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Original Article

Conflicting influences on UK mothers' decisions to introduce solid foods to their infants

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Abstract

Adherence to recommendations to wait until 6 months to introduce solid foods into infants' diets is very poor. An in-depth understanding of the factors involved in this decision is essential if health practitioners are to offer suitable advice and health education. A cross-sectional electronic questionnaire study was conducted with 105 mothers recruited via UK-based Internet parenting discussion forums. Ratings of variables important in making the decision to introduce solid foods were analyzed using factor analysis and multiple regression. Open-ended questions were analyzed qualitatively using content analysis. In this sample of educated women, later weaning was found to be associated with a focus on the importance of the recommendations and a perception that health visitor advice and support was poor. Earlier weaning was associated with a focus on the importance of putative weaning signs from the baby. Qualitative analysis revealed a number of conflicting influences on the decision about when to give solid foods: recommendations, guidelines and advice, signs from the baby, beliefs about solids and maternal considerations. The conflict that some mothers experience in deciding when to give their babies solid food between the rigid recommendations, more tailored guidance from health professionals and their perceptions of putative weaning signs from their infants poses a particular problem for those attempting to provide clear and helpful health education information. Future research must assess the extent to which this conflict is prevalent in the general population, and investigate the salience and utility of different health education messages to promote good infant health.

Keywords: WHO, infant-feeding decisions, complementary feeding, health promotion, weaning.

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Introduction

The World Health Organization (WHO) recommends that '. . . infants should be exclusively breastfed for the first six months of life . . . Thereafter . . . infants should receive . . . complementary foods while breastfeeding continues for up to 2 years of age or beyond' (World Health Organization 2002, p. 7). This recommendation was adopted by the UK Department of Health in 2003 (UK Department of Health 2003). Prior to this, mothers were recommended to introduce solids to their infants between 4 and 6 months of age, but very few mothers in the UK heeded this advice. In 2000, 85% of UK mothers introduced solid foods before 4 months of age (Hamlyn *et al.* 2002). By 2005 the proportion of babies fed solid foods by 4 months of age had dramatically reduced to 51%, although 98% of babies had been given solid foods by 6 months of age (Bolling *et al.* 2007). Thus, although the situation is improving, there is very little adherence to the revised recommendations.

Introducing solid foods to infants before 4 months of age is associated with a range of negative health outcomes. These include features characteristic of cardiovascular risk such as increased body fat and body mass index (Wilson *et al.* 1998), and wheezy respiratory illness in childhood (Wilson *et al.* 1998). There has also been concern raised over the

relationship between the solid food introduction before 4 months and the development of eczema (Tarini *et al.* 2006) and childhood allergies (Chandra 2000), although more recently this relationship has been challenged (Zutavern *et al.* 2008). The evidence for there being any detrimental effect of introducing solids after 4 months is equivocal. Indeed, there may be some benefits to earlier weaning. Northstone *et al.* (2001) reported that infants introduced to lumpy solids at earlier ages (before 6 months) consumed a greater variety of family foods and were less fussy eaters at 15 months than those introduced at later ages (after 10 months). The WHO recommendation was based on a consideration of the adequacy of exclusive breastfeeding for 6 months in developed and developing countries (see Kramer & Kakuma 2002) rather than any detrimental effects of introducing solid foods between 4 and 6 months (see Lanigan *et al.* 2001), particularly for developed countries where the risk of gastrointestinal illness is low (Foote & Marriott 2003). This has led to a debate in the literature about the utility of the rigid WHO 6-month recommendation vs. a 4–6-month (but not before 4 months) guideline that allows for adjustment according to individual differences (Foote & Marriott 2003; Fewtrell *et al.* 2007).

Understanding the predictive factors and reasons that women give regarding their decision about when to start feeding their baby solid foods is important if we are to promote good infant health. Savage *et al.* (1998) found that, in a representative Glasgow sample (in which solid food was introduced at a median age of 11 weeks), a majority of mothers (74%, $n = 73$) reported a belief that their baby required more food as a reason for introducing solids. Mothers who had received formal advice (usually from their health visitor) tended to wean later. Anderson *et al.* (2001) conducted focus groups with mainly first-time mothers. Most of these mothers had or were planning to introduce solids earlier than the then guidelines of 4 months (mean age at introduction = 11.6 weeks) despite being aware of them. These mothers reported that the introduction of solids was led by apparent signs of hunger from the baby or by physical characteristics of the baby (e.g. size of the baby). Alder *et al.* (2004) conducted a Scottish study and compared the characteristics of those who had weaned early (≤12 weeks) with those that had delayed weaning until after 12 weeks. Weaning early was found to be associated with a range of factors: the opinions of the infant's maternal grandmother, living in a deprived area, lack of encouragement from friends to wait, being in receipt of free samples of manufactured food and disagreement with the recommendation to wait until 4 months. This would seem to be at odds with other studies; however, answers to open-ended questions indicated that the early introduction of solids was influenced by maternal perceptions of the infant's food needs (Alder *et al.* 2004), and this may have been a major factor in the reason for the disagreement to wait until 4 months. Wright *et al.* (2004) found that the perceived needs of the baby were a more important influence on the decision to wean than external advice. This was supported by the observation that rapid weight gain up to the age of weaning was a strong predictor of early weaning. These studies indicate that signs from the baby are a key factor that mothers use to decide when to give their infants solid

