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Original Article

Delayed introduction of lumpy foods to children during the complementary feeding period affects child's food acceptance and feeding at 7 years of age

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Abstract

The study aimed to follow up children who had been introduced to lumpy solids (chewy foods) at different ages, and to assess their dietary intake and feeding difficulties at seven years of age. Information was collected from a geographically defined population of 7821 mothers of children born in 1991/92, part of the Avon Longitudinal Study of Parents and Children (ALSPAC). Self-report questionnaires were completed by the mother about her child at 6 months, 15 months, and 7 years postpartum about food foods eaten and feeding difficulties. Children were divided into three groups based on the age at which they were first introduced to 'lumpy' solids: 12.1% were introduced before 6 months of age, 69.8% were introduced between 6 and 9 months of age and 18.1% were introduced after 9 months. Children introduced to lumpy solids after the age of 9 months ate less of many of the food groups at seven years, including all 10 categories of fruit and vegetables, than those introduced to lumpy foods between 6–9 months ($P < 0.05$–0.001). In addition they were reported as having significantly more feeding problems at seven years ($P < 0.05$–0.001). The long-term feeding problems and reduced consumption of important food groups such as fruit and vegetables in children who are introduced to lumpy foods after the age of 9 months is a cause for concern. Health professionals must encourage the progression from purees and exposure to important food groups.

Keywords: children's diets, complementary foods, lumpy foods, weaning.

Introduction

The term 'weaning' (or complementary feeding) describes the progression of infants from an entirely milk-based diet to one which is based on a variety of solid foods. The first solid foods usually take the form of purees, and then there is a gradual progression through mashed foods to lumpy textured foods which need chewing, and then to family foods by the age of 1 year. The ability to eat lumpy foods is dependent on both the experience of chewing and the development

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of oral-motor skills, which occurs during the first year of life (Giesel 1991; Reilly *et al.* 1995). The World Health Organization recommendation for the timing of the introduction to lumpy solid foods is that they should be introduced to the diet between 6 and 9 months of age (WHO 2001). However, research studies have found that a sizeable proportion of infants, ranging from 13% (Coulthard 2001) to 17.6% (Northstone *et al.* 2001), are not introduced to lumps in this period.

The early weaning period, from 4 to 7 months, is believed to be crucial in determining preferences for tastes and textures; children who are exposed to foods in this period can rapidly acquire a preference after as little as one exposure (Birch *et al.* 1998); however, in later childhood, 10 or more exposures might be necessary (Birch & Marlin 1982). It may well be that there is a sensitive period of enhanced acceptance in these early months, when taste preferences are more readily learned (Harris 2000). Infants who experience a greater range of tastes in the weaning period have been found to consume a greater variety of fruit and vegetables in childhood (Skinner *et al.* 2002; Cooke *et al.* 2004). Similarly, there could be a sensitive period for the introduction of lumpy textured foods between the ages of 6 and 10 months. Giesel (1991) found that the most marked changes in the efficacy of chewing occurred between these ages, but only if the infant had experience of textured food in the mouth.

After the age of 10 months or so, introduction of solid textured foods becomes more difficult (Illingworth & Lister 1964; Mason *et al.* 2005). Infants, who had been tube fed, or fed solely on purees, in the first year of life, tended to have feeding difficulties when normal food was introduced (Senez *et al.* 1996; Dello Strologo *et al.* 1997). These feeding difficulties were observed in the short term, and included food refusal and difficulty with chewing (Illingworth & Lister 1964). However, there have been few empirical studies which have tested these observations. One of the only studies to have examined the effects of the age of introduction to lumpy foods on subsequent feeding difficulties was Avon Longitudinal Study of Pregnancy and Childhood (ALSPAC) (Northstone *et al.* 2001), a large, population-based study in Avon, UK. Several associations were found between the late introduction to lumpy foods (later than 9 months) and greater incidence of feeding problems at 15 months, including picky eating, being difficult to feed and prolonged consumption of baby foods. A question which remains unanswered is whether these differences persist in the long term.

