Appetite 59 (2012) 818–825

Contents lists available at SciVerse ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Research report

Toddlers' food preferences. The impact of novel food exposure, maternal preferences and food neophobia

Anika J. Howard [a], Kimberley M. Mallan [a,*], Rebecca Byrne [a], Anthea Magarey [b], Lynne A. Daniels [a,b]

[a] Institute of Health and Biomedical Innovation, Faculty of Health, Queensland University of Technology, 60 Musk Ave., Kelvin Grove, Brisbane 4059, Australia
[b] Nutrition & Dietetics, School of Medicine, Flinders University, Adelaide 5001, Australia

ARTICLE INFO

Article history:
Received 29 June 2012
Received in revised form 9 August 2012
Accepted 22 August 2012
Available online 29 August 2012

Keywords:
Food preferences
Childhood obesity
Food neophobia
Repeated exposure

ABSTRACT

Food preferences have been identified as a key determinant of children's food acceptance and consumption. The aim of this study was to identify factors that influence children's liking for fruits, vegetables and non-core foods. Participants were Australian mothers (median age at delivery = 31 years, 18–46 years) and their two-year-old children (M = 24 months, SD = 1 month; 52% female) allocated to the control group (N = 245) of the NOURISH RCT. The effects of repeated exposure to new foods, maternal food preferences and child food neophobia on toddlers' liking of vegetables, fruits and non-core foods and the proportion never tried were examined via hierarchical regression models; adjusting for key maternal (age, BMI, education) and child covariates (birth weight Z-score, gender), duration of breastfeeding and age of introduction to solids. Maternal preferences corresponded with child preferences. Food neophobia among toddlers was associated with liking fewer vegetables and fruits, and trying fewer vegetables. Number of repeated exposures to new food was not significantly associated with food liking at this age. Results highlight the need to: (i) encourage parents to offer a wide range of foods, regardless of their own food preferences, and (ii) provide parents with guidance on managing food neophobia.

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Introduction

Many children do not meet recommended daily intake of fruits and vegetables and consumption of energy dense, low nutrient (non-core) foods is common. These dietary quality issues have been associated with the high prevalence of childhood obesity in developed countries (Cooke et al., 2004). In 2008, the US Feeding Infants and Toddlers Study (FITS) indicated that at two years of age, 81% of children consumed a dessert, sweet and/or sweetened beverage in the day of the survey whereas 27% had eaten no fruit and 32% no vegetables (Siega-Riz et al., 2010). An Australian study of children aged 12–36 months (N = 374) showed that 15% of children consumed no vegetables and 11% consumed no fruit in the previous 24 h. Of 12 specified high fat/sugar foods and drinks, 11% of children consumed none, 20% one, 26% two, and 43% three or more (Chan, Magarey, & Daniels, 2010). These data indicate that dietary quality issues emerge early and hence are potentially an important target for paediatric obesity prevention and treatment interventions.

Children's dietary patterns are substantially determined by their food preferences, which in turn are strongly influenced by their early feeding experience, particularly the variety of tastes and textures to which they are exposed as infants and toddlers (Domel et al., 1996; Drewnowski, 1997; Gibson, Wardle, & Watts, 1998). To improve child intake of vegetables and fruits we must first understand the factors that shape preferences for these foods. Whilst there is evidence for a genetic component to food preferences (Wardle & Cooke, 2008), environmental factors such as repeated exposure to new foods and parental modelling of healthy eating behaviours have also been shown to influence food preference and acceptance among children (Addessi, Galloway, Visalberghi, & Birch, 2005; Breen, Plomin, & Wardle, 2006). The literature suggests that the number of exposures required for acceptance of a novel flavour or food increases from very few in infants (Maier, Chabanet, Schaal, Issanchou, & Leathwood, 2007; Sullivan & Birch, 1994), five to ten in 2-year-olds, (Birch & Marlin, 1982; Birch, McPhee, Shoba, Pirok, & Steinberg, 1987) and up to 15 in 3–4-year-olds (Sullivan & Birch, 1990). However, children are often not offered this number of repeated exposures; with initial rejection commonly interpreted as genuine dislike for the foods being offered (Cooke, 2007; Cooke et al., 2004; Skinner, Carruth, Wendy, & Ziegler, 2002). Campbell and Crawford (2001) emphasise that once foods are no longer offered, the opportunity for flavour learning and enjoyment of foods is undermined, ultimately resulting in reduced dietary variety.