Key messages

- Mothers experience a conflict between the perceived importance of the recommendation to delay the introduction of solid foods to infants until 6 months of age and the perceived importance of signs from the baby that they are ready for solid foods at an earlier age.
- In this sample of educated mothers, introducing solid foods later was associated with a belief that health visitor advice was poorer. Qualitative data suggested that health visitors may not be consistently giving advice to delay the introduction of solid foods until 6 months.
- The conflict between health recommendations and putative indicators of weaning need poses particular problems for health professionals wanting to deliver health messages to promote the health of the infant, especially where researchers have questioned the validity of a rigid 6-month recommendation.

food and that formal guidance may play a role in delaying solid food introduction. However, it is less clear how these influences may affect mothers' decisions now that the recommendation has changed to 6 months. Bolling *et al.* (2007) investigated the influences on the age of weaning in a UK sample in 2005 and reported that early weaners (prior to 3 months) based their decision on a belief that their baby was no longer satisfied with milk feeds, while later weaners (5 months+) were more likely to base their decision on health professional advice. Synnott *et al.* (2007) found in a cross-European study that parents did not strictly adhere to infant-feeding recommendations when introducing solid foods and that many parents made confident decisions about when to introduce solid foods based on signs from the baby. Given the importance of this decision for infant health, these factors need to be considered in more depth.

Given the findings in many studies that health professional advice is key in mothers' decisions to delaying the introduction of solid foods, it is perhaps surprising to discover that health professionals are not always aware of the correct recommendations. Recent surveys reported that 47.5% of UK general practitioners and paediatricians (Wallace & Kosmala-Anderson 2006) and 30.3% of UK midwives and health visitors (Wallace & Kosmala-Anderson 2007) believed that the current recommendation for the introduction of solid foods was 3 or 4 months. There is also evidence from other fields that health professionals' adherence to treatment guidelines is only modest (e.g. Frankel *et al.* 1999; Ardery *et al.* 2007). Interpreting the effects of health professional advice on mothers' decisions to wean is therefore complex. For example, while Bolling *et al.* (2007) found that health professional advice was related to later weaning, it is not possible to ascertain whether the advice given by health professionals was consistent with the current 6-month recommendation.

In summary, given the very low rates of adherence to the advice to delay weaning until 6 months, an in-depth analysis of the factors involved in this decision is essential. For some women these factors may include a lack of awareness of the health recommendations, but where the recommendations are known, it is also necessary to understand the reasons for the choice to wean early (Scientific Advisory Committee on Nutrition 2008). This study extends previous research by examining the factors after the change in the recommendations to delay the introduction of solid foods until 6 months of age. This understanding is essential if mothers are to receive suitable advice and health education (Scientific Advisory Committee on Nutrition 2008).

Materials and methods

The study utilized an electronic questionnaire survey to collect quantitative and qualitative data using a cross-sectional design. The questionnaire was specifically developed for this study. Questions were informed by previous research findings indicating the likely reasons that mothers might identify as being relevant for their decision to give solid foods to their baby (Savage *et al.* 1998; Anderson *et al.* 2001; Alder *et al.* 2004).

The questionnaire was an electronic form (Word 2003) that utilized checkboxes, drop-down lists and text boxes to enable electronic completion. The questionnaire was piloted with female university staff members with young children/babies to check for face validity. Feedback was also requested on question structure and the ease of electronic completion. Minor amendments were made in response to feedback. The questionnaire had three sections: general information, milk feeding and solid food feeding.

The general information questions asked about participants' age, marital status, education, ethnicity and parity. Questions were asked about the age, gender, birthweight and prematurity of participants' children.

Participants were asked about milk feeding their last-born child. They were asked whether they had breastfed or formula fed their child for the first 6 months, and if they had breastfed, had they done so exclusively, or mixed breast and formula feeds.

Participants were asked about feeding their last-born child,[1] specifically, about the age at which their child was first given solid food. Solid food was defined

[1]In cases where their last-born child was younger than 26 weeks, they were asked about their next youngest child.

as any food other than milk. Participants were then asked to '*Please rate how important the following factors were in making your decision to introduce solid foods to your baby*' on a seven-point Likert scale (not at all important–extremely important).[2] The 23 variables are listed in, or beneath, Table 1. Four additional questions asked about participants' experience of health visitor interaction – support: '*My health visitor supported my decision to introduce solid foods to my baby*'; advice: '*How would you rate the quality of advice that health visitors gave you about introducing solids?*'; approval: '*My health visitor disapproved of my decision to introduce solid foods*'; and confidence: '*How confident did you feel in your health visitors advice?*' Each was rated on a seven-point Likert scale. Open-ended questions asked '*Please describe any other factors that were important to you in deciding to introduce solid foods to your baby*', '*What advice would you give a new mother about when to feed solid foods to their baby?*' and 'D*o you have any other comments about infant feeding and weaning?*' Text boxes allowed participants unlimited space to write their answers.