The main aim of the present study was to follow up the children from ALSPAC who had been introduced to lumpy solids at different ages, in relation to the proposed sensitive period, and investigate their long-term eating behaviour and food intake at 7 years of age. The main hypothesis was that children who had been introduced to lumpy foods from 10 months of age would be more difficult to feed at 7 years of age. In addition, as these children were not exposed to as wide a variety of family foods in the first year of life (Northstone *et al.* 2001), it was expected that they would have a more restricted diet and would eat a smaller range of foods than those introduced to lumpy foods earlier.

Subjects and method

Sample

The ALSPAC recruited pregnant women residents in three Bristol-based health districts of Avon, in the South West of England, with an expected delivery date between 1 April 1991 and 31 December 1992. The cohort was population based and broadly representative at recruitment (Golding *et al.* 2001). Ethical approval for the study was obtained from the ALSPAC Law and Ethics Committee and the Local Research Ethics Committees.

Multiple births and ethnic minorities were excluded from the final analyses because their diets may have differed during weaning and ethnic minorities were under represented in ALSPAC. Of the 13 978 who were eligible for the study, after exclusions, 9360 had data at 6 and 15 months and were included in the Northstone *et al.* (2001) study. Of these, 7821 (83.6%) returned questionnaires at 7 years, and were included in the present study.

Procedure

Mothers of children from ALSPAC were asked to fill in parental-report postal questionnaires when their

child was 6 months, 15 months and 7 years of age. Each questionnaire was posted to the mother with a reply envelope, if it was not returned within 3 weeks, a postal reminder was sent followed by a second reminder 2 weeks later and a telephone call if no response after a further month. Each questionnaire (28–64 pages in length) contained a range of questions with a section asking about feeding the child, including frequency of eating a list of foods and drinks (3–15 pages in length). At 6 and 15 months, the age at introduction of each food/drink was recorded.

Measures

Demographic variables

Various social and demographic variables, which had been shown in previous work to be associated with diet in this cohort (North *et al.* 2000), were included. These had also been considered in the original study (Northstone *et al.* 2001) and had been obtained by parental report questionnaire. These variables were sex of the infant, number of older siblings (0, 1, +2), the mothers highest educational attainment [Certificate of Secondary Education (CSE) or less, vocational, O level, A level or degree], her age at the birth of her child and whether she had a partner, housing tenure (owner/occupied, Council/housing association or other rented property) and a measure of overcrowding (more than one person per room in the house). The age at which the child's first tooth erupted was considered. The length of time spent for breastfeeding was included as a control variable, as this has been found to be associated with acceptance of a greater range of foods (Galloway *et al.* 2003). Early problems with complementary feeding (progression to first solid foods) may be an indicator of oral motor dysfunction, which could lead to subsequent difficulties with lumpy textures (Ramsay *et al.* 1993); therefore; early feeding difficulties at 6 months were also included as a control variable.

Early feeding variables

Introduction of lumpy solids

Our primary independent variable of interest was the age of introduction of lumpy foods. It was assessed via parental response to a question in the questionnaire at 15 months: 'Babies first solid meals are usually a puree. When did your child first start having meals with lumps in? Give age started in months'.

A total of 243 (2.5%) questionnaires were returned without a response to this question. A further 90 (0.9%) children had yet to be introduced to lumps in food by this age, and as this question was not asked again and this small group had not been included in the 2001 analysis, we excluded them from further analysis. The 7821 children with data at all time points were grouped according to the age at which they were first introduced to lumps in their diet: 946 (12.1%) were introduced before 6 months of age (<6 months group), 5457 (69.8%) were introduced between 6 and 9 months of age (6–9 months group), and 1418 (18.1%) were introduced at 10 months or older (10+ months group). There were no differences in drop-out rate across the three groups between the original study (Northstone *et al.* 2001) and the present study ($\chi^2 = 6.00$, $P > 0.05$). The majority of the children had been introduced to complementary foods between the ages of 3 and 4 months as was the recommendation at that time (Department of Health and Social Security 1988). Of those introduced to lumps before 6 months, 25% were in their fourth month and 63% in their fifth month.

