Original Article

Maternal and infant factors associated with reasons for introducing solid foods

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Abstract

The current UK Department of Health advice is to introduce solid foods to infants at around 6 months of age, when the infant is showing signs of developmental readiness for solid foods. However, many mothers introduce solid foods before this time, and for a wide variety of reasons, some of which may not promote healthy outcomes. The aim of the current study was to examine infant and maternal characteristics associated with different reasons for introducing solid foods. Seven hundred fifty-six mothers with an infant aged 6–12 months old completed a questionnaire describing their main reason for introducing solid foods alongside demographic questions, infant weight, gender, breast/formula feeding and timing of introduction to solid foods. The majority of mothers introduced solid foods for reasons explicitly stated in the Department of Health advice as not signs of readiness for solid foods. These reasons centred on perceived infant lack of sleep, hunger or unsettled behaviour. Maternal age, education and parity, infant weight and gender and breast/formula feeding choices were all associated with reasons for introduction. A particular association was found between breastfeeding and perceiving the infant to be hungrier or needing more than milk could offer. Male infants were perceived as hungry and needing more energy than female infants. Notably, signs of readiness may be misinterpreted with some stating this reason for infants weaned prior to 16 weeks. The findings are important for those working to support and educate new parents with the introduction of solid foods in understanding the factors that might influence them.

Keywords: breastfeeding, complementary foods, complementary feeding, weaning, socioeconomic factors, weight.

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Introduction

The World Health Organization recommends that infants are introduced to solid foods at 6 months of age (WHO & UNICEF 2003). This is reflected in UK Department of Health (DoH) guidance that advocate an introduction at 'around six months' (Department of Health 2013), although recommendations stand at 4–6 months in Europe and the United States

(Schwartz *et al.* 2011). Debate continues as to the recommended timing of introduction (Agostoni *et al.* 2008), but typically it is agreed that introducing solid foods before 4 months significantly increases the risk of gastrointestinal and respiratory disorders, otitis media, allergies and obesity with further protection in a delay until 6 months (Wilson *et al.* 1998; Armentia *et al.* 2001; Kramer & Kakuma 2004; Wright *et al.* 2004; Huh *et al.* 2011). Ensuring infants are not

introduced to solid foods before 4 months and ideally delayed until closer to 6 months is a current DoH priority.

Despite recommendations, many mothers introduce solid foods before the guidance of around 6 months in the UK. Thirty one per cent do so by 4 months of age with 75% having done so by 5 months of age. Only 6% wait until the UK recommendation of 26 weeks (McAndrew *et al.* 2012). It is well established that mothers who are younger, with a lower level of education or from an area of poverty are significantly more likely to introduce solid foods both before 4 and 6 months of age. Maternal smoking, obesity and formula feeding have also been linked to an earlier introduction of complimentary foods (Horodyski *et al.* 2007; Olson *et al.* 2010; McAndrew *et al.* 2012; Brodribb & Miller 2013; Clayton *et al.* 2013).

Understanding why mothers choose to introduce solid foods earlier than the guidelines is important to promoting healthier decisions regarding timing of introduction to solid foods. Although the UK DoH gives a guideline of around 6 months of age for introduction of solid foods, the concept of signs of readiness (often referred to as developmental readiness) is present in guidance. Both the DoH (NHS 2011) and British Dietetic Association (More *et al.* 2010) suggest that parents should follow developmental signs in their infant suggesting that they are ready for solid foods e.g. being able to sit up unsupported, grasp food and bring it to their mouths. These motor skills typically emerge at around 6 months of age but can occur sooner in some infants, suggesting there may be a wider window for introduction of solid foods.

Typically, concepts of readiness are not given as a reason for introduction of solid foods, particularly for an early introduction. Instead, mothers often describe factors such as perceptions of hunger, belief that

infants would sleep for longer, desire to give the infant something more than breast/formula milk or the infant wanting the food the mother was eating; none of which fit with concepts of readiness (Tarrant *et al.* 2010; Clayton *et al.* 2013). Specific beliefs that the infant needs solid foods to encourage a later healthy diet are common; fear of food rejection, need to introduce new tastes and to get the infant accustomed to food are often cited (Arden 2010; Chaidez *et al.* 2011). Pressure from others, particularly those who introduced solid foods at an earlier date, is also a common driver (Anderson *et al.* 2001; Alder *et al.* 2004).

Despite a wealth of studies exploring who may introduce solid foods early and what reasons mothers give for an early introduction, there has been little cross-examination of the factors that are associated with specific reasons for introducing solid foods. Timing of introduction to solid foods and reason given have been examined finding that an early introduction is associated with reasons such as hunger, sleep, pressure from others and having a large baby (Wright *et al.* 2004; Tarrant *et al.* 2010; McAndrew *et al.* 2012). One recent study also found that mothers who formula fed were significantly more likely to state that they introduced solid foods on the advice of their health professional whereas mothers who breastfed were more likely to introduce solid foods because they wanted to feed their infant something other than breast milk (Clayton *et al.* 2013). However, other factors such as maternal background and infant characteristics such as weight or gender have not been explored in relation to specific reasons.

The aim of the current study was therefore to examine reasons mothers give for introduction to complementary foods and to explore the association between these reasons and maternal and infant factors.

Key messages

- Maternal age, education and parity were strongly associated with reasons for weaning.
- Solid foods were often introduced to settle behaviour and encourage sleep.
- Breastfeeding mothers introduced solid foods because of slower weight gain, unsettledness and poorer sleep.
- Infant hunger was deemed a sign of need for solid foods rather than increasing breast/formula feeds.
- Male infants were weaned for hunger while female infants to settle behaviour.

Methodology

Participants

Women with an infant aged 6–12 months completed a questionnaire. This age range was used to allow women opportunity to have introduced complementary foods (as per DoH UK guidelines) but with a cut-off that excluded those who had not introduced solid foods within a recent time period. Exclusion criteria included: low birthweight (<2.5 kg), premature birth (<37 weeks gestation) and multiple birth alongside inability to consent.