Open-ended question responses were analyzed qualitatively using partially directed[3] content analysis (Hsieh & Shannon 2005) in which the responses were read, coded and compared, and extracts were then grouped according to content to form categories, the relationships between which were mapped and themes were extracted. Throughout this process the text was read and reread to ensure that the themes truly represented what the participants had written. Extracts from the text are included to illustrate the themes. This analysis provided a good overview of the kinds of influences on mothers' decisions to introduce solid foods. Likely influences were also measured quantitatively in 27 items on the questionnaire. In order to identify categories of influence, a factor analysis was first conducted. These factors were then entered into a multiple regression to see if they were predictive of the age at which solid foods were introduced. Additional variables that were found to be of relevance in the qualitative analysis but which were not included in the final factor solution were also entered into the regression in a second step.

A convenience sample of mothers was recruited via advertisements asking for participants to complete a questionnaire study on 'the factors which influence Mother's decisions about how to feed milk to their babies, and when and how they decide to wean their children (give them any food other than milk)' which were placed on 10 UK Internet parenting discussion forums in the latter half of 2006. Two hundred forty-two participants responded to the advertisement and were emailed further information and a copy of the electronic questionnaire. One hundred forty participants returned the questionnaire (57.9% response rate: this is slightly above average for questionnaire research; Baruch 1999). Five questionnaires were excluded from the analysis because of being unreadable (incompatible file format). The inclusion criterion for this analysis was that participants had at least one child who was 6 months of age or older at June 2003,[4] i.e. at least one child of the recommended weaning age following the 2003 change to those guidelines. One hundred five women met this criterion.

The project was approved by the University Research Ethics Committee. Particular attention was paid in the procedure to the maintenance of confidentiality. Participants who responded to the advertisement were emailed an information sheet about the study and the electronic questionnaire. They were assured that they would not receive unsolicited email and that their email address would not be passed to third parties. At no point during the questionnaire were personal details about the participants requested. Participants were asked to email the completed questionnaire as an attachment to an email

[2]Participants were given the option to state 'not applicable'. For example, where they did not have previous children from which to gain previous experience. These responses were given a score of 0.

[3]In so far as the responses were 'directed' by the three specific questions asked and it was not possible to probe participants about their responses as would occur in conventional content analysis.

[4]The changes to the Department of Health's recommendations were made on 12 May 2003 (Department of Health pers. comm.).

(full instructions about how to do this were given). Upon receipt, participants were emailed for a second time with a message of thanks and some debriefing information. Unless participants requested otherwise, all emails were deleted once attachments had been retrieved. No records of email addresses was kept. From this point onwards, the data were effectively anonymous.

Results

Demographics

The sample had a very high level of education compared with Office for National Statistics (2008b) (http://www.statistics.gov.uk) (10.5% to age 16 years, 18.1% to age 18 years, 51.4% to degree, 15.2% to masters, 3.8% to higher degree). The sample participants were predominantly White (96.2%), and all were married or cohabiting. The mean number of children of each participant was 2.02 (SD = 1.22, range 1–9). The participants were on average 32.3 years old (SD = 4.51, range = 22–45 years) at the time of questionnaire completion, 28.2 years (SD = 4.72, range = 17–38 years) at the birth of their first child and 30.9 years (SD = 4.48, range = 21–44 years) at the birth of their latest child.

The last child who was at least 26 weeks of age (i.e. the children about whom participants answered questions) was on average 80 weeks old (SD = 38 weeks, range 26–155 weeks). Sixty-one of the children were boys and 44 were girls. Their mean birthweight was 3.40 kg (SD = 0.61 kg).

The sample had very high rates of breastfeeding compared with the UK figures (Bolling *et al.* 2007). A total of 36.7% exclusively breastfed for 26 weeks (compared with <1% for the UK in 2005; Bolling *et al.* 2007) while 88.4% breastfed non-exclusively for at least 26 weeks (compared with 25% for the UK in 2005; Bolling *et al.* 2007), and although there was a great deal of variation, the mean age at which breastfeeding ceased was 45.20 weeks (SD = 36.35 weeks, range 0–146 weeks).

The mean age at which participants first gave their baby solid food was 23.07 weeks (SD = 4.73 weeks, range 13–34.7 weeks). A total of 82.5% of participants responded correctly that the official recommendation about when you should start to give solid foods is 6 months or 26 weeks. Fifty-nine per cent of participants reported introducing solids before 26 weeks, 26.7% introduced solids at 26 weeks and 14.5% introduced solid foods after 26 weeks.

Qualitative content analysis

A single overarching theme from the analysis of the text was 'conflicting cues'. Mothers wrote about the huge variety of cues that they received from which they had to make a difficult decision about when to wean their baby:

> Listen to all the advice with an open mind – you'll get an enormous amount of years experience – and then follow what you think is best for your baby. (Participant 88)

Four sub-themes were identified from the analysis. These were: 'recommendations, guidelines and advice', 'signs from the baby', 'beliefs about solids' and 'maternal considerations'.

Recommendations, guidance and advice

The official recommendations were identified by many of the participants as being a cue to weaning although there was no universal agreement that the recommendations were appropriate or correct. Some mothers suggested that it takes effort to wait until 6 months often because of other more salient cues:

> Follow the WHO guidelines; babies don't need solids before 6 months. . . . (Participant 38)

> From personal experience I would say that waiting for 6 months to introduce solid foods is ridiculous. I knew that my daughters needed something more substantial. (Participant 119)

The ambiguity of different sources of guidelines and the confusion that this caused was commented on by many of the participants. The sources of ambiguous guidelines or health advice noted included books, web sites and food labels.