Feeding difficulties

In the questionnaire about the children aged 7 years, mothers were asked to rate five potential feeding difficulties of their child on a four-point Likert-type Scale [yes, worried me greatly (1); yes, worried me a bit (2); yes, but did not worry me (3); no, did not happen (4)] The five feeding difficulties were: (1) not eating sufficient amounts; (2) refusal to eat the right food; (3) being choosy with food; (4) over-eating; and (5) being difficult to get into a feeding routine. These responses were converted to a binary score of whether the problems did (1–3) or did not occur (4).

At both 6 months and 7 years, mothers were asked to rate on a four-point scale whether they had 'Any difficulties getting the child to eat what you wanted him/her to?' [great difficulty (1); some difficulty (2); occasional difficulty (3); no difficulty (4)]. These

responses were reversed, so that a high score indicated high levels of difficulty.

Dietary range

In the questionnaires about their 7-year-old child, mothers were asked if the child consumed 'nowadays' an extensive list of 67 food categories and eight drink categories. These are listed in Tables 2–4. The frequency with which the child consumed the foods was recorded on a scale: never (1); once in two weeks (2); 1–3 times/week (3); 4–7 times/week (4); more than once a day (5). These responses were converted to binary scores, representing whether the child ever had the particular food category (2–5) or not (1).

Five variables were created, relating to the consumption of vegetables and fruit. The number of portions consumed in a typical week was calculated from the frequencies recorded (never = 0, once in 2 weeks = 0.5, 1–3 times/week = 2, 4–7 times/week = 5.5, more than once a day = 10). There were eight categories of vegetables recorded, so a variety score was calculated, by summing how many different types were eaten. Children were also categorized by whether they ate more or less than one portion a day of fruit or vegetables.

Statistical analyses

All statistical analyses were carried out on SPSS version 14. Chi-square tests were carried out to compare participants with non-participants and to examine whether there were any differences in the types of foods and drinks consumed at age seven according to the age of introduction to lumpy foods. Chi-square tests were also carried out to compare consumption of foods from the dietary-range questionnaire. In all the statistical analyses, the 6–9 month group was used as the reference group as this is the recommended age of introduction to lumpy foods in infancy, and tests were carried out comparing this group with the <6 month group and the 10+ month group.

Binary logistic regressions were carried out to see if there were differences in feeding problems and fruit and vegetable eating between the groups. The demographic variables in Table 1 and early feeding difficulties at 6 months were entered into the adjusted analyses as a first step in the regression. In addition, we have shown in a previous analysis of these data that feeding home-cooked or raw fruit or vegetables to infants rather than ready prepared types increased the likelihood of the children eating fruit or vegetables at age seven (submitted paper); therefore, these variables were also entered in the first step of adjusted analyses. This was to control for the effects of these potentially confounding variables.

Results

Demographic variables

The differences between those participating in the study and those not for the demographic and feeding variables are presented in Table 1. Mothers who returned all three questionnaires were more likely to be older, more educated, have fewer children, own their home, have no financial difficulties, be less overcrowded, have a partner and have breastfeed their child. There was no association between returning the questionnaire and the gender of the child or the appearance of the first tooth. There was no consistent relationship between response rates and feeding difficulties at 6 months or the timing of introduction to lumpy foods.

Types of food and drinks consumed at 7 years

The proportion of children, who had eaten a list of food/drink types at 7 years, according to the age of the introduction of lumpy foods, is shown in Tables 2 and 3. The most striking differences between the three groups were in fruit and vegetable consumption. All the 10 categories of fruit and vegetables were eaten by fewer children in the group introduced to lumps after 9 months than in the comparison group. More children in the group introduced to lumpy foods before 6 months ate certain categories of fruit and vegetables than in the comparison group; these included green leafy vegetables and citrus fruits.