Mothers were recruited via local mother and baby groups in the South West Wales area and through online parenting forums based in the UK. Mothers were all resident in the UK and provided a UK post-code to confirm this. All participants gave informed consent prior to inclusion in the study. Ethical approval was granted by a Department of Psychology Research Ethics Committee.

Questionnaire

Participants completed a questionnaire exploring their experience of introducing solid foods to their infant. Questions examined maternal demographic background (age, education, marital status, occupation, return to work), infant background (gender, gestation, birthweight, birth mode), breastfeeding and formula use and timing of introduction to complementary foods. In addition, mothers gave information regarding their experience of introducing solid foods: age of infant, mode of feeding (spoon vs. finger food) and first food choice. An open-ended question asked mothers to state the primary reason why they chose to introduce solid foods. This format was used in place of tick box options as it would enable mothers to give a wider range of reasons driven by their own experiences, rather than the option that best fitted.

Participants had the choice to complete the questionnaire either via a paper copy distributed through local mother and baby groups or via an online survey link whereby data were collected through an online questionnaire hosted by Survey Monkey Inc. (Palo Alto, California, USA). Both the paper and online version of the questionnaire contained information

and consent section and debrief information. Details of how to contact the researcher for further information were included.

Data collection

Data were collected from January 2011 to June 2011. For the face-to-face groups, permission was initially sought from the group leader who distributed the questionnaire to the mothers. Responses were returned to the leader in a sealed envelope. For the online version of the questionnaire, permission was sought from the host of various online parenting groups (e.g. <http://www.mumsnet.com>; <http://www.bounty.com>). Details of the questionnaire were then posted online with a link to the online version of the questionnaire.

Data analysis

For the open-ended question examining reasons for introduction of complementary foods, responses were coded into specific reasons for introduction e.g. hunger, need for something other than breast/formula milk, to promote sleep. These specific reasons were then grouped into larger themes e.g. 'Behaviour' which included reasons such as promoting sleep and to settle the infant (See Table 1). Coding was conducted by one researcher (AB) and confirmed by a second (HR). Agreement was found initially in over 90% of cases with a final consensus on all items.

Data were analysed using IBM SPSS Statistics for Windows, Version 19.0. (Armonk, NY): IBM Corp. Age of introduction to solid foods was initially split into three categories based on UK recommendations: very early (16 weeks or earlier), early (17–25 weeks) and at the recommended stage (26 weeks and over). However, to allow for the DoH guidelines that introduction should be at 'around six months', a further category of 'just before' was introduced to cover infants 24–25 weeks to explore whether these mothers differed significantly in choice to those waiting until 26 weeks or weaning at closer to 4 months. It is also recognised that these categories were chosen based on the current UK guidance but that the 'early' category may reflect a normal introduction period for those in

Table 1. Reasons for introducing solid foods grouped by theme

Theme	Reason	<i>n</i>	%	Example
1. Wanted to eat	Interest in food	66	8.7	She was showing interest in our food.
	Grabbed food/self-fed	30	4.0	He was trying to grab my food.
	Cried when saw food	21	2.7	He was crying every time we ate.
2. Hunger	Hunger	64	8.5	Hungry, draining bottles
	Not enough milk	19	2.5	I didn't have enough milk to satisfy him.
3. Behaviour	Encourage sleep	65	8.6	Baby started waking through the night when previously had been sleeping through. Thought it was the right time.
4. Weight	Make more settled	12	1.6	General grumpiness and wouldn't nap
	Lost weight/low weight	39	5.2	Her weight was slowing down and she had dropped some centiles.
	Big baby/too big	23	3.1	She fed too much so I wanted to slow her down a bit.
	Certain weight reached	11	1.5	He had doubled his birthweight.
5. Medical reasons	Health professional	43	5.2	Was told by health visitor (HV) that baby needed solids
	Medical reasons	22	3.1	I was advised due to babies' reflux
6. Developmental readiness	Signs of readiness	57	7.5	He could sit independently, had the palmer grasp and seemed interested.
7. Convenience	Return to work	16	2.1	Wanted baby to be established on solids before starting nursery
	Less hassle	18	2.4	Solids are less hassle than making up bottles.
	Routine	21	2.7	He was feeding all the time, I wanted to bring some structure to the day.
8. Guidelines	Recommended guidelines	55	7.3	Government advice, he showed no interest before
9. Pressure from others	Pressure from others	50	6.6	My mother was getting more and more insistent.
10. Needed more	Needed new tastes	16	2.1	To get him used to the tastes and textures of food
	Needed more nutrients	33	4.4	I felt like she needed more than milk.
11. Physical development	Teeth	11	1.5	She had two teeth so could chew
	Physically advanced	12	1.6	He reached all his other milestones before other babies so I decided he would need solids sooner too.
	Putting things in mouth	17	2.5	He was able to pick up toys and put them to his mouth.
12. Fun	Fun	16	2.1	My friend had weaned and it looked fun. Her daughter was really enjoying.
	Bored of milk	10	1.3	I got bored with exclusively breastfeeding, fancied starting purees.
	Excitement	9	1.1	I was excited about weaning and giving her new things.
Total participants		756	100	

other countries and findings should be interpreted within context for other countries. However, participants were all UK-based women exposed to the current guideline of 'around six months'.

Mothers were categorised into primiparous or multiparous, married/cohabiting or not and their occupation as professional/managerial, skilled or unskilled as per NSEC (2005).

Statistical analysis

Descriptive statistics were used to explore frequency of reasons for introducing solid foods. All participants had a reason code for introducing solid foods. They were then subcoded into yes/no for each theme e.g. if they reported a behaviour-based reason, they were

coded yes for this theme and no for all remaining themes. This allowed inferential statistical analysis on the reason data.

Chi square was used to explore association between introduction reason (yes/no) and timing of solid foods (very early, early, just before, recommended), infant breast/formula feeding at birth, 2 and 6 weeks (breastfeeding yes/no), infant gender (male/female), maternal current return to work (yes/no), maternal occupation, parity, marital status and birth mode. *T*-tests were used to explore differences in maternal age, years in education and infant birthweight between those who stated a reason or not.

A logistic regression analysis was then performed to explore the significant predictors (infant/maternal

characteristics) for each reason for introducing solid foods. A separate logistic regression model using the enter method was performed for each introduction reason. Analyses report Wald statistic, odds ratio and 95% confidence intervals.