. . . Also labels on baby food still say from 4–6 months so this is also inconsistent. All in all very confusing – even if you are trying to do the right thing – it's not clear what that is. (Participant 34)

It would be nice if all the advice in books and websites was properly updated to the recommendation of waiting till 6 months. So many seem to have been simply altered to read 'between 4 and 6 months' so it's hard to find advice about actually starting at 6 months. (Participant 27)

Mothers aren't being given the correct advice about weaning at all. I know a lot from getting advice from forums on the internet, but a lot just don't know. (Participant 130)

Many of the participants were critical of health visitor advice, especially where they perceived that it deviated from the official recommendations. This criticism seemed to remain even where potentially valid reasons for the deviation from the recommendations (e.g. poor weight gain relative to growth charts) were identified by participants.

Health visitors advice bore no relation to WHO guidance. She was advising me to introduce solids at 16 weeks to help with night sleeping. (Participant 34)

Health visitors very rarely stick to the advice given. In my experience, whenever a baby is seen to be falling on the weight charts the health visitor follows this up with telling the mother to introduce solids, even if it is way before the baby is old enough. This can do more harm than good. All a baby needs in the first 6 months is breast milk. (Participant 130)

One or two mothers reported receiving guidance from health professionals about specific conditions in which deviation from the official recommendations was seen as more legitimate. In these cases the health professional was a paediatrician, suggesting that the type of health professional was important in determining the legitimacy of advice that deviated from the recommendations.

E had severe gastric reflux and after an admission to hospital we were advised by the paediatrician to start early weaning. (Participant 7)

Advice was also commonly received from friends and family although this was usually framed as being negative and out of date. There was also a sense that this kind of advice was received but not sought after:

. . . please IGNORE stuff like 'well, you were weaned at 3 weeks on mince and tatties and you're all right' from your own mother/aunties/other. (Participant 62)

Personally I feel that things should be done upon medical recommendation etc, I hate seeing my friends forcefeeding 4 months old babies just because that's what their mum's say they did – what the right thing to do in the 1970's is not the right thing to do now!!!!! (Participant 115)

Peer pressure to wean early was also commonly identified as a factor. This seems to reflect some kind of competition about advanced development of the child.

It seems to be a competition among new mums who can get their baby onto solids the quickest..I was way behind the rest of the mums I knew waiting til 17 weeks! (Participant 99)

Don't mistake early growth spurts for the need for solid food. Don't feel the urge to compete with other mothers who wean early. (Participant 113)

Signs from the baby

Signs that the baby was ready for solid foods were very commonly reported. These included hunger, milk no longer satisfying (going for less time between feeds or drinking more milk), waking more often, weight (low weight or slowed weight gain), increased interest in food, agitation, lack of tongue thrust response and stealing food.

The only factor was baby's hunger, when his milk feeds became 2 hours apart rather than 4 hours it was clear he needed more. (Participant 106)

S has always been a big eater and at 15 weeks she seemed more than ready for food, i had been holding off for 2 or 3 weeks but as she was trying to grab my food and screaming through my meals we decided to try baby rice. (Participant 85)

If he/she is waking more, showing an interest in food and needing feeds closer together, he may be ready for solids. (Participant 25)

Some mothers rejected commonly accepted signs of a need to wean. Other mothers, particularly those

who followed baby-led weaning,[5] accepted a different set of signs than mothers engaging in more traditional forms of weaning.

There is often a four month growth spurt where they need to feed more often but this shouldn't be confused with readiness for solids. (Participant 79)

It was important to me that my child only started to eat solid food when she was truly ready. I ignored the commonly believed readiness signs (which I know are not the real readiness signs) and waited for her to help herself to solids, which she did at 6.5 months. She still didn't eat more than a mouthful a day until she was 10.5 months. (Participant 24)

Reading about BLW and signs of baby really being ready for solids – sitting up, no tongue thrust, able to pick up and eat finger foods. (Participant 120)

The focus on the signs from the baby was closely aligned to an understanding of the potential role for individual differences in infants' readiness to wean. Individual differences mentioned included size or weight of the baby and differences in hunger. There was a sense that mothers used individual differences to justify their decision as a good one.

Try and be guided by when your baby seems ready. Guidelines are just guidelines and every baby is different. Just because 6 months is OK for one baby, don't feel bad if you introduce solids earlier or later. Your baby knows best! (Participant 37)

. . . I imagine that if you plotted readiness for weaning on a chart that showed number of children (y) against age (x), you would probably get a bellcurve. Now given that WHO has decreed that 6 months is the golden age when *all* children are ready for weaning (indeed, we are told to get them going as quickly as possible after this age), they must have picked a point well to the right of that bell curve. If this is the case, then most babies sit to the left of that point i.e are ready for weaning before 6 months. Certainly from talking to other Mums on the internet etc, this appears to be the case. (Participant 86)

[5]Baby-led weaning or BLW (Rapley 2004, 2005) is an approach to offering infants food in which small items of solid 'finger' food are made available to the infant but are not fed to him/her. Selection, manipulation and ingestion of the food are under the infant's control.

Beliefs about solid food

Mothers reported a wide range of positive and negative beliefs about solid food and the effects of solid food. Often these were framed in relation to milk feeding, particularly with regard to the conflict between breast milk, formula milk and solid foods, and the relative benefits of each for the baby.

