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Fussy eating and feeding difficulties in infants and toddlers consuming a cows' milk exclusion diet

Introduction

Cows' Milk Allergy (CMA) is known to affect ~3% of children in the UK (1). It is also known that parents may incorrectly perceive their child to have a food allergy (2) and that allergen avoidance diets are sometimes initiated unnecessarily (3,4). In practice this means that many children are excluding a major food group from their diet at a time in life that is critical for growth, development and establishment of eating habits. Infants with CMA who are not breastfed are prescribed hypoallergenic infant formulae, which have an altered taste. Parents are also advised that their child should follow a special weaning diet avoiding all forms of cows' milk, usually until at least one year of age, but this exclusion diet may continue for much longer.

Fussy eating and feeding difficulties are separate entities, that may co exist. Fussy eating, generally defined as "consuming a limited variety of food" is a very common problem in young children (5). Up to 20% of infants and toddlers in the UK are reported to be "problem" eaters by their parents (6) with some studies reporting up to 50% are fussy eaters (7). In healthy infants and toddlers, it is known that development of feeding skills occurs from 0-24 months with individual variation in gaining self-feeding fine motor skills (8). Feeding difficulties refers to a spectrum of problematic eating behaviours such as excessive spitting out of food, crying/irritability at feeding time, eating extremely slowly, retching at the sight of bottle or spoon, apparent difficulty in swallowing, throwing and pushing away food (Crist & Napier-Phillips, 2001; Lewinsohn et al., 2005). Feeding difficulties are known to be more common in certain medical conditions (e.g. autism spectrum disorder) (11).

In a young child with suspected or confirmed food allergy, where at least one food group is already being restricted, fussy eating and feeding difficulties are likely to have a considerable impact on eating habits and food intake. To date there has been limited research directly investigating the prevalence of these eating problems in children consuming a special diet for food allergy (12). The existing studies have

mainly recruited children with severe non-IgE mediated gastrointestinal disease and have not included a control group of children eating a normal diet (13,14). The aim of this study is to determine the prevalence of fussy eating and feeding difficulties in infants and toddlers consuming a Cows' Milk Exclusion (CME) diet compared to a control group consuming an unrestricted diet. If found to be more prevalent, intervention by a qualified dietitian will ensure timely diagnoses and appropriate advice to prevent long-term consequences of fussy eating habits.

Methods

Study design

This was a cross sectional study of 8-30 month old children from the Isle of Wight, United Kingdom. This study included two groups: an experimental group, composed of children consuming a CME diet for the treatment of presumed CMA and a control group of children consuming an unrestricted diet. Children were eligible for inclusion in the experimental group if they had consumed a hypoallergenic formula and/or a CME diet in the first year of life for a period of 3 months or longer and or if they were excluding other foods (e.g. egg or soya).

Recruitment took place between July 2013 and December 2014. Participants eligible for the experimental group were identified via routine allergy clinics. The control group was recruited from health visitor clinics in the same locality. Ethical approval was obtained from Berkshire NHS ethics committee.

Data collection

Fussy eating and feeding difficulties were measured using two separate questionnaires. Fussy eating was measured using the Picky Eater questionnaire (15). It consists of 10 items describing specific behaviours related to fussy eating with questions such as "overall to what extent does your child like a wide variety of foods from those that you think he/she should eat?" and "how often do you prepare a special food for your child because he/she does not like what the rest of the family is eating?". Feeding difficulties was measured using the Montreal Children's Hospital Feeding Difficulties questionnaire (16). It consists of 14 comprehensive questions, covering the following feeding domains: oral motor, oral sensory, appetite, maternal concerns about feeding, mealtime behaviours, maternal strategies used and family reactions to child's feeding. Information was also collected on social demographics, family history of allergy, allergic symptoms, infant feeding and growth.

Data analysis

A power calculation for a two-tailed outcome, at 80% power indicated that 124 participants were required in this study. Questionnaires were scored and coded according to published guidelines. Data was analysed using SPSS software (IBM, version 20). Descriptive statistics were calculated. Differences between the CME and control groups were compared using Mann Whitney or X^2 test. Spearmann rho correlations were performed. Multiple regression calculations were performed to determine the contributing factors to the main outcome variables. A significance level of $p < 0.05$ was set for all analyses.

Results

Description of sample

126 participants were recruited. Demographic characteristics are detailed in Table 1. Participants in the CME group were younger than those in the control group ($p = 0.02$), but the age range was the same. There were no differences in gender, number of siblings, ethnicity, maternal age/education or growth measurements between the two groups.

Infant feeding and dietary exclusion

Details of participants' infant feeding history are shown in Table 2. The majority of infants had been breastfed at some stage (81%), but only 13.5% were being breastfed at the time of data collection. Infants in the control group were commenced on solid food ($p = 0.033$), lumpy food ($p = 0.049$) and finger foods ($p = 0.000$) significantly earlier than the CME group.

