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Stability of food neophobia from infancy through early childhood

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ABSTRACT

The purpose of the present study was to examine whether rejection of novel foods during infancy predicted child behavioral and parent-reported neophobia at 4.5 years of age. Data for the present study were drawn from a longitudinal study following individuals (n = 82) from infancy through early childhood. At 6 and 12 months of age, the infants tasted a novel food (green beans, hummus, or cottage cheese) and their reactions were coded for rejection of the food (i.e. crying, force outs, or refusals). The children returned to the laboratory at 4.5 years of age and participated in a behavioral neophobia task where they were offered three novel foods (lychee, nori, and haw jelly) and the number of novel foods they tasted was recorded. Mothers also reported their own and their children's levels of food neophobia. Regression analyses revealed that rejection of novel foods at 6 months interacted with maternal neophobia to predict parent-rated child neophobia. Infants who exhibited low levels of rejection at 6 months showed higher levels of parent-rated neophobia when their mothers also showed high compared to low levels of neophobia. At 12 months of age, however, infants who exhibited high levels of rejection tended to have high levels of parent-rated neophobia regardless of their mothers' levels of neophobia. These results provide preliminary evidence that rejection of novel foods during infancy does predict neophobia during early childhood, but the results vary depending on when rejection of new foods is measured.

1. Introduction

Food neophobia refers to the tendency to reject novel or unknown foods (Birch, 1999; Dovey, Staples, Gibson, & Halford, 2008). This concept originated from research with non-human animals. Omnivores, such as rats and monkeys, do not readily accept new foods. Instead, they tend to show wariness and avoidant behaviors when presented with a novel food. These types of responses serve a protective role by preventing animals from ingesting harmful toxins (Rozin, 1976). Since humans are omnivores, it is believed that they also exhibit food neophobia which emerges during the transition to solid foods during infancy (Birch, 1999). Researchers tend to agree that neophobia appears at rather low levels during weaning, but it increases and reaches a peak during early childhood (Addessi, Galloway, Visalberghi, & Birch, 2005; Birch, 1999; Dovey et al., 2008). However, there are no existing longitudinal studies examining the stability of neophobia from infancy through early childhood. The present study aims to bridge this gap in the literature by investigating whether infants' rejection of novel foods at 6 and 12 months predicts their behavioral and parent-reported neophobia at age 4 years.

Previous research has revealed developmental differences in food neophobia across early childhood. Food neophobia emerges in the second half of the first year of life when infants become more mobile and begin the transition to solid foods (Addessi et al., 2005; Birch, 1999; Dovey et al., 2008). Compared to toddlers and preschoolers, infants exhibit relatively minimal neophobic tendencies. Most of infants' reactions to new foods are positive or very positive as rated by their mothers (Lange et al., 2013; Schwartz, Chabanet, Lange, Issanchou, & Nicklaus, 2011). Preschoolers, on the other hand, are very reluctant to taste new foods and often reject them based on appearance alone (Birch & Fisher, 1998; Dovey et al., 2008). There are also differences in the number of exposures required to increase consumption of a novel food in infancy versus early childhood. Only one exposure during infancy can more than double consumption of a novel food on the subsequent offer (e.g. Birch, Gunder, Grimm-Thomas, & Laing, 1998), whereas multiple exposures are required in preschoolers to increase consumption (e.g. Birch, McPhee, Shoba, Pirok, & Steinberg, 1987). Birch and colleagues suggest that less intense reactions to new foods in

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infancy may be adaptive as parents are in more control of their children's access to food, whereas high levels of food neophobia may be more persistent in older children who are more mobile and independent (Addessi et al., 2005; Birch, 1999).

Despite the adaptive nature of food neophobia, not all children respond negatively to novel foods (Forestell & Mennella, 2012; Moding, Birch, & Stifter, 2014; Pliner & Loewen, 1997). Rather they vary on their reactions with some showing very positive responses to new foods (termed neophilic) (Pliner & Hobden, 1992). These individual differences appear to be driven by underlying temperament or personality characteristics, such as approach/withdrawal. High approach infants, who typically show positive responses to other novel objects (i.e. new toys, new people) also tend to show positive responses to novel foods, including fewer facial expressions of distaste and more acceptance behaviors compared to low approach infants (Forestell & Mennella, 2012; Moding et al., 2014). Similarly, children who are high on the temperament dimension of shyness, which is driven by approach/withdrawal processes, tend to have higher levels of food neophobia compared to their peers who are less shy (Pliner & Loewen, 1997). As approach/withdrawal tendencies are moderately stable from infancy through early childhood (e.g. Kagan & Fox, 2006), it is possible food neophobia may also show stability across the same time period.