Results

Seven hundred eighty-nine mothers fully completed the questionnaire. Twenty-seven mothers gave more than one reason for introducing solid foods. The decision was made to discard these respondents from the analysis. A further six mothers gave reasons for introducing solid foods which did not fit with any theme or did not appear clear, despite themes being broad and inclusive of many specific reasons (see coding of reasons in the succeeding text). For example, one respondent simply stated 'Christmas' and another noted that they left the infants milk bottle at home so they gave solid food. It was also decided to exclude these respondents from the analysis leaving 756 in the analysis. Mean age of the respondents was 29.01 (SD: 5.33; range 18–45) with a mean number of 13.82 (SD: 3.09) years in education. Five hundred thirty-eight (71.2%) were primiparous and 218 (28.8%) were multiparous. Further demographic details can be found in Table 2.

Table 2. Sample distribution by maternal demographic factors

Indicator	Group	<i>n</i>	%
Age in years	≤19	28	3.7
	20–24	107	14.2
	25–29	271	41.1
	30–34	211	45.8
	35≥	97	11.1
Education	School	132	17.4
	College	189	25.0
	Higher	314	41.5
	Postgraduate	121	16.0
Marital Status	Married	524	69.3
	Cohabiting	199	26.3
	Single	30	3.9
Maternal occupation	Professional/managerial	319	45.1
	Skilled	264	37.3
	Unskilled	73	10.3
	No occupation	52	7.3
Total participants		756	100

Mean recall time from age of weaning (in weeks) to current infant age (in weeks) was 15.18 weeks (SD: 8.85; range 2 to 36 weeks). No significant difference or association in recall time was seen for any reason nor timing for introducing solid foods. Similarly, no difference in any measure was found between women recruited online or via face-to-face groups.

Timing of introduction to solid foods

Mothers reported age of introducing solid foods in weeks. Mean age of weaning was 19.6 weeks (SD: 5.172) with a range from 6 to 32 weeks. Two hundred twenty-five (29.8%) mothers were categorised as introducing solid foods to their infant very early, 273 (36.1%) early, 110 (14.6%) just before 6 months and 148 (19.6%) at 6 months or later.

Reasons for introducing solid foods

Twenty-six reasons were identified which were grouped into 12 themes. The three most popular reasons for introducing solid foods were the infant appearing to want to eat solid foods, infant hunger and to try and change infant behaviour. Alongside infant weight, these most popular four reasons accounted for almost half of decisions to introduce solid foods (Table 3). A total of 14.8% of mothers chose to introduce solid foods based on the DoH guidelines or because of the signs of developmental readiness for solid foods discussed in the guidelines. Associations between timing of introduction to solid foods, maternal characteristics, infant characteristics, breast/formula feeding and reason for introducing solid foods were then explored.

Timing of introduction to solid foods

The association between introduction groups (very early, early, just before, recommended) and reason for introducing solid foods was then explored using chi square (Table 4). Two patterns of timing groups appeared: those who introduced solid foods very early or early tended to be similar in their reasons. Mothers in these groups were more likely to introduce solid foods for reasons of hunger, infant weight and behaviour.

Table 3. Mean age at introduction of solids (in weeks) and difference in age of introduction to solid foods (in weeks) between those who chose to wean for that reason or not

Rank	Theme	<i>n</i>	%	Mean age at weaning (weeks)	Significance
1	Wanted to eat	117	15.5	19.87 (5.22)	<i>t</i> (754) = 0.695, <i>P</i> = 0.487
2	Hunger	83	11.0	15.96 (3.08)	<i>t</i> (754) = -6.931, <i>P</i> < 0.001
3	Behaviour	77	10.2	19.31 (3.97)	<i>t</i> (754) = -0.455, <i>P</i> = 0.649
4	Weight	73	9.7	18.87 (4.88)	<i>t</i> (754) = -1.198, <i>P</i> = 0.231
5	Medical	65	8.6	19.23 (5.50)	<i>t</i> (754) = -0.546, <i>P</i> = 0.585
6	Developmental readiness	57	7.5	23.91 (2.05)	<i>t</i> (754) = 6.791, <i>P</i> < 0.001
7	Convenience	55	7.3	20.32 (5.74)	<i>t</i> (754) = 1.133, <i>P</i> = 0.257
8	Guidelines	55	7.3	24.69 (1.01)	<i>t</i> (754) = 7.973, <i>P</i> = 0.002
9	Pressure from others	50	6.6	17.32 (4.68)	<i>t</i> (754) = -3.197, <i>P</i> = 0.001
10	Needed more	49	6.5	17.41 (5.52)	<i>t</i> (754) = -3.036, <i>P</i> = 0.002
11	Physical development	40	5.3	18.57 (5.35)	<i>t</i> (754) = -1.246, <i>P</i> = 0.213
12	Fun	35	4.6	20.74 (6.40)	<i>t</i> (754) = 1.379, <i>P</i> = 0.168
Total participants		756	100		

Likewise, those who introduced solid foods just before or at the recommended time reported similar reasons to each other. Developmental readiness, following the guidelines and wanting to eat were highest in these groups. Overall, little difference was seen in reason for introducing solid foods between those who did so just before or at the recommended time, apart from those who introduced solid foods at the recommended time were more likely to do so because of pressure from others and less likely to do so because of behaviour.

Notably, introducing solid foods because the infant wanted to eat, for physical development, pressure from others was associated with either very early or recommended stage of introduction.

Maternal characteristics

Mothers who chose to introduce solid foods for reasons of fun [*t* (754) = -2.291, *P* = 0.022], hunger [*t* (754) = -2.752, *P* = 0.006] or pressure to eat [*t* (754) = -2.029, *P* = 0.043] were significantly younger than those who did not. Conversely, those who introduced solid foods according to the guidelines [*t* (754) = 3.144, *P* = 0.002], developmental readiness [*t* (754) = -3.752, *P* < 0.001] or behaviour [*t* (754) = 2.934, *P* = 0.003] were significantly older.