71.2% of the CME group was excluding cows' milk only, whilst 28.8% were excluding another food allergen in addition to cows' milk. Cows' milk was excluded at a median age of 9.5 weeks (range 1-30). Three infants in the CME group were breastfed as their main source of milk and did not have any substitute formula. At the time of data collection, the median duration of a hypoallergenic formula use was 41.0 weeks (range 2-91 weeks). The most commonly used hypoallergenic formula was Amino Acid Formula (45.5%), followed by Extensively Hydrolysed (EH) whey formula (25.8%) and EH casein formula (16.6%).

Reported symptoms and SPT status

Participants in the CME group reported a median number of 4.0 symptoms (ranging from 1-7 symptoms). Participants whose mother had a history of food allergy had

significantly more symptoms reported (p = 0.000), with reported higher rates of vomiting (p = 0.037), abdominal pain (p = 0.000) and colic (p = 0.004) than those with no maternal history of food allergy. Twenty participants (30.3%) in the CME group had a positive SPT to cows' milk (> 3mm). Participants who had a positive SPT to cows' milk reported significantly more symptoms (p = 0.006).

Main outcome measures

Feeding difficulties

The median feeding difficulty score in the CME group (26.5, range 16-68) was significantly higher than that of the control group (22.0, range 15-53) (p < 0.01), although both groups were within the normal range (< 45). Nine participants in the CME group (13.6%) had scores diagnostic of clinical feeding difficulties (> 45), compared to only one participant in the control group (1.6%). There was no affect of gender, being older or younger than 12 months, or breastfeeding status on feeding difficulty score. Participants whose mothers had a history of food allergy symptoms recorded significantly higher scores of feeding difficulties (p = 0.03).

Within the CME group, there was no correlation between feeding difficulty score and age at introduction of hypoallergenic formula, duration or type of hypoallergenic formula consumption or SPT status. However, some symptoms were found to be significantly correlated with a higher feeding difficulty score. These are listed in Table 3. In addition, the amount of milk substitute formula consumed per day and "attention paid to healthy eating" were also found to be significantly correlated to a higher feeding difficulty score as was a younger age at time of initiating the exclusion diet. Maternal age, age of child, parental education, number of siblings, duration of breastfeeding, age of introduction of solid/lumpy food and duration of exclusion diet were not correlated with feeding difficulty score.

A standard entry multiple regression analysis was undertaken on the CME group to determine the ability of several factors to predict the level of feeding difficulties. In the final model, 41.3% of the variance in feeding difficulties could be explained (R = 0.642, SE 11.09). A history of colic made the most contribution to this model (B score = -0.459, p = 0.03). Three variables made a unique statistically significant contribution (colic, dry cough at night and other food related problems). Details are shown in Table 4.

Fussy Eating

The CME group had a significantly higher median score (22.5, range 10-63) than the control group (18.0, range 10-44) ($p < 0.01$), indicating they have higher levels of fussy eating, although both groups' median scores could be considered in the non-fussy range(15). Overall there was no difference in scores for gender, being older or younger than 12 months, maternal food allergy history or breastfeeding status. Within the CME group, there was no correlation between fussy eating score and age at introduction of hypoallergenic formula, duration of hypoallergenic formula consumption, type of hypoallergenic formula or SPT status. A positive correlation existed for volume of milk substitute consumed per day (Table 3).

Discussion

This study set out to compare level of feeding difficulties and fussy eating in two groups of young children; one group consuming a CME diet for CMA and a control group consuming an unrestricted diet. Overall we demonstrated that the CME group scored significantly higher for fussy eating and feeding difficulties, although the results for both groups were within normal ranges. Feeding difficulties were found to be significantly positively correlated with a number of allergic symptoms and both variables were found to be correlated with a higher volume of milk substitute consumed per day.

The higher scores observed on the feeding difficulty questionnaire in the CME group was statistically significant. This is the first time this has been reported in a study of infants with suspected CMA using a control group and a validated questionnaire. However it should not be overlooked that both groups had median scores well within normal levels. Indeed the number of children in the control group with feeding difficulties (1.6%) is considerably lower than that reported in previous studies of normal healthy developing children (6,9), however the methodology for those studies was different.

Studies of feeding difficulties and food allergy have typically been conducted on children with complex gastrointestinal allergies (13,14,17), or in children who also have an underlying comorbidity (18), therefore the participants are not necessarily reflective of the "typical" infant with CMA. Meyer et al. (n = 437) found that 30-40% of children with Food Protein-Induced Gastrointestinal Allergies (FPIGA) had feeding difficulties reported in their medical notes, with a higher rate in those with symptoms of abdominal pain, vomiting, bloating and constipation. Although there are differences between that study and this; there are some commonalities. They

identified a significant correlation between feeding difficulties and extra-intestinal manifestations (joint pain, lethargy, headaches). Likewise this study identified a significant correlation between non-gastrointestinal allergic symptoms (wheeze and cough) and feeding difficulty score, illustrating that childhood eating/feeding habits are influenced by a wide range of health-related factors. It is known that oral eating requires the coordination of a suck-swallow-breathe pattern and it may be that difficulties in sensory processing are related to cardiorespiratory symptoms including those present in asthma (19). Feeding difficulties are also reported in children with other respiratory conditions (20,21).

