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Picky eating in preschool children: Associations with dietary fibre intakes and stool hardness

Caroline M. Taylor [a, *], Kate Northstone [b], Susan M. Wernimont [c], Pauline M. Emmett [a]

[a] Centre for Child and Adolescent Health, School of Social and Community Medicine, University of Bristol, Bristol, UK
[b] School of Social and Community Medicine, University of Bristol, Bristol, UK
[c] Nestlé Nutrition R&D, King of Prussia, PA, USA

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ABSTRACT

It has been suggested that constipation may be associated with picky eating. Constipation is a common condition in childhood and a low intake of dietary fibre may be a risk factor. Differences in fibre intake between picky and non-picky children and its relation to stool consistency is currently not well-understood. Children enrolled in the Avon Longitudinal Study of Parents and Children identified as picky eaters (PE) were compared with non-picky eaters (NPE): (1) to determine dietary fibre intake at 38 months; (2) to investigate whether any difference in dietary fibre intake was predictive of usual stool hardness at 42 months. PE was identified from questionnaires at 24 and 38 months. Usual stool hardness was identified from a questionnaire at 42 months. Dietary intake was assessed at 38 months with a food frequency questionnaire. Dietary fibre intake was lower in PE than NPE (mean difference −1.4 (95% CI −1.6, −1.2) g/day, $p < 0.001$). PE was strongly associated with dietary fibre intake (adjusted regression model; unstandardised B −1.44 (95% CI −1.62, −1.24) g/day, $p < 0.001$). PE had a lower percentage of fibre from vegetables compared with NPE (8.9% vs 15.7%, respectively, $p < 0.001$). There was an association between PE and usually having hard stools (adjusted multinomial model; OR 1.31, 95% CI 1.07, 1.61; $p = 0.010$). This was attenuated when dietary fibre was included in the model, suggesting that fibre intake mediated the association (OR 1.16, 95% CI 0.94, 1.43, $p = 0.180$). Picky eating in 3-year-old children was associated with an increased prevalence of usually having hard stools. This association was mediated by low dietary fibre intake, particularly from vegetables, in PE. For children with PE, dietary advice aimed at increasing fibre intake may help avoid hard stools.

1. Introduction

Picking eating is known to result in rejection of specific familiar and unfamiliar foods (Dovey, Staples, Gibson, & Halford, 2008; Taylor, Wernimont, Northstone, & Emmett, 2015), with a reduction in dietary variety and consequently an unhealthy or possibly inadequate diet (Carruth et al., 1998; Jacobi, Agras, Bryson, & Hammer, 2003; Li et al., 2014; Northstone & Emmett, 2013). Its prevalence in developed countries ranges from about 6% to 50% in preschool children (Taylor et al., 2015). The effect of picky eating on dietary fibre intakes, however, is not well documented. Several studies have shown that children who are picky eaters frequently reject, or limit their intake of vegetables (Cardona Cano et al., 2015; Galloway, Fiorito, Lee, & Birch, 2005; Galloway, Lee, & Birch, 2003; Haszard, Skidmore, Williams, & Taylor, 2014; Jacobi et al., 2003; Jones, Steer, Rogers, & Emmett, 2010; Li et al., 2014; Tharner et al., 2014; Xue, Lee, et al., 2015; Xue, Zhao, et al., 2015), which is likely to result in a low intake of dietary fibre. A similar effect would be caused by a low intake of wholegrain products in picky eaters (Cardona Cano et al., 2015; Tharner et al., 2014). There are few studies in which dietary fibre intakes have been measured directly in children with picky eating and compared with intakes in a comparison group: in such studies, dietary fibre intakes have been found to be lower in picky eaters than non-picky eaters but intakes in both groups have generally been found to be below recommended levels (Galloway et al., 2005; Xue, Lee, et al., 2015; Xue,

Abbreviations: ALSPAC, Avon Longitudinal Study of Parents and Children; FFQ, food frequency questionnaire; FR, food record; NDNS, National Diet and Nutrition Survey; SACN, Scientific Advisory Committee on Nutrition.

* Corresponding author. Centre for Child and Adolescent Health, School of Social and Community Medicine, University of Bristol, Oakfield House, Oakfield Grove, Bristol BS8 2BN, UK.
E-mail address: Caroline.m.taylor@bristol.ac.uk (C.M. Taylor).

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Zhao, et al., 2015). Two further studies have documented low fibre intakes in preschool-age picky eaters but did not include a comparison group (Kwok, Ho, Chow, So, & Leung, 2013; Volger et al., 2013).

It has recently been suggested that constipation may also be associated with picky eating in children. For example, in a study of children attending a Korean paediatric gastroenterology clinic for constipation, being a picky eater was identified as a characteristic by 27% of caregivers compared with only 13% in a control group (Chang et al., 2013). A bidirectional association between picky eating and constipation in preschool children in the Netherlands has also been reported in which there is a 'vicious circle' set up between the two (Tharner et al., 2015). Constipation is a common condition in childhood, affecting up to 30% of school-age children in the UK and accounting for about 3% of general paediatric consultations (Auth, Vora, Farrelly, & Baillie, 2012; Mugie, Di Lorenzo, & Benninga, 2011). In the USA alone, it is estimated to incur annual healthcare costs of US$3.9 billion. Symptoms include reduced frequency of defecation, occurrence of faecal incontinence, stool retention, painful or hard bowel movements, or large diameter stools. Usual treatments include education, toilet training and disimpaction with maintenance therapy and long-term follow-up. For many children, the causes are unknown, but may include genetic predisposition, stool withholding behaviour, cows' milk protein allergy, dietary change or coeliac disease. Fluid intake and physical activity levels may also be important. The primary dietary cause is lack of dietary fibre (Roma, Adamidis, Nikolara, Constantopoulos, & Messaritakis, 1999), and fibre supplements have been shown to be effective in children with chronic constipation (Castillejo, Bullo, Anguera, Escribano, & Salas-Salvado, 2006).