Other factors, such as maternal neophobia, may also affect the development and stability of neophobia during early childhood. For example, previous research indicates that maternal food neophobia is positively associated with child food neophobia (e.g. Falciglia, Pabst, Couch, & Goody, 2004: Galloway, Lee, & Birch, 2003). This positive association can be explained by a combination of genetic and environmental factors. For example, food neophobia appears to be strongly heritable. In one study, genetic factors accounted for 72% of the variance in neophobia for children ages 4 through 7 (Faith, Heo, Keller, & Pietrobelli, 2013). However, environmental factors, such as food availability, also appear to play a role. Previous research shows that when the parents who are in charge of food purchasing and preparation report high levels of neophobia, they also tend to report being less likely to offer novel foods to their family members (Hursti & Sjödén, 1997). Further, parents who consumed a varied diet were found to have children with lower levels of neophobia (Faith et al., 2013; Galloway et al. 2003). Taken together, these findings suggest that a mother's own level of neophobia may influence the variety of foods she offers her child, and subsequently her child's level of neophobia. The present study will explore whether maternal neophobia moderates the relationship between rejection of novel foods during infancy and neophobia during childhood.

The present study. Two primary questions guided the present study. First, we asked whether the rejection of novel foods during infancy would predict behavioral and parent-reported neophobia at age 4 years. Although there are no existing longitudinal studies on this topic, previous research suggests that responses to novel foods are related to the temperament dimension of approach (e.g. Forestell & Mennella, 2012; Moding et al., 2014), which is moderately stable across early childhood (e.g. Kagan & Fox, 2006). Thus, we hypothesized that infants who were more rejecting of a novel food at 6 and 12 months of age would also be less willing to try novel foods in the laboratory and as reported by their mothers at age 4 years.

Second, we investigated whether maternal neophobia would moderate the relationship between rejection of novel foods during infancy and neophobia during childhood. Maternal neophobia may lessen or exacerbate initial child neophobic tendencies, but no previous research has examined this relationship. However, maternal neophobia has been shown to be related to the variety of foods mothers offer their children and subsequently their children's levels of neophobia (e.g. Faith et al., 2013; Galloway et al. 2003). Thus, we hypothesized that maternal neophobia would moderate children's initial tendencies to reject novel foods in the present study. Specifically, we expected infants who exhibited low levels of rejection at 6 and 12 months of age to be more neophobic during early childhood when their mothers had high compared to low levels of neophobia. Conversely, infants who showed high levels of rejection were expected to be less neophobic in early childhood if their mothers reported low compared to high levels of neophobia.

2. Method

2.1. Participants

Infant-mother dyads ($N = 115$; 52 female infants) were recruited as part of a longitudinal study with data collection occurring when the infants were within 2 weeks of being 4, 6, 12, and 18 months of age.[1] The present investigation also includes follow-up data collection of the original study sample when the children ($n = 82$) were 4.5 years of age. The dyads were originally recruited through birth announcements and a local community hospital in central Pennsylvania. Criteria for inclusion in the study were mothers' full-term pregnancy, ability to read and speak English, and maternal age greater than 18 years. The families were primarily Caucasian ($n = 108$) and mothers averaged 29.93 years of age (range = 19–41) and 14.67 years of education (range = 11–20) at the start of the study. The highest percentage of families reported an average annual income of either $40,000 to $60,000 (26%) or $20,000 to $40,000 (25%). The majority of mothers were married ($n = 93$). All study procedures were approved by The Pennsylvania State University Human Subjects Institutional Review Board and written consent was obtained from parents for their own and their children's participation in the study.

The present study includes data from laboratory visits when the infants were 6 ($n = 103$) and 12 months of age ($n = 95$) and one laboratory visit when the children were 4.5 years of age ($n = 82$; $M = 4.57$ years). Primary reasons for study attrition include family relocation and inability to contact families to schedule laboratory visits. In addition, 22 infants were excluded from analyses using the 6-month novel food task: 21 infants were not fed solid foods at the time of the 6-month visit and 1 infant was ill during this laboratory visit. Two infants who completed the 12-month visit were excluded from analyses using the 12-month novel food task: one infant was not eating solid foods at the time of the study and one infant did not take a bite of the novel food. There were no systematic differences between the participants who completed the 4-year visit and those who dropped out of the study on the demographic (e.g., education, family income), and feeding variables (e.g., type of milk feeding, age first introduced to solid foods, 6-month novel food response). Of the infants who completed the 6-month novel food task ($n = 81$), 27 were exclusively breastfed for 16 or more weeks.

2.2. Procedures

Two identical novel food tasks were administered to infants at 6 and 12 months of age where the mothers fed their infants a new food for the first time. During a subsequent laboratory visit when the children were 4.5 years of age, they participated in a novel food task where they were asked if they would be willing to taste three

[1] Results from this study sample have been previously reported by Moding et al. (2014).