Associations of parental food-choice control and use of food to soothe with adiposity in childhood and adolescence

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ABSTRACT

Background: Associations of parental feeding techniques with adiposity are mixed and largely rely on cross-sectional studies. We examined associations between parental food-choice control and using food to soothe at 3.5 years on adiposity at 7 and 15 years.
Methods: Participants were from the Avon Longitudinal Study of Parents and Children (n = 7312). Food-choice control was assessed using the item 'how much choice do you allow him/her in deciding what foods he eats at meals?'. Use of food to soothe was reported by mothers on the item 'how often do you use sweets or other foods to stop his/her crying or fussing?'. BMI at 7 and 15 years was converted to sex- and age-adjusted z-scores. Fat mass was assessed at 15 years using dual energy X-ray absorptiometry.
Results: In fully-adjusted models, children given the least choice had 0.08 lower BMI z-score at age 7 years and 0.12 lower BMI z-score,1.46 kg lower fat mass at 15 years than children with the most choices. There was no evidence of an association between using food to soothe and adiposity.
Conclusions: Contrary to some studies, higher parental control over food choice was associated with lower adiposity, but use of food to soothe was not associated with adiposity at ages 7 and 15.

1. Introduction

Overweight and obesity is a global public health challenge with 42 million children under 5 years overweight or obese (Word Health Organization, 2015). Due to the high prevalence of overweight and obesity, there is interest in examining how early life feeding experiences influence children's later food preferences, diets and adiposity (Collins, Duncanson, & Burrows, 2014; Sleddens, Gerards, Thijs, de Vries, & Kremers, 2011; Ventura & Birch, 2008; Vollmer & Mobley, 2013).

Parental feeding practices that may influence children's adiposity include the use of feeding control and food to soothe (Ventura, & Birch, 2008). There is a lack of a universal definition of

feeding control (Hughes et al., 2013). Most studies conceptualize feeding control as pressuring children to eat certain foods or deliberately restricting children's intake of energy-dense food. Systematic reviews have shown that higher parental pressure to eat is associated with lower children's body mass index (BMI) (Hurley, Cross, & Hughes, 2011; Shloim, Edelson, Martin, & Hetherington, 2015). It has been suggested that parental use of pressure increases children's dislike for foods and likelihood of picky eating. Findings on the association between feeding control and children's eating and adiposity are inconsistent. Birch and Fisher reported that restrictive feeding is associated with more snacking and adiposity in 5-year-old girls (Birch & Fisher, 2000; Fisher & Birch, 1999). The authors suggested that restrictive feeding increases children's preference for the restricted foods and children are more likely to eat in the absence of hunger (Birch & Fisher, 1998; Birch, Fisher, & Davison, 2003). Several cross-sectional studies found no association or a positive association between restrictive feeding and adiposity outcomes particularly in toddlers and pre-schoolers (Hurley et al., 2011; Shloim et al., 2015), while two longitudinal studies reported a negative association (Campbell et al., 2010;

Farrow & Blissett, 2008).

Food to soothe is conceptualized as using food in response to the child's crying or fussing (Baughum et al., 2001; Braden et al., 2014; Stifter, Anzman-Frasca, Birch, & Voegtline, 2011; Wardle, Sanderson, Guthrie, Rapoport, & Plomin, 2002), for instance, when a child is upset or has temper tantrums (Stifter et al., 2011; Vollrath, Stene-Larsen, Tonstad, Rothbart, & Hampson, 2012). Most studies that examined food to soothe and child's eating and adiposity are cross-sectional (Braden et al., 2014; Stifter et al., 2011), with findings varying from no association (Baughum et al., 2001; Carnell & Wardle, 2007; Rodenburg, Kremers, Oenema, & Van De Mheen, 2013) to positive associations (Anzman-Frasca et al., 2013; Stifter & Moding, 2015; Stifter et al., 2011).

A review of 32 articles on parental feeding practice on children's eating behaviours and weight found that 22 studies were cross-sectional and therefore unable to establish temporal order between parenting and adiposity (Ventura, & Birch, 2008). For instance, it is unclear whether parental control influences children's adiposity, or parents who perceived their children as overweight are more controlling (Farrow, & Blissett, 2008). Longitudinal studies with short-term follow up may be difficult to detect the effects, especially when sample sizes are small. The current study used data from a large, population-based prospective study to investigate the associations between parental food-choice control and food to soothe at 3.5 years on children's BMI z-scores at 7 and 15 years and fat mass at age 15 years. Our primary analyses used BMI as an outcome at ages 7 and 15 to examine consistency of associations between feeding practices and adiposity in childhood and adolescence, and fat mass at age 15 when adiposity is strongly predictive of adult outcomes (Owen et al., 2009). In secondary analyses, we explored the maternal and child characteristics that may influence parental use of food-choice control and food to soothe. For instance, child temperament may influence maternal feeding and adiposity (Anzman, Stifter, & Birch, 2012; Bergmeier, Skouteris, Horwood, Hooley, & Richardson, 2013).

