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Breastfeeding and dietary variety among preterm children aged 1–3 years

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ABSTRACT

Among infants born at term, breastfeeding is associated with increased dietary variety in childhood. Preterm birth can limit early feeding options while simultaneously increasing risk for negative health outcomes that could benefit from dietary-based preventative measures. We assessed whether breastfeeding is associated with increased dietary variety at 1–3 years amongst children born preterm. We analyzed baseline data from two clinical trials investigating cognitive development after fatty-acid supplementation for 10-39 month-old children born before 35 weeks gestation (n = 189). At baseline, mothers reported breastfeeding history and completed a 161-item food-frequency questionnaire for their child. Dietary variety was assessed via 3 measures: (1) proportion items consumed at least once per month, (2) servings of a given item consumed relative to total monthly food servings, (3) daily probability of consuming a given item. Overall, 88% of children were ever breastfed (median duration = 89 days, range = 0–539), and 48% of children were ever exclusively breastfed (median duration = 59 days, range = 3–240). Exclusive breastfeeding duration was associated with dietary variety increases of 0.9% (95% CI = 0.1–1.7) for vegetables, 1.6% (95% CI = 0.2–3.0) for meat/fish, and 1.3% (95% CI = 0.2–2.4) for grain/starch, for each additional month of exclusive breastfeeding after adjustment for key confounders. Correspondingly, the variety of sweets consumed decreased by 1.2% (CI: −2.1, −0.3) per month of any breastfeeding after adjustment. These results are consistent with those in children born at term, and if causal, could provide additional support for exclusive breastfeeding to improve diet and health in children born preterm.

1. Introduction

Children vary in their willingness to try and accept new and unfamiliar foods, especially vegetables and meats (Caton et al., 2014; Cooke & Wardle, 2005; Dovey, Staples, Gibson, & Halford, 2008; Skinner, Carruth, Bounds, & Ziegler, 2002). A varied diet, especially a diet rich in fruits and vegetables, is important for health and development (Joshipura et al., 2001; Makrides et al., 2009; Steinmetz & Potter, 1996). For example, increased dietary variety improves nutrient intake (Foote, Murphy, Wilkens, Basiotis, & Carlson, 2004) and reduces risk of obesity and metabolic syndrome (Knaapila et al., 2015; Quick et al., 2014; Vadiveloo, Dixon, Mijanovich, Elbel, & Parekh, 2015; Vadiveloo, Parkeh, & Mattei, 2015). Understanding factors that contribute to a varied diet in early childhood is especially important since early diet is a good predictor for later diet (Grimm, Kim, Yaroch, & Scanlon, 2014; Meyerkort, Oddy, O'Sullivan, Henderson, & Pennell, 2012; Skinner et al., 2002). Amongst children born at term, breast milk exposure has been reported to predict acceptance of unfamiliar foods in childhood (de Lauzon-Guillain et al., 2013; Forestell & Mennella, 2007; Mennella, Jagnow, & Beauchamp, 2001; Perrine, Galuska, Thompson, & Scanlon, 2014; Sullivan & Birch, 1994). Breast milk reflects the composition and flavor of the maternal diet (Mennella & Ventura, 2010), and experimental manipulations of maternal diet during breastfeeding demonstrate that breastfed infants show greater receptiveness to these same flavors when later introduced into their diet (Mennella et al., 2001).

The feeding history of children born preterm is often more complicated than the feeding history of children born at term (Dutta et al., 2015; Lucas & Smith, 2015). Preterm birth often limits

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early feeding options due to the immaturity of the infant's digestive system and suck-swallow coordination. Moreover, mothers of infants born preterm may have more difficulty with lactation compared to mothers of term infants (Cregan, De Mello, Kershaw, McDougall, & Hartmann, 2002; Donath & Amir, 2008; Hill, Aldag, Chatterton, & Zinaman, 2005). Thus, preterm infants in neonatal intensive care units may be fed at the breast, pumped milk from their own mother, pumped milk from donors, infant formulas aimed at premature infants, or may be fed intravenously (Dutta et al., 2015; Murase et al., 2014; M. Sharp, Campbell, Chiffings, Simmer, & French, 2015).

Compounding the complication for children born preterm, these children are at higher risk of developmental delay, chronic lung disease, and gastrointestinal disorders (Robbins, Hutchings, Dietz, Kuklina, & Callaghan, 2014; Vohr et al., 2000). Thus, such children are both more difficult to breastfeed and at higher risk of health problems that could be mitigated by improved diet.

