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Research report

The influence of maternal infant feeding practices and beliefs on the expression of food neophobia in toddlers ☆

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ABSTRACT

Food neophobia is a highly heritable trait characterized by the rejection of foods that are novel or unknown and potentially limits dietary variety, with lower intake and preference particularly for fruits and vegetables. Understanding non-genetic (environmental) factors that may influence the expression of food neophobia is essential to improving children's consumption of fruits and vegetables and encouraging the adoption of healthier diets. The aim of this study was to examine whether maternal infant feeding beliefs (at 4 months) were associated with the expression of food neophobia in toddlers and whether controlling feeding practices mediated this relationship. Participants were 244 first-time mothers ($M = 30.4$, $SD = 5.1$ years) allocated to the control group of the NOURISH randomized controlled trial. The relationships between infant feeding beliefs (*Infant Feeding Questionnaire*) at 4 months and controlling child feeding practices (*Child Feeding Questionnaire*) and food neophobia (*Child Food Neophobia Scale*) at 24 months were tested using correlational and multiple linear regression models (adjusted for significant covariates). Higher maternal *Concern about infant under-eating and becoming underweight* at 4 months was associated with higher child food neophobia at 2 years. Similarly, lower *Awareness of infant hunger and satiety cues* was associated with higher child food neophobia. Both associations were significantly mediated by mothers' use of *Pressure to eat*. Intervening early to promote positive feeding practices to mothers may help reduce the use of controlling practices as children develop. Further research that can further elucidate the bi-directional nature of the mother–child feeding relationship is still required.

Introduction

Food neophobia – the avoidance and rejection of novel foods – is a highly heritable trait (Cooke, Haworth, & Wardle, 2007; Faith, Heo, Keller, & Pietrobelli, 2013). For our prehistoric ancestors who foraged for food, an aversion to novel tastes promoted safety against the ingestion of potentially toxic items (Pliner & Hobden, 1992). In the contemporary western food environment, the risk associated with the consumption of novel foods has been predominantly eliminated (Pliner, Pelchat, & Grabski, 1993), thus food neophobia may be considered a maladaptive trait that hinders development of a range of food preferences and results in limited dietary variety (Falciglia, Couch, Gribble, Pabst, & Frank, 2000; Howard, Mallan, Byrne, Magarey, & Daniels, 2012; Pliner et al., 1993; Russell & Worsley, 2008). However between 22% and 29% of the phenotypic variation in child food neophobia is accounted for by non-shared environmental factors (Cooke et al., 2007; Faith et al., 2013). Given the association between food neophobia in children and poorer food preferences and dietary outcomes, gaining a better understanding of the modifiable environmental determinants that influence the expression of neophobia in children is paramount.

Limited dietary variety of food neophobic children leads to reduced dietary quality and lower nutrient intakes (Birch, Galloway, & Lee, 2003; Cooke, Carnell, & Wardle, 2006; Cooke et al., 2004; Falciglia et al., 2000; Russell & Worsley, 2008). Children with food neophobia have limited intakes, and liking, of fruits and vegetables (Cooke et al., 2004, 2006; Howard et al., 2012; Jones, Steer, Rogers, & Emmett, 2010). However, food neophobic children consume just as many sweet, fatty and salty foods as food neophilic

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children (Cooke, Wardle, & Gibson, 2003). Liking for these foods is also not affected by level of neophobia (Howard et al., 2012). These findings are not surprising given that infants display a preference for sweet and salty over bitter and sour tastes (Birch, 1998), and that humans have an innate preference for energy dense foods (Johnson, McPhee, & Birch, 1991). Unhealthy childhood eating habits may interfere with optimal growth and development whilst laying the foundation for poor eating habits and associated chronic diseases in adolescence and adulthood. Food neophobia is therefore a potential risk factor for the development of lifelong unhealthy eating habits and non-communicable disease (Tan & Holub, 2012).

Maternal feeding beliefs/attitudes and feeding practices have been associated with child eating behaviours and weight status (Faith et al., 2013; Ventura & Birch, 2008). Feeding beliefs such as concern about infant under-eating and becoming underweight and poor awareness of infant hunger and satiety cues have been linked with less desirable feeding practices and health outcomes in children, including reduced self-regulation of intake (DiSantis, Hodges, Johnson, & Fisher, 2011) and increased weight status (Worobey, Islas Lopez, & Hoffman, 2009). Parents who use 'controlling' feeding practices attempt to dictate the amount or type of foods their children eat by encouraging the child to eat more food (pressure), limiting foods that are perceived as unhealthy to maintain health (restriction for health), or limiting foods in order to lose or maintain weight (restriction for weight) (Musher-Eizenman & Holub, 2007). Previous research in a sample of mothers and their infants ($N = 208$) showed that maternal concern about their children being underweight was associated with pressure to eat (Gross, Mendelsohn, Fierman, & Messito, 2011). A smaller study of mothers ($N = 50$) of infants aged 12–25 months found that mothers who perceived their infant as thin engaged in pressuring feeding practices (Holub & Dolan, 2012). These findings suggest that mothers who perceive their children as underweight use more pressuring feeding practices.

