



Research report

Vegetables by stealth. An exploratory study investigating the introduction of vegetables in the weaning period

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ABSTRACT

Few studies have examined in detail weaning practices and how mothers introduce vegetables into the diets of their infants. The current exploratory study set out to use both qualitative and quantitative methods to investigate approaches to nutrition in the weaning period and in early infancy with a particular focus on vegetables. 75 mothers of infants aged 24–72 weeks filled out a postal questionnaire regarding infant feeding during the weaning period. Mothers completed the infant feeding questionnaire (IFQ) and a food frequency questionnaire (FFQ) to measure familial fruit and vegetable intake. Mothers introduced solid food to their infants at around 20 weeks of age and those who breast-fed their infants tended to introduce solid foods later compared to formula feeding mothers (21 wks versus 17.8 wks, $p < 0.05$). Infants were offered around 3 different types of vegetable during the first 4 weeks of weaning. 13 mothers then took part in a follow-up in-depth interview. Mothers reported that they relied upon advice from family and friends and their interpretation of cues from their infants indicating the readiness for food, rather than relying on official guidelines. Mothers demonstrated high concern about the nutrient quality of their child's diet and perceived vegetables to be an integral part of the diet. A number of strategies for promoting vegetable intake were identified by mothers, offering vegetables by stealth was one of the most commonly identified strategies.

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Introduction

A child's early experience with food has the capacity to influence their taste development and food preferences right through in to adulthood. An infant's earliest experience with a variety of tastes has been demonstrated to occur *in utero* via the flavours ingested by the mother. This chemical continuity follows through in to the post-natal period whereby flavours are passed through to the infant through breast milk (Mennella & Beauchamp, 1997; Mennella, Jagnow, & Beauchamp, 2001). However, an infant's very first experience with solid food occurs in the weaning period following the cessation of a milk only diet. The current recommendation in the UK is that the introduction of solid foods should be delayed until the infant reaches 24 weeks of age and certainly no foods should be introduced before 16 weeks (Department of Health, 2008; World Health Organisation, 2003). Mothers are also advised to breast feed their infants exclusively until they are six months of age. Despite this advice, research has demonstrated a wide disparity between officially sanctioned recommendations and what is actually practiced by mothers (Anderson et al., 2001). Weaning earlier than 6 months is very

common in the UK. Savage, Reilly, Edwards and Durnin (1998) reported two major reasons why mothers weaned their infants early; these included the perception of the child not being satisfied with just milk and because babies were not sleeping throughout the night (Alder et al., 2004; Anderson et al., 2001; Harris, 1988; Rosen, 2008; Savage et al., 1998; White, 2009). Additionally mothers report that they "know best" as revealed by Alder et al. (2004). Readiness for solid foods is related to the individual baby and might occur at different ages for different infants (Alder et al., 2004). However, there is evidence that early introduction of solid foods is linked to rapid infant weight gain (Sloan, Gildea, Stewart, Sneddon, & Iwaniec, 2008) and increased body fat during childhood (Forsyth, Ogston, Clark, Florey, & Howie, 1993; Wilson et al., 1998). Rapid infant weight gain has also been linked to increased risk of obesity in childhood and adulthood (Baird et al., 2005; Ong et al., 2006).

Despite the purported detrimental effects of early weaning on the development of overweight or obesity, early weaning may indeed have an associated benefit. The "sensitive period" hypothesis (Harris, 1993) describes how between the ages of 4 and 6 months infants are more likely to accept a wider range of different foods and that this willingness to eat a varied diet tracks into later years. Infants who are offered a wide variety of vegetables in the weaning period are more likely to accept novel foods (Maier, Chabanet, Schaal, Leathwood, & Issanchou, 2008)

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increasing their food repertoire. Nicklaus, Boggio, Chabanet, and Issanchou (2005) conducted a longitudinal study where they examined children's food preferences at age 2–3 years old and followed the participants in to early adulthood. Their results demonstrate that variety seeking at age 2–3 years predicted variety seeking until early adult life, highlighting the importance of establishing a varied food intake in early infancy.