Mothers who introduced solid foods for reasons of fun [*t* (754) = -2.686, *P* = 0.007], hunger [*t* (754) = -2.772, *P* = 0.006], [*t* (754) = 2.462, *P* = 0.014], pressure to eat [*t* (754) = -3.026, *P* = 0.003], because the infant wanted to eat [*t* (754) = 2.522, *P* = 0.012] and convenience [*t* (754) = -4.598, *P* < 0.001] had significantly fewer years in education. Conversely, those who introduced solid foods because of the guidelines [*t* (754) = 2.522, *P* = 0.012] or developmental readiness [*t* (754) = 4.086, *P* < 0.001] had significantly more years of education.

Further associations were seen for parity, occupation and marital status. First-time mothers were significantly more likely to introduce solid foods because of hunger, need for more nutrients, wanted to eat or pressure from others and less likely to do so because of the guidelines or developmental readiness compared with multiparous mothers. Mothers in non-skilled occupations were more likely to introduce for reasons of hunger or pressure from others while professional and skilled mothers introduced for developmental readiness or following the guidelines. Finally, mothers married/cohabiting were significantly more likely to introduce for developmental readiness and less for hunger or weight compared with mothers who were single. No significant associations were seen between reasons for introduction and birth mode or return to work (Table 5).

Table 4. Association between infant factors and primary reason for introducing solid foods (chi square); showing the split of the percentage of sample who stated each reason for each infant factor ($n = 756$). Bold areas represent significant associations

Theme	Gender		Milk birth		Milk 2 weeks		Milk 6 weeks		Milk 6 months		Age at weaning				
	Male	Female	Breast	Formula	Breast	Formula	Breast	Formula	Breast	Formula	≤16	17-23	24-25	≥26	
Wanted to eat	%	14.6	16.5	16.2	14.8	18.1	14.4	17.0	14.4	18.4	12.3	16.4	16.1	1.8	23.0
	P	X = 0.52, P = 0.266													
	%	14.1	7.5	9.7	21.0	9.6	14.4	9.4	12.8	9.3	13.7	13.8	18.3	0	1.4
Hunger	P	X = 8.22, P = 0.003**													
	%	7.3	13.4	10.5	8.6	11.8	P	9.4	9.7	13.0	5.8	15.1	8.4	18.2	0
	P	X = 7.72, P = 0.004**													
Behaviour	%	12.8	6.1	10.8	3.7	11.1	6.0	10.8	9.0	11.2	7.2	10.2	12.5	9.1	4.1
	P	X = 9.61, P = 0.001**													
	%	7.3	10.1	8.5	12.3	7.6	11.2	7.4	9.7	6.9	11.3	8.0	8.8	10.0	8.1
Medical	P	X = 1.83, P = 0.110													
	%	8.3	6.7	7.7	7.4	9.1	3.7	9.4	4.7	9.7	4.1	4.4	0	12.2	24.5
	P	X = 0.49, P = 0.246													
Developmental readiness	%	4.5	10.3	6.3	6.2	5.9	10.7	6.5	9.0	5.8	9.6	5.3	7.3	3.6	12.8
	P	X = 9.44, P = 0.002**													
	%	7.5	7.0	7.5	7.4	7.6	6.5	9.3	4.6	7.6	6.5	0	0.4	12.8	13.8
Convenient	P	X = 0.08, P = 0.440													
	%	7.5	5.6	6.3	8.6	6.7	6.5	2.4	10.0	6.3	7.2	14.2	2.9	0	6.8
	P	X = 1.16, P = 0.176													
Guidelines	%	6.0	7.0	6.9	3.7	6.5	6.5	6.9	6.0	6.0	7.2	5.8	9.2	0	7.4
	P	X = 0.28, P = 0.350													
	%	6.0	4.5	5.4	4.9	5.5	4.7	4.9	5.6	5.4	5.1	8.4	3.7	0.9	6.8
Pressure	P	X = 0.96, P = 0.214													
	%	4.0	5.3	4.3	1.2	4.3	5.6	2.8	6.3	4.8	4.4	2.7	8.1	0	4.7
	P	X = 0.70, P = 0.252													
Needed more	%	6.0	4.5	5.4	4.9	5.5	4.7	4.9	5.6	5.4	5.1	8.4	3.7	0.9	6.8
	P	X = 0.96, P = 0.214													
	%	4.0	5.3	4.3	1.2	4.3	5.6	2.8	6.3	4.8	4.4	2.7	8.1	0	4.7
Physical	P	X = 0.70, P = 0.252													
	%	6.0	4.5	5.4	4.9	5.5	4.7	4.9	5.6	5.4	5.1	8.4	3.7	0.9	6.8
	P	X = 0.96, P = 0.214													
Fun	%	4.0	5.3	4.3	1.2	4.3	5.6	2.8	6.3	4.8	4.4	2.7	8.1	0	4.7
	P	X = 0.70, P = 0.252													
	%	6.0	4.5	5.4	4.9	5.5	4.7	4.9	5.6	5.4	5.1	8.4	3.7	0.9	6.8
Developmental readiness	P	X = 0.96, P = 0.214													
	%	4.0	5.3	4.3	1.2	4.3	5.6	2.8	6.3	4.8	4.4	2.7	8.1	0	4.7
	P	X = 0.70, P = 0.252													
Convenient	%	6.0	4.5	5.4	4.9	5.5	4.7	4.9	5.6	5.4	5.1	8.4	3.7	0.9	6.8
	P	X = 0.96, P = 0.214													
	%	4.0	5.3	4.3	1.2	4.3	5.6	2.8	6.3	4.8	4.4	2.7	8.1	0	4.7
Guidelines	P	X = 0.70, P = 0.252													
	%	6.0	4.5	5.4	4.9	5.5	4.7	4.9	5.6	5.4	5.1	8.4	3.7	0.9	6.8
	P	X = 0.96, P = 0.214													
Pressure	%	4.0	5.3	4.3	1.2	4.3	5.6	2.8	6.3	4.8	4.4	2.7	8.1	0	4.7
	P	X = 0.70, P = 0.252													
	%	6.0	4.5	5.4	4.9	5.5	4.7	4.9	5.6	5.4	5.1	8.4	3.7	0.9	6.8
Needed more	P	X = 0.96, P = 0.214													
	%	4.0	5.3	4.3	1.2	4.3	5.6	2.8	6.3	4.8	4.4	2.7	8.1	0	4.7
	P	X = 0.70, P = 0.252													
Physical	%	6.0	4.5	5.4	4.9	5.5	4.7	4.9	5.6	5.4	5.1	8.4	3.7	0.9	6.8
	P	X = 0.96, P = 0.214													
	%	4.0	5.3	4.3	1.2	4.3	5.6	2.8	6.3	4.8	4.4	2.7	8.1	0	4.7
Fun	P	X = 0.70, P = 0.252													
	%	6.0	4.5	5.4	4.9	5.5	4.7	4.9	5.6	5.4	5.1	8.4	3.7	0.9	6.8
	P	X = 0.96, P = 0.214													

