adverts placed on parenting websites (n = 13), leaflets placed in local nurseries (n = 7) or by word of mouth (n = 4). Families were randomly assigned to one of three experimental groups: a 'fruit book' group (n = 42; 22 males); a 'vegetable book' group (n = 46; 22 males); or a control group (n = 39; 17 males).

Of the 127 families who participated in the intervention, completed diary records of families' experiences during the taste exposure phase were returned by parents of 100 children (50 boys; mean age post-intervention = 23.2 months, SD = 1.7). These 100 families were the participants in the current study. Full demographic data for participating parents and children are provided in Table 1. The distribution across the three experimental groups of the 27 families who did not return diary records did not differ from chance, χ^2 (2) = 2.46, p = .29, Cramer's V = .14 (fruit book: n = 10; vegetable book: n = 12; control group: n = 5).

Of the 100 participating families, follow-up questionnaires were returned 3 months after the intervention by parents of 74 children (36 boys; mean age at follow-up = 26.6 months, SD = 1.5). The distribution across the three groups of the 26 families who failed to respond at follow-up again did not differ from chance, χ^2 (2) = 1.79, p = .41,