In the UK children (Gregory and Lowe, 2000) as well as adults (Henderson, Gregory, & Swan, 2002) are not consuming the recommended five or more portions a day of fruit and vegetables (DOH, 2003). A diet rich in plant sources confers benefits to the consumer including the prevention of chronic diseases in later life (Jew, AbuMweis, & Jones, 2009). In addition to their high nutrient quality, vegetables are also low in energy density (kcal/g) and when consumed as part of the habitual diet in the recommended amounts, they might also serve to prevent the development of overweight and obesity in children. However, it is clear from many of the papers in this issue vegetables are often disliked by children (Cooke & Wardle, 2005) making them difficult to incorporate in to the diet. Liking and consumption of vegetables in infants and children is governed by a number of factors including exposure to a variety of vegetables during the weaning period and beyond (Mennella, Nicklaus, Jagolino, & Yourshaw, 2008; Sullivan & Birch, 1994) and the family/maternal diet (Jones, Steer, Rogers, & Emmett, 2010). It has been shown that repeated and frequent exposure increases liking for vegetables (see Nicklaus this issue), however, parents tend to offer tastes of vegetables far fewer than the recommended 8–10 times. In addition to repeated exposure there are also a number of techniques that can be used to attempt to promote vegetable intake in children, such as modelling of significant others (Birch & Fisher, 1998; Savage, Fisher, & Birch, 2007), making the food appeal visually (Jansen, Mulken, & Jansen, 2010; Houston-Price et al., 2009a; Houston-Price, Butler, & Shiba, 2009b) and via the classical learning paradigms of flavour-nutrient (Zeinstra, Koelen, Kok, & de Graaf, 2009) and flavour-flavour learning (Havermans & Jansen, 2007).

Overall, there is advice to wean infants at around 6 months of life, there is encouragement to consume a diet which is rich in fruits and vegetables, but vegetables are generally disliked. There may be a period early in the weaning period which presents an optimal window for exposing babies to vegetable flavours, but parents who are convinced that their child dislikes vegetables may be unwilling to persist in presenting infants with sufficient quantities and variety of vegetables to increase their liking and acceptance. How then do parents decide when to wean, what to give to their infants and what strategies do they use to encourage vegetable intake during the early development of food preferences? The present study set out to address these questions using both questionnaire and in-depth interview techniques. The main aim of the research was to explore parental feeding practices relative to official recommendations and to discover the ways by which parents encourage their children to like and to consume vegetables.

Methods

Participants

A sample of 220 families was contacted via SureStart (Hoyland, Barnsley, South Yorkshire, UK) with a postal questionnaire. SureStart children's centres are government funded and provide integrated information and services for all children under 5 and their families to ensure that each child get the best start in life. All the families contacted were identified as having an infant aged between six and eighteen months old at the time the questionnaire was sent out. A total of 75 mothers completed and returned the

Table 1

Postal questionnaire participant demographics ($n=75$, means \pm SEM).

	Mean \pm (SEM)	Range
Maternal age (years)	30.47 (0.6)	16–41
Maternal BMI (kg/m ²)	24.57 (4.2)	19.7–44.5
School leaving age (years)	18.31 (0.3)	15–26
Parity	1.67 (0.1)	1–4
Birth weight (g)	3474.6 (62.5)	1980–4564
Age of child at the time of the questionnaire (weeks)	61.47 (1.7)	32–94

Table 2

Interviewee demographics ($n=13$, means \pm SEM).

	Mean \pm (SEM)	Range
Maternal age (years)	28.5 (1.2)	20–36
Maternal BMI (kg/m ²)	24.6 (1.4)	19.2–38
School leaving age (years)	17.3 (0.5)	15–21
Parity	1.7 (0.3)	1–4
Birth weight (g)	3498.3 (161.2)	2495–4564
Age of child at the time of the questionnaire (weeks)	58.4 (4.2)	34–76

postal questionnaire (Table 1, BMI from self-reported height and weight). Following the postal questionnaire 13 parents and caregivers were then contacted to take part in a follow-up interview (Table 2). Interviewees were randomly selected from a list of those who had returned the postal questionnaire. All participants who filled out the questionnaires agreed to be contacted to take part in interviews.

Materials

Postal questionnaire

Based on current literature and a broad range of exploratory research questions, a number of open and closed questions were generated in order to investigate several aspects of weaning and early infant food intake. Participants were asked to report general demographic information including height, weight, school leaving age and parity. They were then asked a series of questions relating to their infant, who was between the ages of 6 and 18 months. Participants were asked questions about milk feeding, age of introduction of solid foods, age of introduction of specific food items and to provide examples of the types of foods given during the first month of weaning. These were then used as an indication of the number of different fruits and vegetables offered to the infant. Each different fruit or vegetable named as an example was scored and summed over the first two-week period of weaning and the first month of weaning for each infant.

Infant feeding questionnaire

The infant feeding questionnaire (Baughcum et al., 2001) is a validated tool containing 20 items about maternal feeding practices during the first year which might be related to the risk of development of childhood obesity. Each item has a 5-point scale ranging from 0 for “never”/“disagree a lot” to 5 for “always”/“agree a lot”. The IFQ measures 7 factors; (1) concerns about the infant undereating or becoming underweight, (2) concern about the infant's hunger, (3) awareness of infant's hunger and satiety cues, (4) concern about the infant overeating or becoming overweight, (5) feeding the infant on a schedule, (6) using food to calm infant's fussiness, (7) social interaction with the infant during feeding. Scores were averaged across the items for a particular factor with a minimum score of 0 and a maximum score of 4.

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