Although constipation seems to be more prevalent in picky eaters, it has not been fully established whether picky eating is associated with lower dietary fibre intakes compared with normal eating and evidence is especially lacking in preschool-age children. It is not known whether low fibre intakes might be caused by rejection of particular fibre-containing foods and/or particular food groups. Finally, it is not known whether dietary fibre is a mediator for possible constipation in this group. The aim of this study was to determine dietary fibre intake, and the relative contribution from food sources, in preschool-age children enrolled in the Avon Longitudinal Study of Parents and Children (ALSPAC) who were identified as picky eaters compared with those who were not picky eaters. A further aim was to investigate the difference in usual stool hardness (as a marker for constipation) between the two groups, and whether dietary fibre intake mediated this difference.

2. Materials and methods

2.1. The ALSPAC cohort

ALSPAC is a longitudinal population-based study investigating environmental and genetic influences on the health, behaviour and development of children. All pregnant women in the former Avon Health Authority with an expected delivery date between April 1991 and December 1992 were eligible for the study; 14,541 pregnant women were initially enrolled, resulting in a cohort of 14,062 live births with 13,988 alive at 1 year of age (Boyd et al., 2013). The social and demographic characteristics of this cohort at recruitment were similar to those found in UK national census surveys (Fraser et al., 2013). Further details of ALSPAC are available at www.bris.ac.uk/alspac and the study website contains details of all the data that are available through a fully searchable data dictionary (http://www.bris.ac.uk/alspac/researchers/data-access/data-dictionary). Ethics approval for the study was obtained from the ALSPAC Ethics and Law Committee and the Local Research Ethics Committees. The study flowchart is shown in Supplementary Fig. 1.

2.2. Defining picky eating in the ALSPAC cohort

The primary caregiver (usually the mother) received a series of postal self-completion questionnaires. The questionnaires are available from the study website (http://www.bristol.ac.uk/alspac/researchers/questionnaires/). A single question on picky eating was asked 24 and 38 months. The question was: 'Does your child have definite likes and dislikes as far as food is concerned?' with possible responses No/Yes, quite choosy/Yes, very choosy. The responses were scored 0, 1 or 2, respectively. A measure of persistence and severity of picky eating was made by combining the scores at 24 and 38 months (combined PE score): 0, score 0 at both time points; 1, score 1 at either or both time points; 2, score 2 once; 3, score 2 at both time points.

2.3. Dietary assessment

2.3.1. Food frequency questionnaires

A full food frequency questionnaire (FFQ) was included in the questionnaire at 38 months. The list of foods covered by the FFQ can be found in North and Emmett (2000). Daily intakes of energy, macronutrients and fibre as non-starch polysaccharide (NSP) were estimated (Rogers & Emmett, 1998). NSP broadly includes the cell wall components of plants (including cellulose, hemicelluloses, pectins, gums, mucilages and beta-glucans). It excludes resistant starch or oligosaccharides, which are part of fibre as measured by some other analytical methods, such as that of the AOAC (Department of Health, 1991). Thus fibre intakes measured as NSP are slightly lower than those using AOAC analysis. The FFQ data have been correlated with food record (FR) data collected about 5 months later in the same children (Spearman correlations ranged from 0.12 to 0.33 for nutrients and 0.18 to 0.56 for food groups, all $p < 0.001$). These correlations were very similar to those found between weighed FRs and a widely used FFQ in a definitive study of dietary assessment methods (0.13 to 0.44) (Bingham et al., 1994). The FR data in ALSPAC have been compared with data from the UK National Diet and Nutrition Surveys (NDNS) of children of a similar age and have been found to be closely related (Emmett, Rogers, Symes, & ALSPAC Study Team, 2002).

2.3.2. Food records

A 10% subsample of the ALSPAC cohort was invited to a research clinic when the children were aged 43 months. Prior to the clinic, parents were mailed a structured diary to record all the foods and drinks that the child consumed over three individual days (one weekend day and two weekdays) in household measures. The FR were checked with the parents in the clinic and then used to calculate daily mean energy, macronutrient and fibre intakes for each child, as described by Emmett et al. (2002). These data were used in this study to confirm data from the FFQ.

2.3.3. Food group sources of dietary fibre

Fibre-providing foods were grouped according to type and the weight of the food, the amount of fibre and percentage contribution to total fibre was calculated for each food group.

2.4. Stool hardness

Stool hardness was assessed at 30 and 42 months. The caregiver was asked: 'Nowadays how often are his/her stools hard?' with possible responses Usually/Sometimes/Never. This was considered