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

Table 5. Association between maternal factors and primary reason for introducing solid foods (chi square); showing the split of the percentage of sample who stated each reason for each maternal factor (*n* = 756). Bold areas represent significant associations

Theme	Relationship		Occupation		Parity		Return work		Birth			
	Couple	Single	Professional	Skilled	Non-professional	Primiparous	Multiparous	Yes	No	Vaginal	Section	
Wanted to eat	%	13.9	26.7	15.4	14.8	19.2	17.5	10.6	14.7	16.8	15.8	15.4
	P	X = 3.04, P = 0.033*		X = 0.862, P = 0.650			X = 5.682, P = 0.010*		X = 1.36, P = 0.146		X = 0.4, P = 0.507	
Hunger	%	8.8	16.2	9.4	9.5	19.2	9.5	14.7	10.9	11.6	11.2	10.3
	P	X = 1.01, P = 0.228		X = 6.545, P = 0.019*			X = 4.291, P = 0.028*		X = 0.083, P = 0.432		X = 0.12, P = 0.424	
Behaviour	%	10.7	8.7	8.5	10.2	12.3	9.7	11.5	10.0	10.1	10.4	9.7
	P	X = 1.573, P = 0.174		X = 1.22, P = 0.543			X = 0.551, P = 0.268		X = 0.01, P = 0.526		X = 0.06, P = 0.468	
Weight	%	8.6	10.0	4.2	4.7	4.0	10.0	8.7	9.4	10.1	10.4	8.0
	P	X = 3.04, P = 0.034*		X = 0.05, P = 0.997			X = 0.311, P = 0.342		X = 0.07, P = 0.438		X = 0.84, P = 0.223	
Medical	%	10.1	7.9	8.8	9.8	6.8	8.7	8.3	9.6	6.1	9.1	6.9
	P	X = 0.074, P = 0.488		X = 0.66, P = 0.717			X = 0.045, P = 0.479		X = 2.38, P = 0.082		X = 0.87, P = 0.220	
Developmental readiness	%	8.6	3.3	10.5	8.7	2.1	4.9	9.2	7.6	7.5	6.8	9.1
	P	X = 3.76, P = 0.015*		X = 3.25, P = 0.023*			X = 3.174, P = 0.035		X = 0.00, P = 0.564		X = 1.04, P = 0.195	
Convenient	%	7.3	6.7	8.2	6.4	9.6	6.3	9.6	7.2	7.1	6.8	7.4
	P	X = 3.04, P = 0.623		X = 1.05, P = 0.591			X = 2.52, P = 0.078		X = 0.07, P = 0.540		X = 0.07, P = 0.451	
Guidelines	%	8.4	4.8	7.5	7.2	1.4	6.1	10.1	7.2	7.6	7.5	5.7
	P	X = 0.33, P = 0.377		X = 3.04, P = 0.031*			X = 3.603, P = 0.043*		X = 0.02, P = 0.494		X = 0.68, P = 0.261	
Pressure	%	6.5	7.0	1.8	2.4	9.7	9.1	0.5	7.1	5.5	5.8	9.7
	P	X = 0.55, P = 0.394		X = 2.51, P = 0.015*			X = 18.79, P < 0.001**		X = 1.54, P = 0.140		X = 3.29, P = 0.055	
Needed more	%	7.1	5.2	3.0	2.9	1.5	5.4	9.2	6.5	6.6	6.3	7.4
	P	X = 3.04, P = 0.075		X = 0.92, P = 0.629			X = 3.665, P = 0.043*		X = 0.01, P = 0.549		X = 0.27, P = 0.356	
Physical	%	5.3	6.7	4.4	6.4	5.5	5.4	5.0	5.6	4.5	5.3	5.7
	P	X = 0.11, P = 0.482		X = 1.20, P = 0.547			X = 0.037, P = 0.504		X = 0.31, P = 0.357		X = 0.054, P = 0.472	
Fun	%	5.0	3.9	5.6	3.4	5.5	5.4	2.8	4.2	6.1	4.6	4.7
	P	X = 0.287, P = 0.412		X = 1.70, P = 0.427			X = 2.44, P = 0.081		X = 1.17, P = 0.186		X = 0.02, P = 0.567	

P* = < 0.05.*P* = < 0.001.

Infant characteristics

Birthweight was significantly associated with introduction reasons. Mothers who chose to introduce solid foods because of infant weight [$t(754) = 5.578$, $P < 0.001$] or hunger [$t(754) = 2.404$, $P = 0.016$] had a significantly heavier infant at birth than those who did not while those who introduced solid foods because of convenience [$t(754) = -4.395$, $P = 0.000$] had a significantly lighter infant. Significant associations were also found between reasons for introducing solid foods and infant gender (Table 4). Male infants were significantly more likely to be introduced to solid foods for reasons of hunger and weight and less likely for behaviour or convenience than female infants.

Breast/formula feeding was also associated with introduction reason. At birth, 650 (88.9%) infants were breastfed and 81 (11.1%) were formula fed. Mothers who formula fed were more likely to introduce solid foods because of hunger but less likely to do so for weight compared with mothers who breastfed. At 2, 6 and 26 weeks, those who were giving any breast milk at all were more likely to report introducing solid foods based on developmental readiness, behaviour, hunger and weight but less likely for convenience compared with those who formula fed. Additionally, breastfeeding at 6 weeks was associated with introduction for medical reasons, and at 6 and 12 weeks, introduction was associated with the infant wanting to eat or with the guidelines compared with those who formula fed.