Experimental evidence suggests that novel tastes are more readily accepted when paired with energy density (Johnson, Mcphee, & Birch, 1991). As noted by Daniels et al. (2009) and Hill (2002), the ubiquitous availability of, and hence exposure to en-

* Corresponding author.
E-mail address: kimberley.mallan@qut.edu.au (K.M. Mallan).

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http://dx.doi.org/10.1016/j.appet.2012.08.022

ergy dense, nutritionally poor (non-core) foods in a child's immediate environment may enhance preferences for these foods.

The food behaviours of the family unit also play a pivotal role in the development of children's food preferences. Parents, particularly mothers, select foods to be eaten and model food behaviours such as food likes and dislikes to children (Cathey & Gaylord, 2004; Savage, Fisher, & Birch, 2007; Scaglioni, Salvioni, & Galimberti, 2008). In a study by Cooke et al. (2004) of children aged two to six years ($N = 564$), children's fruit and vegetable consumption were positively correlated with maternal intake ($r = .39$, $p < .005$ and $r = .49$, $p < .001$), suggesting that mothers and children tend to like similar foods. Studies have also identified that mothers tend to avoid introducing foods to their child which they themselves dislike (Cathey & Gaylord, 2004; Cooke et al., 2004; Falciglia, Pabst, Couch, & Goody, 2004; Skinner et al., 1998). This behaviour has a detrimental impact on children's dietary variety and may enhance food fussiness and neophobia (Dovey, Staples, Gibson, & Halford, 2008).

One to three years of age is a critical period for the acquisition of food preferences (Skinner et al., 2002). During these 'toddler years' children experience developmental gains in body function, language, and motor and social skills (Birch, Savage, & Ventura, 2007; Cathey & Gaylord, 2004), and establish a large proportion of their food preferences (Savage et al., 2007; Scaglioni et al., 2008; Skinner et al., 2002). Food neophobia the unwillingness to try and the rejection of new or novel foods characteristically peaks between two and six years of age (Addessi et al., 2005; Cooke, Carnell, & Wardle, 2006; Dovey et al., 2008; Falciglia et al., 2004l Falciglia, Couch, Pabst, & Frank, 2000). Although an aversion to novel tastes may have promoted safety from toxins in our prehistoric past when humans foraged for food, food neophobia is no longer adaptive in the modern food environment and can influence children's dietary variety and overall diet quality (Fox, Pac, Devaney, & Jankowski, 2004; Savage et al., 2007; Wardle & Cooke, 2008). Food neophobia among children aged two to five years is associated with reduced preferences for all food groups, in particular vegetables (Cooke, 2007; Cooke, Haworth, & Wardle, 2007; Fox et al., 2004), with liking fewer food types, a higher number of untried food types, a less varied range of food preferences, and less healthful food preferences overall (Carruth & Skinner, 2000; Cooke et al., 2004; Fox et al., 2004; Skinner et al., 2002).

Given that early introduction or exposure to fruits and vegetables is positively associated with increased intake and variety of these foods consumed later in childhood (Cooke et al., 2004; Skinner et al., 2002), investigation into the development of food preferences in very young children is warranted. This paper reports a secondary, cross-sectional analysis of data collected from the control group of the NOURISH randomised controlled trial (RCT) (Daniels et al., 2009). The aim of this study was to examine the influence of maternal food preferences, child food neophobia, and repeated exposure to novel foods on toddler food preferences in the Australian context. In contrast to previous studies that have assessed the effect of one independent variable, such as child age, on child food preferences (Cooke & Wardle, 2005; Fox et al., 2004; Skinner et al., 2002), this study sought to investigate the multivariable effect of three key predictor variables on toddler food preferences after also adjusting for key maternal and child covariates.