To our knowledge, no previous studies have examined whether the impact of breast milk exposure amongst children born preterm is similar to that of children born at term. Examining whether this association holds for preterm infants with their more complicated feeding histories can provide insight into whether the association between breastfeeding and dietary variety is robust in the context of factors such as later introduction of breastmilk and variability in milk source. The aim of this study is to globally examine whether a history of partial or exclusive breastfeeding is associated with improved dietary variety amongst children born preterm.

2. Methods

2.1. Study design and participants

We analyzed secondary data (n = 194) from two ongoing clinical trials (NCT01683565 & NCT01576783) aimed at investigating the role of long-chain polyunsaturated fatty acids on cognitive outcomes (Fig. 1). Both trials were conducted at Nationwide Children's Hospital (NCH) in Columbus Ohio, USA. All recruited children had been previously admitted to an NCH managed neonatal intensive care unit or had been scheduled for a neonatology follow up visit at NCH. We restricted our analysis to the first trial visit (prior to the dietary supplement intervention) and to children enrolled by December 1 2014. Five respondents were dropped (two because maternal responses were not available for breastfeeding history and three because no food frequency (FFQ) data were available). Participants comprised 10–16 month old children (age corrected for gestational age at birth) born at less than 35 weeks' gestation (n = 133) and 18–39 month old children born at less than 29 weeks' gestation (n = 56). All enrolled children were in a normal growth range (children in the top or bottom 5th percentiles on gestational age adjusted growth curves were excluded), had ceased breastfeeding by enrollment, and were capable of consuming food orally (children were excluded if they had severe preterm-related feeding difficulties, such as reliance on a gastrostomy tube). Half the children (n = 28) from clinical trial NCT01683565 had demonstrated developmental delay or symptoms of a developmental disorder, as is common for children born extremely preterm. Multiple births were not excluded (see statistical methods). Characteristics of the final sample are presented in Table 1.

2.2. Breastfeeding exposure variables

Breastfeeding history was obtained through an interview-assisted questionnaire with the mother during the first study visit. Since all families were required to have ceased breastfeeding by trial enrollment, this was a retrospective assessment of breastfeeding history. The age cut-off for inclusion in this study was 39 months, limiting the recall window to roughly three years, consistent with recommendations for reliable assessment of breastfeeding history (Li, Scanlon, & Serdula, 2005). We defined the exposure "breastfed" to encompass both direct feeding (breast milk directly from breast) and indirect feeding (pumped milk from mother or other donor). Both exclusive and partial breastfeeding durations were assessed, where breastfeeding was considered exclusive if no other foods, beverages or formula were fed concurrently and partial otherwise. We separately modeled binary (ever partially or exclusively breastfed), and continuous (duration) exposures. Results from the continuous models are presented in full. Results from the binary models are available as supplementary material.

3. Dietary variety outcome measures

Parents completed a modified version of the Harvard semi-quantitative food frequency questionnaire (FFQ) (vitamins and supplements section omitted, 161 total items) (Rimm et al., 1992; Willett et al., 1985), reflecting child diet over the past month. Dietary variety was assessed for the entire FFQ, as well as separately for five food categories of interest: (1) Vegetables (excluding

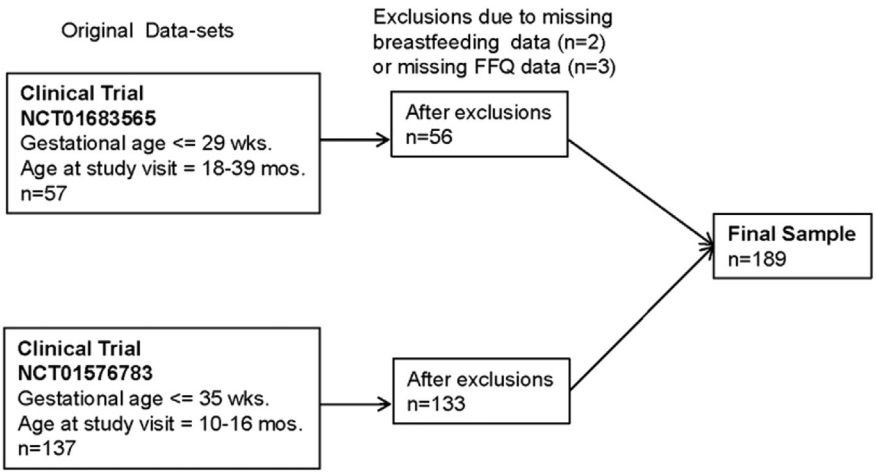

Fig. 1. Sample selection process.