Table 1. Pearson chi-square tests to look at differences in demographic and feeding variables according to research participation

	Participants who returned all three questionnaires (%) ($n = 6157$)	Participants who did not return all three questionnaires (%) ($n = 7821$)	Pearson chi-square
Sex of infant			
Boy	51.3	52.1	n.s.
Girl	47.9	47.9	
Mothers age (years)			
<25	21.0	43.1	**
25–29	33.7	29.5	
30+	45.2	27.4	
Mother's education			
CSE	14.2	29.9	**
Vocational	8.7	11.8	
O Level	35.5	33.0	
A Level	25.8	17.2	
Degree	15.8	8.1	
Number of siblings			
0	42.9	39.0	**
1	38.4	37.3	
2 or more	18.7	23.7	
Housing tenure			
Owned	82.3	60.6	**
Council	8.5	22.7	
Other rented	9.3	16.8	
Financial difficulties			
None	40.1	29.0	**
Some	43.7	44.7	
Many	16.2	26.3	
Overcrowding			
No	95.9	89.1	**
Yes	4.1	10.9	
Has a partner			
Yes	98.4	96.1	**
No	1.6	3.9	
Appearance of first tooth			
0–5 months	27.4	30.3	**
6–9 months	56.4	52.5	
>10 months	16.1	17.2	
Breastfeeding duration			
Never	21.0	33.0	**
<1 month	15.8	17.3	
1–<3 months	15.6	16.5	
3–<6 months	13.6	11.1	
6 months or more	34.0	22.1	
Feeding difficulties at 6 months			
No	3.4	3.3	**
Yes, some difficulties	32.1	29.2	
Yes, great difficulties	64.5	67.5	
Age of introduction to lumpy foods			
<6 months	12.0	15.8	**
6–9 months	69.9	65.5	
>9 months	18.1	18.7	

CSE, Certificate of Secondary Education. $^{**}P < 0.001$; n.s., non significant.

Table 2. Chi-square tests to compare of the proportion of children eating certain foods at age seven

	Age of introduction to lumpy/chewy foods		
	6–9 months	<6 months	10+ months
	69.8%	12.1%	18.1%
	(5457)	(946)	(1418)
Fruit and vegetables			
Peas, broad beans	71.1	72.7	64.8**
Sweet corn	68.4	70.2	61.7**
Dark green leafy vegetables	73.9	78.2**	70.1**
Other green vegetables	77.0	81.3**	73.1**
Carrots	90.8	91.9	88.5*
Other root vegetables	48.4	51.4	43.4**
Tomatoes	55.1	60.7**	49.7**
Salad	65.9	68.5	61.4**
Citrus fruit	79.0	82.3*	74.8**
Other fresh fruit	97.1	98.1	91.7**
Proteins			
Sausages/burgers	84.3	87.7*	80.6**
Meat pies/pasties	41.6	49.1**	40.3
Vegetarian pies/pasties	21.3	22.9	17.2**
Ham, Bacon, Pate, cold meats	83.4	84.3	80.5*
Meat roast, chops, stew curry	87.2	89.9*	84.4*
Fat on meat	94.5	93.4	94.9
Liver, kidney, heart	4.0	5.0	3.8
Coated chicken/turkey	88.4	89.3	87.5
Poultry	92.0	92.9	88.5**
Shellfish	13.6	15.6	13.2
White fish in breadcrumbs	87.7	89.7	86.0
Uncoated white fish	35.9	38.8	34.1
Tuna	53.2	53.8	48.1**
Other fish	20.0	23.5*	19.0
Eggs	72.6	74.3	70.8
Cheese	87.8	89.6	86.5
Pizza	79.6	82.8*	77.9
Baked beans	78.5	80.8	73.5**
Pulses	12.7	12.9	11.2
Soya meat	12.1	9.7*	9.5*
Peanuts/peanut butter	34.9	36.7	30.4*
Other nuts	12.6	12.9	10.4*
Starch/cereals			
Oven chips	71.3	69.6	69.6
Fried chips	74.9	76.9	73.7
Roast potatoes	82.7	85.8*	81.2
Boiled/mash/jacket potato	92.5	93.4	89.7**
Boiled/fried rice	70.5	74.6*	64.8**
Canned pasta	70.7	74.6*	68.7
Boiled pasta	81.1	82.5	76.6**
Crispbreads	26.2	26.9	24.4
Oat cereal	47.2	52.1*	39.7**
Whole grain cereal	80.9	85.4**	76.8**
Other cereals	96.0	96.7	95.7