My son was hungry all the time, beyond what could be attributed to a growth spurt. I tried to contact my HV and spoke to a colleague of hers who said that I mustn't give solids and that if my baby was hungry, I should give him formula. I didn't want to do that as I believed that he was still better off being breast-fed, so I chose to give him solids and breast milk. (Participant 86)

Also some believe solids will help a baby gain weight better, another myth seeing milk is calorifically and nutritionally supervisor. (Participant 129)

Some mothers wrote about their beliefs about the links between age at weaning and the later development of eczema, asthma and other allergies, and their concern that their choice to wean early caused these problems. Some mothers mentioned specific types of foods that were suitable or not suitable to give to babies at certain ages.

I would advise mothers to try and wait as long as possible as my son was weaned at 15 weeks and now suffers from food allergies and bad eczema, which I believe may have been worsened due to early weaning. (Participant 102)

Wait till 6 months, it isn't worth fiddling around with fruit purees, baby rice etc. (Participant 57)

Others focused on the perceived effects that different weaning practices have on later eating habits. This was particularly in relation to the types and ranges of foods that are offered to the child and the time at which they were offered:

Finger foods are also a lot more convenient and more interesting for baby. Holding and manipulating fingerfoods is also beneficial developmentally for baby. Most babies who are

weaned early (therefore needing to be fed mush) are not offered finger foods until much later in the first year. (Participant 24)

. . . you can tell when they are ready, try letting them feel the food, they will get used to eating a wide range if you let them explore early on. (Participant 91)

Maternal considerations

Mothers reported a number of external considerations that they had in deciding when and how to give solids to their baby. Some considerations were practical in nature, particularly with reference to mothers returning to work:

My baby wouldn't take expressed milk and having returned to work I was anxious that she was getting hungry in my absence so I reluctantly started her on solids so my husband had a way to feed her! (Participant 99)

My son was at nursery full-time and had expressed breast milk. Unfortunately, he started to refuse EBM completely and would not take formula. I introduced solids and he had breastfeeds outside nursery hours. (Participant 113)

Many of the mothers conceived of the decision to wean (or not to) and the weaning process itself as difficult and stressful.

I think to say NOT before four months . . . but then between 4–6 months is fair. To 'strain' a new Mum by saying NOT before six months is horrendous . . . my son would have been screaming for two months! (Participant 29)

Follow your baby's hunger! My first son thrived on my milk, he actually turned away from solids because I introduced them too early. He was 13 months before he began to eat solids well. (Participant 80)

One of the most common considerations mentioned was maternal instincts or some specialist abstract knowledge that only a mother could have. It is not clear from the text whether this is about proximity to the baby and being able to read the 'signs' more easily or a true instinct, i.e. a decision not requiring thought (Collins English Dictionary, http://www.collinslanguage.com)

Follow your own instincts, try and hold off as long as possible, but remember all baby's are different and have different needs. Follow these. (Participant 89)

To start when you feel ready each baby is different and you will know when your child is ready. (Participant 45)
I strongly believe that not enough emphasis is given to maternal instincts and yet every mother I know acts on this regardless of how old their children are. (Participant 88)

Some mothers reported feeling regret or guilt about their weaning decisions, particularly with regard to the perceived deleterious effects of 'early' weaning on previous children and their intentions to make different decisions with a later child.

I weaned my first child early on the advice of my GP and HV and he has gut problems and reactions to certain foods, I didn't want the same thing to happen to my other children. (Participant 24)

Health workers should stress the dangers of weaning early etc as most mothers I know have weaned early. At no point was I told of the dangers of weaning early and I feel that my son has suffered thanks to this. (Participant 102)

Try and be guided by when your baby seems ready. Guidelines are just guidelines and every baby is different. Just because 6 months is OK for one baby, don't feel bad if you introduce solids earlier or later. Your baby knows best! (Participant 37)

Predicting age that solid foods were introduced

Identification of factors

A factor analysis was conducted on the 23 reasons for deciding when to introduce solid foods and the four items assessing previous health visitor interactions. Initially, the data were screened for outliers. This revealed that four items ('receiving free baby food samples', 'cost', 'labels on baby food' and 'returning to work') showed extremely positively skewed data, with between 59 and 86% of participants rating this as 'not at all important'. These variables were therefore removed from subsequent analysis. The data were then assessed with regard to their suitability for factor analysis: the Kaiser–Meyer–Olkin measure of sampling adequacy was

0.66 (above the recommended value of 0.6) and Bartlett's test of sphericity was significant [χ^2 (253) = 807.72, $P < 0.001$]. The diagonals of the anti-image correlation matrix were greater than 0.5 for a majority of the items supporting the inclusion of these items in the factor analysis, except for 'baby reaching a developmental milestone' (0.38), 'baby appearing interested in food' (0.45), 'personal experience from feeding previous children' (0.45) and 'other people being able to feed the baby' (0.48), which were therefore excluded from further analysis. During several steps, four items were eliminated because they did not meet the criterion of having a communality value of above 0.5: 'support from my partner (or other close family member)' (0.47), 'GP advice' (0.30), 'baby teething/having teeth' (0.24) and 'my health visitor disapproved of my decision to introduce solid foods' (0.44). The factor analysis was therefore run on the remaining 15 variables.