Predictive characteristics for reasons given for introducing solid foods

Given a number of infant and maternal characteristics were significantly associated with each reason for introducing solid foods, a series of logistical regression analyses were performed. Taking each reason as the dependent variable, each characteristic significantly associated with that reason was entered into a linear regression model using the enter method. The characteristics that remained predictive (and their significance) are shown in Table 6 alongside the models' significance.

Younger maternal age, education and parity were reflected in social reasons e.g. convenience, pressure

from others and fun. Notably, breastfeeding (particularly at 6 weeks) remained a predictor of introducing solid foods for reasons related to wanting to eat, hunger, weight and behaviour alongside developmental readiness and convenience. Meanwhile male infant gender continued to predict introducing solid foods for weight and hunger while female infant gender predicted solid introduction to modify behaviour.

Discussion

This study explored the factors driving decisions to introduce solid foods and the maternal and infant characteristics associated with these. The findings showed that mothers introduce solid foods to their child for a wide range of reasons, many of which do not follow current public health advice. Namely infants were predominantly introduced to solid foods for beliefs that the infant wanted to eat solid foods, that the infant was hungry, to try and change infant behaviour and for concerns regarding infant weight, which reflects previous literature (e.g. Alder *et al.* 2004; Tarrant *et al.* 2010; Clayton *et al.* 2013). Moreover, it illustrated that particular reasons for introducing solid foods are associated with maternal background (e.g. age, education) and infant factors (e.g. weight, gender and breast/formula feeding), supporting and extending previous work (e.g. Moore *et al.* 2012a,b). The findings have important implications for those supporting new mothers, to understand the factors that drive decisions at this time.

Current DoH guidelines recommend introducing solid foods at around 6 months of age, looking for signs of developmental readiness for food. Developmental readiness and government advice accounted for only 14.8% of reasons for introduction (with developmental readiness associated with introducing solid foods at the recommended time). Instead, solid foods were introduced based on infant behaviour or pressure from others. A common belief was that solid foods would settle challenging infant hunger and behaviour with around one-fifth of mothers choosing this reason. This is problematic for two reasons. Firstly, perceptions of difficult infant behaviour often represent developmentally normal infant behaviour. Frequent, irregular feeding, waking during the night

Table 6. Logistic regression analysis for predictors of primary reason for introduction to solid foods (reason = dependent variable, $n = 756$)

Weaning reason	Predictive factors	Wald	df	<i>P</i>	OR	95% CI	Cox and Snell R^2
Wanted to eat	Education	6.68	1	0.010	1.12	1.06, 1.30	0.047
	BF 6 weeks	4.17	1	0.048	2.23	1.01, 4.96	
	Marital status	3.79	1	0.049	2.36	0.92, 0.99	
Hunger	Gender	7.33	1	0.007	0.43	0.26, 0.75	0.069
	BF 6 weeks	10.97	1	0.001	0.592	0.94, 3.86	
	Birthweight	6.71	1	0.042	0.85	0.75, 0.96	
Behaviour	Primiparous	3.48	1	0.008	1.52	0.95, 2.54	0.092
	Gender	7.93	1	0.005	2.21	1.14, 3.52	
	Maternal age	4.033	1	0.000	0.380	0.240, 0.600	
Weight	BF 6 weeks	9.88	1	0.002	0.625	1.12, 3.12	0.068
	Birthweight	22.75	1	0.000	3.228	1.99, 5.22	
	BF 6 weeks	3.12	1	0.045	1.32	0.54, 0.96	
Medical	Gender	8.553	1	0.004	1.78	0.11, 0.84	0.016
	Age	4.743	1	0.029	1.05	1.01, 1.11	
	BF 2 weeks	17.18	1	0.000	0.380	240, 0.600	
Developmental readiness	BF 6 weeks	5.432	1	0.023	1.43	0.69, 0.98	0.064
	Maternal age	4.768	1	0.029	1.07	1.47, 3.23	
	BF 6 weeks	15.73	1	0.000	2.52	1.07, 1.59	
Convenience	Birthweight	13.375	1	0.000	0.406	0.251, 0.658	0.051
	Education	4.220	1	0.040	2.006	1.03, 3.90	
	Gender	6.316	1	0.012	2.15	1.5, 10.39	
Guidelines	BF 26 weeks	6.314	1	0.012	3.07	1.4, 2.69	0.057
	Education	14.938	1	0.000	2.612	1.61, 4.30	
	BF 6 weeks	4.395	1	0.036	1.667	1.03, 2.68	
Pressure	Age	6.024	1	0.014	0.538	0.328, 0.883	0.074
	Parity	8.881	1	0.003	0.048	0.006, 0.352	
	Age	4.652	1	0.031	0.931	0.873, 0.994	
Needed more	Birthweight	12.185	1	0.000	2.23	1.42, 3.15	0.021
	BF 6 weeks	4.475	1	0.034	0.645	0.42, 0.97	
	Age	7.007	1	0.008	1.65	1.03, 2.44	
Physical	Education	3.839	1	0.049	2.02	1.00, 4.12	0.018
	Age	5.514	1	0.019	1.098	1.02, 1.19	
	Primiparous	4.501	1	0.034	0.251	0.070, 0.90	

BF, breastfeeding; CI, confidence interval; df, degree of freedom; OR, odds ratio.

and infant crying are appropriate behaviours of infants (Ball 2003; Horne *et al.* 2004; Gartner *et al.* 2005; Kurth *et al.* 2006). However, these behaviours are often perceived as abnormal and that a 'good' or well-parented infant should be more settled (Hardyment 2007; Lansky 2012). Hunger is often central to this, with a belief that the infant is 'unsettled' because they are hungry and need more than breast/formula milk (Heinig *et al.* 2006; Jacknowitz *et al.* 2007). Solid foods, particularly before sleep periods, are perceived as a way to meet infant hunger and/or settle infant behaviour (Alder *et al.* 2004; Crocetti *et al.* 2004; Tarrant *et al.* 2010; Clayton *et al.* 2013). This ties in with considerable social pressure that depicts a settled infant as 'good' and an indicator

of 'good' parenting (Liamputtong & Westall 2011; Lansky 2012).