*$P < 0.05$; **$P < 0.001$.

Table 3. Chi-square tests to compare pudding, snack and beverage consumption at 7 years

	Age of introduction to lumpy/chewy foods		
	6–9 months ($n = 5457$)	<6 months ($n = 946$)	10+ months ($n = 1418$)
Puddings			
Canned fruit	49.4	54.3*	46.2*
Yoghurt/fromage frais	95.2	94.4	93.6*
Milk puddings	63.0	66.1*	62.1
Ice cream	93.6	93.1	93.5
Ice lollies	79.4	79.0	76.3*
Pudding	64.4	68.0*	60.6*
Custard/cream	46.1	48.4	44.9
Snack foods			
Cakes/buns	92.5	92.0	91.4
Crisps/corn snacks	95.9	96.8	95.6
Full-coated chocolate biscuits	92.9	94.0	93.3
Other biscuits	90.6	90.8	91.2
Chocolate bars	92.7	90.2*	92.1
Sweets	86.4	85.7	84.8
Beverages			
Fruit juice from tin	7.8	8.4	8.0
Pure fruit juice	82.6	83.6	76.3**
Squash/juice	94.5	94.5	93.5
Cola	68.2	70.1	67.3
Other fizzy drinks	71.2	72.7	67.8*
Water	76.7	77.2	73.4*
Milk	78.1	79.6	80.1
Flavoured milk	47.0	49.3	44.0*

Significance represents difference in consumption according to Pearson's chi-square tests comparing the reference group (6–9 months) with each of the other two groups in separate analyses (<6 months and 10+ months); *$P < 0.05$; **$P < 0.001$.

Feeding problems at 7 years

The results of binary logistic regressions, both unadjusted and adjusted for all the variables listed in Table 1, testing whether there were differences in feeding problems between the groups, are presented in Table 4. Children who were introduced to lumps from 10 months were reported as having more feeding problems at 7 years of age. These included not eating sufficient amounts, refusal to eat the right amount and being choosy with food.

Fruit and vegetables at 7 years

Table 5 presents binary logistic regressions in relation to the amount and variety of fruit and vegetables eaten. Children introduced to lumpy solids from 10 months were reported as eating fewer portions of fruit and vegetables than the rest of the sample. They also ate fewer types of vegetables in a typical week than the rest of the sample did.

Discussion

The aim of the present study was to provide longitudinal data on the impact of the timing of the introduction of lumpy foods on later food acceptance and feeding problems. The ALSPAC study is the first to address this issue, using a longitudinal design with a cohort sample. This study shows that at 7 years of age, differences persisted in food acceptance and feeding problems according to the age at which lumpy foods were introduced, even after controlling for the potentially confounding effects of early feeding difficulties at 6 months and various demographic variables. Children, who were introduced to lumpy foods

Table 4. Binary logistic regressions to examine differences in feeding problems at 7 years of age according to the timing of the introduction of lumpy food