There are data to suggest that low awareness of infant hunger/satiety cues is also related to controlling feeding practices. In a United States urban subpopulation study ($N = 368$), "infant crying" and "hand sucking" were assigned as hunger cue by a majority of participating mothers (Gross et al., 2010). These two perceptions were related to a pressuring feeding style and the belief that babies should finish their bottle (Gross et al., 2011). Another smaller study ($N = 50$) found that mothers with low awareness of infant hunger and satiety cues were more likely to have restrictive rather than pressuring feeding styles (Holub & Dolan, 2012). These data suggest that mothers who believe that their infants cannot regulate their own feeding may feel it is necessary to control the feeding interaction themselves (Holub & Dolan, 2012). Studies in older children also support the link between a lower awareness of infant cues and pressuring feeding practices (Orrell-Valente et al., 2007; Sherry et al., 2004). Focus groups accessing attitudes, practices and concerns about child feeding in socio-economically diverse white, Hispanic and African-American mothers of 2- to 4-year-old children showed that a majority of these mothers thought their children were lying when they said that they were full and thus they encouraged them to eat more (Sherry et al., 2004). Similarly, home-based observations of 142 families of kindergarteners revealed that in 78% of families, parents did not consider their children's appetite signals regarding the quantity they wanted to eat when serving meals (Orrell-Valente et al., 2007).

Controlling feeding practices in older children over 24 months have been a focus of existing research on food neophobia. In a cross-sectional questionnaire based study of 564 parents of children aged 2–6, food neophobia was related to parents' use of the controlling feeding practices restriction for health and pressure (Wardle, Carnell, & Cooke, 2005). This aligns with the cross-sectional study ($N = 90$) by Moroshko and Brennan (2013) who found that authoritarian feeding (high demandingness/low responsiveness), restriction and pressure to eat were significantly associated with the variance in food neophobia in children aged 2–5. Tan and Holub (2012) investigated this link in mothers ($N = 85$) of 3- to 12-year-old children and found that food neophobia was positively related to higher use of restriction for health but was not related to pressure or restriction for weight.

Based on past literature we speculate that early feeding beliefs such as concern about under-eating and poor awareness of cues may precipitate the use of controlling feeding practices and child neophobia. Thus the purpose of this study was to examine whether controlling feeding practices (pressure and restriction) mediate the hypothesized pathway between mothers' early feeding beliefs (concerns about infant under-eating and poor awareness of infant cues) and the emergence of food neophobia in toddlerhood.

Methods

Study design

This paper reports a secondary analysis of data from participants allocated to the control condition of the NOURISH randomized controlled trial (RCT) (Australian and New Zealand Clinical Trials Registry Number 12608000056392). The NOURISH RCT evaluated an early feeding intervention designed to prevent childhood obesity. The trial involved first-time mothers and their infants from two Australian capital cities, Brisbane and Adelaide. The protocol has been described in detail in Daniels et al., (2009). Eligible participants for the study were at least 18 years of age, had delivered a healthy term infant (≥37 weeks gestation) with a birth-weight above 2500 g, were willing and able to attend assessment and education sessions at designated metropolitan child health clinics, and had facility with written and spoken English. Mother–infant pairs were excluded if the mother had a documented history of domestic violence or intravenous substance use or self-reported eating, psychiatric disorders or mental health problems, or if the infant had any diagnosed congenital abnormality or chronic condition likely to influence normal development (including feeding behaviours). All eligible mothers were approached whilst they were still in the hospital (Stage 1) to seek consent for later contact. Mothers who gave consent at Stage 1 were recontacted via mail when their infants were 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. $M = 27.4$, $SD = 5.6$), more likely to have completed a university degree (58% vs. 33%), and more likely to have a spouse (either married or de facto; 95% vs. 88%). Data were collected at four time points: (i) at birth and first contact (ii) Time 1 (T1): baseline and prior to allocation; infant mean age = 4.3 ($SD = 1.0$) months; (iii) Time 2 (T2): infant mean age = 13.7 ($SD = 1.3$) months; and (iv) Time 3 (T3): infant mean age = 24.1 ($SD = 0.7$) months. Mothers who discontinued participation in the study (22% at T3) were younger ($M = 28.0$, $SD = 5.5$ vs. $M = 30.6$, $SD = 5.2$) and less likely to have a university degree (40% vs. 63%) than those who completed. Approval was obtained from the relevant Human Research Ethics Committees covering Queensland University of Technology, Flinders University and all recruitment hospitals (QUT HREC 00171 Protocol 0700000752) (Daniels et al., 2009).

Participants

Data from participants allocated to the control group only ($n = 346$ at T1) are presented in this paper. Data collected at T1–T3 were used in this secondary analysis, thus the final sample size was reduced to 244 due to missing data.