However, solid food has not been shown to increase sleep or settle an infant (Crocetti *et al.* 2004; Nevarez *et al.* 2010) but may lead to overfeeding and a breakdown in the infant's ability to control intake (Ventura & Birch 2008). Infants who are introduced to solid foods early are more likely to be overweight (Seach *et al.* 2010), pressuring infants to consume more which is later associated with child overweight and lower satiety responsiveness (Brown & Lee 2013). Moreover, introducing solid foods for these reasons was associated with an early or very early timing of introduction. Thus reacting to developmentally normal behaviour by increasing energy intake

might affect infant weight and other health issues (particularly before 4 months of age; Wilson *et al.* 1998; Kramer & Kakuma 2004; Wright *et al.* 2004), with no impact upon current sleep and behaviour.

Timing of introduction to solid foods

A notable pattern emerged for introduction reason and timing of first solid food. Mothers who introduced solid foods very early or early reported a band of reasons surrounding hunger, weight and behaviour compared with those who introduced solid foods just before or at 6 months who were following developmental readiness and the guidelines were more common. This reflects previous research exploring reason and timing (e.g. Wright *et al.* 2004; Tarrant *et al.* 2010; McAndrew *et al.* 2012; Moore *et al.* 2012a). However, pressure from others emerged as a reason for both very early and recommended introduction suggesting two different kinds of pressure; very early perhaps because of misinformation from family and friends and at the recommended stage as it may appear late in contrast to historical timing and compared with current peers because of typical earlier introduction.

These findings are of interest as they show very little difference in introduction reason for mothers choosing to introduce solid foods just before or at 6 months, suggesting similar drivers in these two groups. Notably, following developmental readiness was higher in the just before group compared with the at 6 months group, adding weight to the finding that infants may be developmentally ready for solid foods within an age window rather than on a specific date (as per the majority of other infant development indicators e.g. walking). Overall, four main drivers for introducing solid foods emerged in the regression analyses: maternal background, infant weight, infant gender and breastfeeding.

Maternal background

Mothers who were younger, less educated, not married, in non-professional jobs and first-time mothers were particularly likely to introduce solid foods for reasons such as convenience, fun or pressure

from others. Conversely, older, more educated, professional mothers were more likely to introduce solid foods based on the guidelines or infant signs of readiness reflecting previous research (Arden 2010; Brown & Lee 2011b; Brown *et al.* 2011a; Moore *et al.* 2012b). Younger mothers are more likely to listen to the advice of family and friends when it comes to infant care (Brown *et al.* 2011a; Moore *et al.* 2012a). Recommended timing of introduction to solid foods has changed; when these mothers were themselves infants, it was likely that recommendations were earlier at around 12 weeks (Moore *et al.* 2012b). Following grandparent's advice is associated with increased pressure to wean (Moore *et al.* 2012a), at an earlier age (Moore *et al.* 2012b), especially if the infant is showing perceived signs of hunger (Wright *et al.* 2004).

Older mothers were more likely to introduce solid foods to modify infant behaviour. Older mothers may find it more difficult to adapt to lifestyle changes a new baby brings (Hewlett 2002). They are more likely to perceive their infant as difficult or unsettled (Ventura & Stevenson 1986) and want their infant to be 'independent' (Arnott & Brown 2013). This may drive introduction of solid foods, believing it will modify infant behaviour.

Infant weight

A higher birthweight infant was more likely to be introduced to solid foods for hunger or weight. Larger infants are often believed to need solid foods earlier (Huh *et al.* 2011). However, while larger infants need more calories, breast/formula milk contains more energy than many weaning foods and infant weight alone does not signify need for solid foods (Moore *et al.* 2012a). Higher birthweight infants can start to slow down in their growth patterns faster than lower birthweight babies, as the infant settles into their natural weight trajectory (Batista *et al.* 2012). Larger infants may also demand more frequent feeds which may be interpreted as hunger so solid foods are introduced to settle the infant (Sachs *et al.* 2006). However, if breastfeeding is established, the majority of mothers will be able produce sufficient milk for the infant (Huggins 2000) and the DoH guidance

is to offer increased breast/formula feeds on demand (Department of Health 2013). This may be misconstrued as a sign of not receiving enough breast/formula milk so solid foods are introduced.

Infant gender

Male infants were more likely to be weaned because of hunger and needing food. Male infants do consume more breast/formula milk (da Costa *et al.* 2010), feed more frequently (Powe *et al.* 2010) and wake more in the night (Richardson *et al.* 2010a), which can be perceived as hunger (da Costa *et al.* 2010). Again, these are normal infant behaviours with additional breast/formula milk able to provide more calories but often interpreted as needing more than milk. Consequently, male infants are more likely to be weaned earlier (Schrempft *et al.* 2013). Conversely, female infants were more likely to be introduced to solid foods in an attempt to settle behaviour. Gender stereotyped expectations of behaviour in older children are common; parents have higher expectations of disciplined behaviour in girls (Fagot 1978). In infancy, despite female infants sleeping more and crying less (Richardson *et al.* 2010b), mothers view female infants' behaviour as more manipulative and needing their behaviour shaped (Arnott & Brown 2013). Introducing solid foods may be viewed as a way to do this.

Breast/formula feeding

Mothers who breastfed were more likely to cite following signs of developmental readiness or following the guidelines as found in previous research (e.g. Brown & Lee 2011a; Brown & Lee 2013). However, breastfed infants were also notably more likely to be introduced to solid foods for a cluster of reasons based on weight, hunger, sleep or unsettled behaviour. Breastfed infants are often perceived as not gaining enough weight with worries about milk consumption (Thulier & Mercer 2009). Breastfed infants naturally consume less milk (Dollberg *et al.* 2001), feed more frequently and irregularly than formula fed infants (Casiday *et al.* 2004) and gain weight more slowly (Dewey *et al.* 1995) than formula fed infants. They are more likely to wake during the night for longer dura-

tions (Galbally *et al.* 2013). However, this can be interpreted as a lack of intake and slow weight gain, so solid foods are introduced (Wambach & Cohen 2009).