	6–9 months (5457)	<6 months (946)	>10 months (1418)
Difficulties getting the child to eat (% yes)	55.3	50.6	61.8
OR unadjusted	1.00	0.95 (0.88, 1.02)	1.17 (1.11, 1.25)**
OR adjusted	1.00	0.93 (0.85, 1.02)	1.15 (1.07, 1.24)**
Not eaten sufficient amounts (% yes)	20.3	18.4	24.0
OR unadjusted	1.00	0.95 (0.86, 1.04)	1.23 (1.12, 1.35)**
OR adjusted	1.00	0.87 (0.78, 1.00)	1.15 (1.03, 1.29)*
Refused to eat the right food (%)	54.2	58.0	61.9
OR unadjusted	1.00	1.09 (0.97, 1.22)	1.15 (1.06, 1.25)**
OR adjusted	1.00	1.01 (0.88, 1.17)	1.09 (1.00, 1.20)*
Been choosy with food (% yes)	72.0	66.9	76.7
OR unadjusted	1.00	0.91 (0.82, 0.99)*	1.19 (1.10, 1.30)**
OR adjusted	1.00	0.82 (0.73, 0.93)*	1.16 (1.05, 1.28)*
Over eaten (% yes)	17.5	21.3	15.9
OR unadjusted	1.00	1.67 (1.03, 1.32)*	0.91 (0.81, 1.03)
OR adjusted	1.00	1.07 (0.92, 1.26)	0.89 (0.77, 1.03)
Difficulty to get into a feeding routine (% yes)	10.1	10.7	13.0
OR unadjusted	1.00	1.00 (0.87, 1.14)	1.22 (1.10, 1.35)**
OR adjusted	1.00	0.95 (0.79, 1.13)	1.10 (0.97, 1.25)

OR adjusted: adjusted for sex of infant, mother's age and education, number of siblings, housing tenure, financial difficulties, overcrowding, presence of a partner, appearance of first tooth, breastfeeding duration and feeding difficulties at 6 months and feeding of home-cooked, raw or ready-prepared fruit and vegetables in first year; *$P < 0.05$; **$P < 0.001$.

from 10 months of age, were more likely to be difficult to feed, to not eat sufficient amounts, to be choosy with food and to refuse to eat foods at age seven than the children, who were introduced to lumpy foods at the recommended time, were. This is in line with the findings from this cohort when the children were 15 months of age (Northstone *et al.* 2001). In addition, this study suggests that a delay in the introduction of lumpy foods to infants may have an effect on the range of foods that children accept in middle childhood. In unadjusted analysis, children introduced to lumpy foods after the recommended age were less likely to eat all 10 types of fruits and vegetables, fruit-based puddings and fruit-based drinks at age seven, compared with other children. Adjusted analysis showed that these children ate fewer portions of fruit and vegetables and had less variety of vegetables.

There was no evidence that introducing lumps before 6 months (in practice this meant at about 5 months) was detrimental. In fact, there was evidence that those introduced early were more likely to eat certain categories of fruit and vegetables, those with bitter or sour tastes, and eat more vegetables more often. This is in line with the findings of Cohen *et al.* (1995), where the group fed complementary food from 4 months ate vegetables more often and a larger variety of foods at 9 months than the group exclusively breastfed to 6 months did.

Taken overall, our results provide further evidence for a sensitive period in the first year of life during which infants more readily accept tastes and textures (Harris 2000; Cooke *et al.* 2004). It is likely that mothers, who do not expose their infants to foods that vary in taste and texture during the first year of life, continue not to do so throughout their childhood. These findings may be a result of increased exposure, or that children, who progress rapidly, are more enthusiastic eaters who dictate a faster pace of weaning. However, it needs to be borne in mind that many tests were carried out during this study and it is possible that some of these findings are spurious.