Principal components analysis with varimax rotation produced five factors with eigenvalues greater than 1 (3.73, 2.47, 1.61, 1.40 and 1.14, respectively). Together, these explained 69.0% of the variation in scores (24.86, 16.46, 10.75, 9.36 and 5.20, respectively). Five-, four- and three-factor solutions were examined. The four-factor solution was preferred because although the scree plot did not clearly show a 'levelling off' of eigenvalues, there were significant cross-loadings and difficulty in interpreting the five- and three-factor models.

Factors one to four seemed to form coherent categories that were consistent with the qualitative findings. Factor one included three items about health visitor interaction alongside 'health visitor advice' from the reasons for deciding to introduce solids. This factor was therefore named *health visitor advice*. Factor two included the WHO advice and advice from books, television and the Internet. This factor was named *WHO recommendations*. Factor three included baby's weight, baby's hunger and advice from family. This factor was therefore named *signs from baby*. The fourth factor included mother's tiredness, and reducing and omitting night feeds, and was therefore labelled *tiredness*.

A total of four items were eliminated because they did not contribute to a simple factor structure. 'Food allergies/asthma/eczema' loaded on both WHO recommendations (0.509) and tiredness (–0.430). 'Baby's health' loaded on both WHO recommendations (0.403) and signs from baby (0.637). 'Advice from friends with children' loaded both on WHO recommendations (0.402) and tiredness (0.464). 'Convenience' did not meet the minimum criterion for communality in the four-factor solution (0.297) and was therefore removed.

A principal components factor analysis of the remaining 11 items using varimax rotation revealed that the four factors explained 71% of the variance. All items had primary loadings over 0.4. Where items had cross-loadings above 0.3, these items had strong primary loadings that met Bedford's (1997) criteria of a 0.2 difference between the primary loading and the cross-loading. Internal consistency for each of the factors was examined using Cronbach's alpha. These varied from being very good to just below normally accepted criteria: 0.85 for health visitor advice (four items), 0.69 for WHO guidance (two items), 0.59 for signs from baby (three items) and 0.55 for tiredness (two items).

The factor loading matrix for this final solution is presented in Table 1.

There are clear similarities between the factors and the qualitative themes. Health visitor advice and WHO recommendations reflect different sources of information from the 'recommendations, guidelines and advice' theme. Signs from baby was fairly consistent with the 'signs from the baby' theme although it also included family advice which from the qualitative analysis was found to be predominantly about out of date (earlier) weaning practices. Tiredness did not come out as a theme within the qualitative analysis although the relationship between the introduction of solid foods and baby being able to sleep through the night was alluded to in some of the comments.

Regression analysis

Multiple regression[6] was used to predict the age at which infants were first given solid food (in weeks)

[6]Bivariate scattergrams of the predictor variables with the criterion variable did not indicate curvilinear patterns.

Table 1. Factor loadings based on principal components analysis for reasons for deciding to introduce solids and health visitor interaction

	Health visitor advice	WHO recommendations	Signs from baby	Tiredness
How would you rate the quality of advice that health visitors gave you about introducing solids?	**0.909**	–0.086	–0.054	0.099
How confident do you feel in your health visitor's advice?	**0.867**	–0.146	0.138	0.166
My health visitor supported my decision to introduce solid foods.	**0.736**	0.012	0.077	0.074
Importance of health visitor advice	**0.733**	0.142	0.394	–0.067
Importance of advice from books/television/Internet	–0.003	**0.872**	–0.050	0.095
Importance of WHO advice	–0.098	**0.775**	–0.107	–0.257
Importance of baby's weight	0.111	–0.062	**0.798**	0.034
Importance of baby's hunger	0.013	–0.379	**0.742**	0.030
Importance of advice from family members	0.303	0.369	**0.592**	0.172
Importance of mother's tiredness	0.027	0.105	0.001	**0.870**
Importance of reducing/omitting night feeds	0.214	–0.302	0.149	**0.741**

WHO, World Health Organization. Note: The following variables were excluded from the final factor solution: my health visitor disapproved of my decision to introduce solids; the importance of: receiving free baby food samples, cost, labels on baby food, returning to work, baby reaching a developmental milestone, baby appearing interested in food, personal experience from feeding previous children, other people being able to feed the baby, support from my partner (or other close family member), general practitioner advice, baby teething/having teeth, food allergies/asthma/eczema, baby's health, advice from friends with children and convenience. **Boldface** values indicate items which load onto which factor.

Table 2. Multiple regression analysis predicting age at which solid foods were first introduced (weeks) from four factor scores

Factor	Unstandardized coefficients		Standardized coefficients
	B	Standard error	Beta
(Constant)	23.04	0.35	
Health visitor advice	–1.93	0.35	–0.41*
WHO recommendations	2.51	0.36	0.52*
Signs from baby	–0.86	0.34	–0.19**
Tiredness	–0.24	0.34	–0.05

WHO, World Health Organization; *$P < 0.001$; **$P < 0.05$. Note: Higher values on each factor indicate ratings of greater importance or more positive value.

from the four factor scores.[7] Overall, the variables predicted the age at which solid foods were first introduced, accounting for 47.0% of the variance [$R = 0.701$, $R^2 = 0.492$, adjusted $R^2 = 0.470$, $F(4, 93) = 22.48$, $P < 0.0001$]. From Table 2, WHO recommendations were positively related to age at introduction of solid food (weeks) while health visitor advice and weaning signs and advice were negatively related to age at introduction of solid food. Thus, placing importance on WHO recommendations was predictive of later introduction of solids, while ratings of health visitor advice as good and placing importance on signs from the baby were predictive of earlier introduction of solids.