Implications for practice

The findings have important implications for those supporting mothers to introduce solid foods. More education is needed on recognising the true signs of infant hunger and the importance of increased breast/formula milk not solid foods (particularly for breastfeeding mothers) alongside how frequent feeding and night waking are normal infant behaviours. Greater emphasis also needs to be placed on how solid foods are unlikely to improve infant sleep or make the infant more settled. Moreover, the potential implications of using food to modify behaviour upon infant weight and appetite control are important. Recognising how younger, less educated mothers may be more prone to following these misconceptions, particularly when fuelled by family and friends, may help direct advice and support while considering older mothers increased likelihood of trying to settle infant behaviour through solid foods is significant.

Knowledge and understanding of the concept of developmental readiness requires a specific consideration. Guidelines surrounding this concept need to be clear so that spurious signs of readiness are not used. Notably, in this sample some mothers stated that they followed developmental readiness signs to introduce solid foods before their infant was 4 months of age. At this age, an infant will rarely be developmentally ready for solid foods (Bentley *et al.* 2004). It is likely that 'wanting food' or being physically ready denotes maternal misinterpretation of signs of hunger or spurious physical developmental signs such as teeth or simply interest in parental behaviour. This is a critical consideration when promoting following signs of developmental readiness because of the possibility of misinterpretation, particularly because of the rise in mothers following baby-led weaning (Brown & Lee 2011a).

Further consideration also needs to be given as to how new mothers can be supported to delay solid foods until closer to 6 months (or certainly not before 4 months), and for reasons of developmental readi-

ness, rather than for psychosocial reasons. The results clearly show that foods are introduced to alleviate sole responsibility of feeding, to modify behaviour or to attempt to counteract frequent demands for feeding e.g. for non-nutritious reasons. Introduction is often at an earlier stage than the current DoH guidance even though typically knowledge of guidelines is high among mothers (Moore *et al.* 2012b; Renfrew *et al.* 2012). Although much debate surrounds whether 'around twenty-six weeks' is the most appropriate time to introduce solid foods, most agree that introducing solid foods before 4 months is detrimental to infant health (Agostoni *et al.* 2008; Schwartz *et al.* 2011). Moving away from age, introduction of solid foods should be responsive to infant hunger rather than used to manipulate behaviour (WHO & UNICEF 2003). Although education is important, recognition of the challenges of infant care and support for new mothers should also be paramount. Nutritional knowledge is not the sole driver of behaviour and this must be recognised and the challenges acknowledged with new mothers; if a breastfeeding mother is faced with a frequently feeding infant, solid foods may appear to be the solution to her exhaustion, if only because someone else can feed the infant. Greater consideration needs to be given as to how we can support new mothers to avoid at least very early introduction of solid foods by encouraging family and friends to support the mother in ways other than feeding the infant or by enabling her to rest. Wider family education for grandparents as to how guidelines have changed over the years might enable mothers to delay solid feeding for longer.

The research does have its limitations. Participants were self-selecting. Mothers were older, more educated with a higher percentage of professional occupations than average (ONS 2011). The proportion of mothers who delayed solid foods until 6 months postpartum was higher than the UK average, as were levels of breastfeeding (McAndrew *et al.* 2012) suggesting that mothers more interested in infant feeding practices may have taken part. Convenience sampling was also used, meaning there is no way of estimating potential sample size and completion rate, although this is a common approach in health research. Moreover, data on ethnic background of participants were

not collected. Although, a range of demographic groups were included, care should be taken in generalising to a wider population.

The study also uses a retrospective design asking women to recall practices. This may have led to bias or inaccuracy in recall (Pieters *et al.* 2006) although the recall time frame was relatively short. However, many studies in infant feeding research use a retrospective design with similar recall lengths (e.g. Arden 2010; Brown & Lee 2013; Moore *et al.* 2012b) with other diet-related studies using recall of a much greater length (e.g. Dube *et al.* 2001; Brunstrom *et al.* 2005; Kollins *et al.* 2005).

During data collection, the mother was also asked to give the primary reason why she introduced solid foods. It is recognised that decision to introduce solid foods can be complex e.g. introducing solid foods because the baby seemed hungry, unsettled and was not gaining weight. However, asking mothers to identify the primary reason allowed exploration of maternal and infant characteristics associated with this reason to be examined. Clustering the 26 reasons that emerged into 12 themes also allowed similar reasons to be compared together. However, the limitations and simplification of this approach are recognised. Future research should perhaps consider how these factors interact and care should be given to generalisation; the findings are indicative of patterns, and a starter point for discussion, but not necessarily the wider picture.

Recruitment used online data collection. Although this method is now popular in health research (e.g. Alcalde 2011; Ferguson & Hansen 2012; Hamilton *et al.* 2012), it may lead to a bias towards older, more educated women, proactive participants (Drentea & Moren-Cross 2005). However, pregnant and new mothers are a well-known user group of internet forums (Plantin & Danebeck 2009). Use tends to be inclusive of demographic groups (Sarkadi & Bremberg 2005) and allows cost-effective access to a targeted sample (Koo & Skinner 2005). No significant differences were seen for any measure for those who participated online or via paper copy.

Despite these limitations, the data show that maternal and infant factors appear to be linked to reasons for introducing solid foods. Notably, misinterpretation

of normal infant behaviour such as waking in the night or wanting frequent, irregular feeds was perceived as a need for solid foods. Solid feeding was essentially being used not for nutritive reasons, but to try and modify infant sleep and behaviour, which may have negative outcomes for child weight. These views were particularly prevalent among mothers who were younger or had lower levels of education and linked to using formula milk. Wider maternal factors such as age and parity and infant factors such as weight and gender also appeared to drive choices, highlighting how broader social factors may influence decisions surrounding introduction of solid foods. The findings are important for those working with new mothers to consider how information and support can be targeted and common misconceptions changed.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions

AB was responsible for study design, data collection, data analysis and manuscript drafts. HR was responsible for data analysis and manuscript drafts.

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