The associations with feeding problems suggest that children, who were introduced to lumpy foods late in the first year, were perceived to have later problems with both the variety and the amount of food consumed. Perceived problems with the variety of foods

Table 5. Binary logistic regressions to examine differences in fruit and vegetable consumption at 7 years of age according to the timing of the introduction of lumpy food

	6–9 months (5457)	<6 months (946)	>10 months (1418)
Fruit consumption			
Mean weekly score	7.1	7.3	6.4
OR unadjusted	1.00	1.01 (0.99, 1.02)	0.97 (0.96, 0.98)**
OR adjusted	1.00	1.01 (0.99, 1.03)	0.97 (0.95, 0.98)**
Vegetable consumption			
Mean weekly score	11.6	12.7	10.5
OR unadjusted	1.00	1.02 (1.01, 1.03)**	0.98 (0.97, 0.99)**
OR adjusted	1.00	1.02 (1.01, 1.04)**	0.98 (0.97, 0.99)**
Vegetable variety score			
Mean number varieties/week	4.3	4.6	3.9
OR unadjusted	1.00	1.06 (1.03, 1.10)**	0.92 (0.89, 0.94)**
OR adjusted	1.00	1.10 (1.06, 1.14)**	0.94 (0.91, 0.96)**
Percentage of sample eating less than one portion of fruit/day	62.9	59.8	68.5
OR unadjusted	1.00	0.89 (0.76, 1.02)	1.29 (1.13, 1.47)**
OR adjusted	1.00	0.85 (0.72, 1.02)	1.33 (1.14, 1.55)**
Percentage of sample eating less than one portion of vegetables a day	27.7	23.5	34.4
OR unadjusted	1.00	0.80 (0.68, 0.94)**	1.37 (1.21, 1.55)**
OR adjusted	1.00	0.70 (0.57, 0.85)**	1.21 (1.05, 1.41)**

OR adjusted: adjusted for sex of infant, mother's age and education, number of siblings, housing tenure, financial difficulties, overcrowding, presence of a partner, appearance of first tooth, breastfeeding duration and feeding difficulties at 6 months and feeding of home-cooked, raw or ready-prepared fruit and vegetables in first year; $^{**}P < 0.001$.

consumed at 7 years supports the theory that infants need to be exposed to lumpy foods within a critical period. However, perceived problems with appetite may suggest that the refusal to eat lumpy foods may be partly based on child factors. Infants with lower levels of appetite may be choosier about what foods they decide to eat, and the more challenging texture of lumpy foods may be more readily refused and mothers, therefore, could be basing decisions about when to give the child certain foods on the perceived needs and desires of the infant (Harris 1988). If this is the case, then these mothers need to be supported in persisting with more challenging textures, so that their children can develop appropriate feeding skills.

The results are based on parental-report questionnaires returned by only 56% of the original eligible sample and there was evidence of bias towards mothers of higher socio-economic status, completing the questionnaires. However, the sample was large and there was good coverage of factors likely to confound the associations and the fact that associations were found with similar feeding problems at both 15 months and 7 years, suggesting that the findings are robust. There was no validation of the answers to the questionnaires for these variables and the questions about feeding difficulties related to the mother's perception of what she found difficult not to a measured standard. However, in this case, it was the mother who fed the child, so her perception of any problem was likely to be an important factor, regarding feeding the child. This study did not cover ethnic minorities, so further work would be necessary to determine if this finding is applicable in different cultural settings.

Conclusion

The findings of this study support the theory that there is a critical period for exposure to different textures during weaning (Illingworth & Lister 1964). Early exposure, not only to a variety of tastes, but also of textures, is important in the long-term develop-

ment of child food preferences and feeding skills. Early exposure to fruit and vegetables is particularly important, as these foods have been implicated in the prevention of such diseases as cancer and heart disease (Steinmetz & Potter 1996; Hu *et al.* 2000). As the current World Health Organization recommendation that children are weaned onto solid foods at 6 months, it is very important for health professionals to impress, upon mothers, the importance of rapid exposure to new tastes and textures after this time to promote long-term dietary variety.

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Conflicts of interest

None declared.

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