During the factor analysis, a number of items were removed because they did not meet minimum criteria or did not contribute to a simple factor structure. However, they may remain important predictors of age of introduction of solids, particularly where the qualitative analysis had identified them as being of importance. Therefore, five items that had been identified as important in the qualitative analysis were added into the multiple regression described earlier

[7]The multiple regression analysis was also run with the four mean factor scores as predictors. This produced the same pattern of results.

(and in Table 2) as a second step.[8] These were: 'baby appearing interested in food', 'advice from friends with children', 'food allergies/asthma/eczema', 'support from my partner' and 'baby's health'.[9] Although the two-step model was significant and accounted for 47.2% of the variance [$F(9, 88) = 10.63$, $P < 0.001$], the change produced by adding the five additional items was not significant [R^2 change = 0.029, $F(5, 88) = 1.07$, $P = 0.38$]. Thus these variables did not significantly add to the prediction of age at which solids were introduced. The first model produced from the four factor scores (health visitor advice, WHO guidance, signs from baby and tiredness) was therefore retained.

The residuals were examined and found to be approximately normally distributed on a histogram and normal probability plot, and to show homoscedacity on partial regression plots. Values of Cook's distance ranged from 0 to 0.12.

Discussion

Both the quantitative and qualitative analyses indicated that the mothers in this sample faced a conflict in deciding when to feed their babies solid foods between the recommendations to wait until 6 months and the perceived signs from the baby that they are ready for solid foods at an earlier age. A later introduction of solid foods was associated with rating health visitor advice and support as poor.

Waiting until 6 months may require mothers to ignore some commonly accepted signs of readiness to wean. In this study a later introduction of solid foods was associated with a focus on the 6 months recommendation as important and *not* on the perceived signs from the baby regarding readiness to wean as important. This is consistent with previous research finding that an earlier introduction of solid foods was associated with a focus on signs from the baby (Anderson *et al.* 2001; Wright *et al.* 2004; Bolling *et al.* 2007; Synnott *et al.* 2007).

Given the importance placed by some mothers on perceived readiness to wean signs from the baby, it is perhaps surprising that there appeared to be no consensus about which signs from the baby are 'true' signs of readiness for weaning. If mothers and/or health professionals are to be guided by signs from the baby, then the identification of reliable signs is essential. Mothers are encouraged to be responsive to their baby's hunger needs in order to promote demand feeding as part of best breastfeeding practice (World Health Organization 1998). A continuation of this responsiveness should allow mothers to identify an infant's need for solid food. However, for many signs, it may be the timing that distinguishes whether they are signs of the need for weaning or signs of a growth spurt. For example, the UK Department of Health's (2007) current weaning leaflet advises: 'If your baby seems hungrier at any time before six months, they may be having a growth spurt, and extra breast or formula milk will be enough to meet their needs'. Thus, if the baby appears to be hungry at 4 or 5 months, then this is not a 'real' sign for a need to wean, but if the baby appears to be hungry at 6 months, then this is a 'true' sign of the need to wean. To my knowledge there has been no research that has investigated whether there are qualitative differences in infant behaviour associated with signs of hunger at 3, 4, 5 and 6 months. Future research should address this discrepancy.

In contrast with Bolling *et al.* (2007) and Synnott *et al.* (2007), in the present sample of women, a belief that health visitor advice was poorer was associated with the later introduction of solid foods. This alongside some of the qualitative comments suggest that health visitors may not be consistently giving advice to delay weaning until 6 months and that some women who do delay the introduction of solid foods may be doing so in opposition to advice from health visitors to start earlier. This may reflect a lack of awareness of the correct recommendations by health visitors, as has been found in a recent survey (Wallace & Kosmala-Anderson 2007) conflicting with an awareness of the correct recommendation in this highly educated

[8]None of the predictor variables correlated more than 0.8, thereby meeting multicollinearity criteria for a regression analysis.

[9]'Returning to work' was also identified as important in the qualitative analysis but was not included in the regression because of the extremely skewed distribution of this item.

sample, or health professionals might be aware of, and be giving advice in response to, some of the recent debates in the literature about the validity of the rigid WHO recommendation as opposed to a more flexible approach (see Foote & Marriott 2003; Fewtrell *et al.* 2007). Alternatively, health visitors could be making conscious decisions to advise earlier weaning based on a consideration of '. . . infants' individual developmental and nutritional needs, whether breastfed, mixed fed or given solely infant formula milk . . .' (Scientific Advisory Committee on Nutrition 2008, p. 25). In particular, the mothers in this study identified poor weight gain relative to UK growth charts as a reason why health professionals might advise early weaning. The utility of growth charts based on predominantly formula-fed infants has been brought into question for exclusively breastfed children (see Whitehead & Paul 1984). WHO charts that are based on exclusively breastfed infants have been recommended for introduction in the UK (Scientific Advisory Committee on Nutrition & The Royal College of Paediatrics and Child Health 2007) although these were only universally introduced in 2009 (The Royal College of Paediatrics and Child Health 2008). Given the potentially vital role that health visitors and other health professionals play in advising mothers on introducing solid foods to their infants, this study highlights the need for extensive research assessing the type and quality of this advice and its likely effects on the behaviours of different mothers.