2. Methods

The Avon Longitudinal Study of Parents and Children (ALSPAC) is a population-based, prospective study investigating the determinants of children's health and development. A total of 14,541 pregnant women resided in the Southwest of England with delivery date between 1st April 1991 and 31st December 1992 were recruited into the study. The core eligible ALSPAC sample consists of 13,978 infants who were alive at 1 year of age (Fig. 1). The cohort is considered broadly representative of the population living in Avon at the time although ethnic minorities, single parents and unmarried couples were slightly underrepresented (Boyd et al., 2013). The study website contains details of all the data that is available through a fully searchable data dictionary (http://www.bris.ac.uk/alspac/researchers/data-access/data-dictionary/). Ethical approvals were obtained from the ALSPAC Law and Ethics committee and local Research Ethics committees. Written informed consent was obtained from all participants.

2.1. BMI and fat mass

At age 7 and 15 years, participants were invited to attend the annual assessment clinics where anthropometric measurements were taken by trained researchers. Height was measured without shoes to the nearest 0.1 cm using the Harpenden Stadiometer (Holtain Croswell, Dyfed, UK). Weight was measured in light clothing (Tanita, Arlington Heights, IL) to an accuracy of 0.1 kg. BMI was calculated as weight (kg)/height (m^2) and converted to z-scores based on the British 1990 growth reference as these are

temporally and culturally appropriate to the ALSPAC cohort (Cole, Freeman, & Preece, 1995). Total fat mass was assessed at a mean age of 15.5 years using dual energy X-ray absorptiometry (DXA) (Prodigy scanner, Lunar Radiation Corp, Madison, Wisconsin, US).

2.2. Parental food-choice control and food to soothe

Parental food-choice control was measured at age 3.5 years using an item 'how much choice do you allow him/her in deciding what foods he eats at meals?'. Mothers responded to this item as 'he/she can choose from any food available', 'he/she is given a choice from a few alternatives that I select', and 'I decide what he/she will eat'. Mothers who decided what the child will eat were considered as endorsing higher control than mothers who allowed their child to have food choices (Patrick, Hennessy, McSpadden, & Oh, 2013). Mothers' use of food to soothe at age 3.5 years was measured using one item 'how often do you use sweets or other foods to stop his/her crying or fussing?'. Response to this item was 'frequently' (once a day or many times a week), 'infrequently' and 'never'. The selected food-choice control and food to soothe items were based on face validity that they captured existing definitions in the literature and mapping with items in other validated questionnaires (Musher-Eizenman & Holub, 2007; Wardle et al., 2002).

2.3. Potential confounders

Potential confounders of the association between parental food-choice control, use of food to soothe and adiposity were decided *a priori* based on current literature. Potential confounders included maternal education, home ownership, household crowding, parental social class, and financial difficulties, child's dietary patterns at 3 years of age, and child and parent factors (child temperament, birth weight z-score, ethnicity, eating difficulties, maternal age, maternal pre-pregnancy BMI, sole parenting, postnatal depression, smoking, alcohol intake during pregnancy, and number of other children). Full details of how these potential confounders were measured are provided in Supplementary material.

2.4. Analysis

Multiple linear regression models were used to estimate the associations between food-choice control, use of food to soothe and BMI z-scores at age 7 and 15 years and fat mass at 15 years. First, we estimated the unadjusted effect of food-choice control and use of food to soothe on outcomes separately (Model 1). We then adjusted for children's temperament (Model 2) and dietary patterns (Model 3). In Model 4, the food-choice control model was adjusted for all potential confounders and parental use of food to soothe (and age, sex, and height for fat mass); the food to soothe model was adjusted for all potential confounders and food-choice control (and age, sex, and height for fat mass). All analyses were performed using Stata version 13.0 (Stata Corp, College Station, Texas).

2.5. Multiple imputation

Twenty imputed datasets were generated using the 'mi impute chained' command in Stata under the missing at random (MAR) assumption (Rubin, 1976). Under the MAR assumption, missing data are assumed to be missing at random conditional on observed covariates, so that any remaining differences between complete case and imputed samples are random (i.e., cannot be a source of systematic bias). Multiple imputation is a widely recommended tool for handling missing data that helps minimise selection bias (Spratt et al., 2010; Sterne et al., 2009). Multiple imputation was