Methods

Study design

The NOURISH RCT was conducted in the capital cities of two Australian states: Brisbane, Queensland and Adelaide, South Australia. NOURISH evaluated an early feeding intervention designed to promote feeding practices hypothesised to result in healthy child eating behaviour, intake and growth at two years of age. The protocol has been described elsewhere (Daniels et al., 2009). In brief, a two-stage recruitment strategy (referred to as Stage 1 and Stage 2) was used to access a consecutive sample of first-time mothers with the aim of reducing potential volunteer bias and increasing the representativeness of our study sample. We endeavoured to approach all eligible mothers who had delivered a healthy term infant (>35 weeks, >2500 g) whilst they were still in hospital (Stage 1) and to seek consent for later contact. Infants diagnosed with congenital abnormalities, or a chronic condition likely to affect normal development were not eligible for the trial. Additional eligibility criteria included no documented history of domestic violence or intravenous drug use; no self-reported eating or psychiatric disorder; facility with written and spoken English, and ability to attend group sessions. Mothers who gave consent at Stage 1 were recontacted via mail when their infant was aged 2–7 months (Stage 2).

Of those who consented to recontact and were contactable at Stage 2, 44% ($N = 698$) consented to participate and were allocated to the control or intervention group. Compared to non-consenters and non-contacts, allocated mothers were older ($M = 30.1$, $SD = 5.3$ vs. $M = 27.4$, $SD = 5.6$; $p < .001$), more likely to have completed a university degree (58% vs. 33%; OR = 2.9; CI95% = 2.4–3.5; $p < 0.001$), and more likely to have a spouse (either married or defacto; 95% vs. 88%; OR = 2.5, CI95% = 1.7–3.6; $p < .001$). Mothers who consented were less likely to have smoked at any time during their pregnancy (93% vs. 89%; OR = 0.4, CI95% = 0.3–0.5; $p < .001$), and were more likely to report that they intended to breastfeed their baby exclusively (88% vs. 75%; OR = 1.8, CI95% = 1.3–2.5; $p < .001$). Data were collected at four time points: (i) at birth and first contact (ii) Time 1 (T1): baseline and prior to allocation; infants 4.3 ± 1.0 months; (iii) Time 2 (T2): infants 13.7 ± 1.3 months; and (iv) Time 3 (T3): infants 24.1 ± 0.7 months. Participant characteristics and covariates (except where detailed otherwise) based on data from first contact and T1 and outcome data from T2 and T3 are used in this paper.

Participants

Data from participants allocated to the control group only ($N = 346$ at T1) are presented in this paper. Outcomes of interest in this secondary analysis were the number of vegetables, fruits and non-core foods liked and never tried by children at T3 ($N = 245$). Full data were available for $N = 230$ mother–child dyads for the hierarchical regression analyses reported in this study.

At T3, 81% of participants in the control group and 74% in the intervention group were still active in the study. Mothers who discontinued participation in the study (T3) were younger ($M = 28.0$, $SD = 5.5$ vs. $M = 30.6$, $SD = 5.2$; $p < .001$) and less likely to have a university degree (40% vs. 63%, OR = 0.4 CI95% = 0.3–0.6; $p < .001$) than those who completed. Relationship status, smoking during pregnancy, intention to breastfeed exclusively and being born in Australia did not differ between women who completed or discontinued, p values $\geqslant 0.2$. However, non-completers did not vary as a function of group allocation on any of these demographic characteristics (data not shown).

Measures

Maternal and child characteristics

Maternal and child characteristics collected at first contact included maternal age at delivery (years), education (University degree), and child gender. Child birth weight was collected from hospital records. At follow up assessments maternal and child weights and heights (child standing) were measured by trained

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