The mothers' 'beliefs about solids' reflected some of the concerns held in the scientific community about the potential relationship between early weaning and allergies/eczema (Chandra 2000; Tarini *et al.* 2006; Zutavern *et al.* 2008). The relative merits of introducing formula or solid foods (prior to 6 months) to an exclusively breastfed infant (where a need for additional nutrition has been recognized) were also identified as an issue of concern. This has not been adequately researched (Fewtrell *et al.* 2007) and, despite a clear need, is not currently addressed in health education literature (e.g. UK Department of Health 2007, weaning leaflet).

Some of the mothers reported finding waiting until 6 months before introducing solid foods difficult, and that they felt 'guilty' or 'bad' about decisions made that they had subsequently perceived to be inappropriate for their child. They also identified individual differences in infants as being important. This reflects one of the problems of a rigid recommendation (which mothers either meet or 'fail' to meet) as opposed to more flexible guidelines. In addition, some authors have questioned whether breast milk alone is sufficient for all infants until 6 months of age (e.g. Butte *et al.* 2002; Reilly & Wells 2005), and there is very little evidence for the recommendation to delay the introduction of solid foods until 6 months for infants receiving formula (Fewtrell *et al.* 2007). Additional research is required in order to assess whether a more flexible guideline-based approach might be justified if it enabled mothers to make decisions that they were happy with while not jeopardizing the health of their child.

Baby-led weaning (Rapley 2004, 2005) and a move towards finger foods as opposed to purées for babies' first foods were commonly written about by the mothers in this study. Rapley's (2005) research was conducted with a sample of only five breastfed infants, and there has been very little subsequent research (searches for 'baby-led weaning'[10] on Medline and Web of Science resulted in 0 hits). Recently, the approach has been criticized on the grounds of a lack of current evidence (Reeves 2008). However, sources of Internet-based information about baby-led weaning are much more numerous. A search for 'baby-led weaning' on Google[11] resulted in 43 400 hits. It seems likely therefore that the choice of this sample of mothers to utilize Internet-based information sources to inform their decisions about when and how to give their infants solid foods has exposed them to a potentially biased view on the utility of the baby-led weaning approach.[12] The problem of the lack of peer review of the information available on the Internet, and the amount of information based on personal accounts rather then scientific research, has

[10]Searches performed on 7 October 2008.

[11]Search performed on http://www.google.com on 7 October 2008.

[12]As opposed to an approach in which both purées and solid finger foods are offered (Reeves 2008).

been identified as one of the major problems of the Internet as a source of health information (see Cline & Haynes 2001).

Study limitations

There are a number of limitations of the study. The sample was self-selecting from advertisements placed on UK Internet parenting forums. Consistent with surveys of Internet users in the UK (Office of National Statistics 2008a), the sample included mainly highly educated White women. They are not therefore representative of mothers in general, and consistent with other research using Internet recruitment (see Gosling *et al.* 2004), the results are not widely generalizable. Additionally, it is highly likely that the responders, who knew that the research was concerned with infant feeding and weaning, were those with particular interests in the area. Their use of the Internet also meant that they were exposed to a potentially different set of information about weaning compared with other groups (Cline & Haynes 2001). Moreover, this sample reported very high rates of breastfeeding relative to UK norms (Bolling *et al.* 2007). Previous research indicates that highly educated White women are more likely to adhere to breastfeeding recommendations (e.g. Wright *et al.* 2006). However, the fact that this sample still tended to introduce solid foods earlier than the recommendations, despite following breastfeeding guidelines, suggests that different factors affect adherence to weaning advice.

Importantly, even though this sample of highly educated women had access to a broad range of resources, they were still exposed to conflict and confusion regarding when they should commence weaning, indicating that for this health behaviour, access to resources does not equate to clarity on the appropriate action. Clearly, further research with a more representative sample is required, and while it is unlikely that the same influences will be applicable across all mothers, this study provides some key areas on which such research might focus.

The data for this study were collected in the latter half of 2006. Although official recommendations have not changed since this time, it is conceivable that other factors have changed. It is therefore important that future research examines the effect of time on mothers' decisions to introduce solid food to their infants.

The study required that participants provided information from memory about decisions that they had made previously. There is some evidence that knowledge of the outcome of decisions may affect the memory of the factors affecting that decision (see Pieters *et al.* 2006). Future research could address this by studying mothers prospectively during the process from milk feeding to solid feeding.

Conclusion

The findings of this study suggest that despite WHO recommendations, which state that solid foods should not be given to infants until 6 months of age, health advice (from health visitors) and putative weaning signs from the infant provide conflicting cues which, for the mothers in this sample, were sometimes more salient than the recommendations. This conflict between the rigid recommendations, more tailored guidance from health professionals, and mothers' perceptions of their infants' desire and readiness for solid foods poses a particular problem for those attempting to provide clear and helpful health education information. Future research must investigate this conflict in a much broader sample of mothers and seek ways in which appropriate health messages can be delivered that promote the health of the infant.

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