Similar to the study by Crist et al (9), feeding difficulty score was not found to be related to socioeconomic status or birth order/number of siblings. Contrary to previous studies (22,23), a link between the age of introduction of any type of solid foods and feeding difficulty score was not identified. Introduction of lumpy foods did contribute to the multiple regression model predicting higher feeding difficulty score, however only in combination with other variables. However, it must be highlighted that the reporting of age of introduction of solid food was based on parent recall, which may affect the accuracy of this data.

Overall infants in the CME group scored significantly higher on their fussy eating questionnaire than the control group. However the median score of 22.5, is still well below the maximum questionnaire score of 70, indicating that as a whole the group were not particularly fussy eaters. In a previous study of 2-3 year old children, “picky eaters” were found to have a mean score of 34.3, compared to “non-picky eaters” who had a mean score of 22.7(15). A study of 12 month old infants examining the role of food texture and fussiness reported a mean score of 25 on a subscale of the questionnaire (24), which is similar to our findings.

No correlations were identified between fussy eating and allergic symptoms. A recent study of 4 year old children in Holland identified a bidirectional correlation between constipation and fussy eating (25). They found no difference in fussy eating levels between those with and without CMA history (personal communication Tharner, January 2015). Other studies have reported that fussy eating occurs across different socioeconomic statuses, genders, ethnic groups and ages (15), which is consistent with our findings. Across all participants, no difference in fussy eating score was found in relation to maternal age or education/occupation status. It is notable that the total volume of milk/milk substitute consumed/day was positively correlated with fussy eating score. This supports the simple dietetic advice to reduce excessive consumption of formula in order to encourage a better appetite and mealtime behaviour.

Fussy eating can be difficult to quantify accurately and is usually evaluated by a parental report tool or asking of a single yes/no question, rather than analysis of dietary records (26). Although several tools have been developed for measurement of preschool children's fussy eating behaviour, none have been specifically designed for children under 18 months old and this was identified as a gap in the literature in a recent review (27). The questionnaire used in this study was chosen as it has been validated against behavioural measures of eating in 12-month old infants (24) and against two types of dietary records in children aged 24-36 months old.

The measurement of feeding difficulties can also be problematic due to the variability in definitions used. In many cases feeding difficulties are transient; however it is not always straightforward to distinguish feeding problems that are likely to be short-lived from those that are more persistent (28). By comparison, the term ''Infant Feeding Disorder'' is a formal diagnosis used in the current diagnostic systems of the World Health Organisation ICD-10 [29] and Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (30). Both sets of criteria specify that an infant feeding disorder is a persistent failure to eat adequately, associated with weight loss/ significant failure to gain weight, that is not directly due to a medical condition or another mental disorder, with onset before 6 years of age. As many children who consume exclusion diets maintain a normal weight and have an underlying disorder (i.e. food allergy), the use of this definition was not appropriate for this study. Other classification systems such as the Chatoor criteria and Wolfson criteria (31) have been developed, but both involve lengthy questionnaires. The Montreal Hospital Children's feeding scale questionnaire is, to the authors' knowledge, the only validated questionnaire for measurement of feeding difficulties in children under two years of age (16). It is an easy to use measurement that has been demonstrated to be valid and reliable in children with and without medical diagnoses and could be quickly administered in an outpatient setting, in approximately five minutes, with good reliability and internal consistency.

Limitations and strengths of study

There are some limitations to this study. There may be a recruitment bias whereby those more interested in diet are more likely to participate. The method used is reliant on subjective parental report. Parental feeding behaviours, which have the potential to influence infant feeding behaviours (32) were not assessed. The control group was slightly older than CME group, which may have skewed the results slightly. The CME group included participants consuming both single and multiple

exclusion diets. As this was a typical caseload of patients from a secondary care allergy clinic, participants were diagnosed with CMA using clinical history, SPT and dietary exclusion/reintroduction, rather than an oral food challenge. As correlations are reported, causality cannot be confirmed.

The strengths of this study are the use of a control group, which was recruited from the same geographical locality as the CME group. The groups were closely matched for all demographic variables; only participant age differed by three months. As the research took place in a secondary care allergy clinic, the results are broadly generalisable to the majority of other clinics around the UK. The fact that the infant feeding data of the group as a whole is so similar to national feeding trends demonstrates that the control group is also reflective of the general population. The recruitment target of the study was met, meaning the study was sufficiently powered. Validated and age-specific questionnaires were used. Data collection, coding, analysis and interpretation took place by the same researcher to minimise the effect of researcher bias.

Conclusion

In summary, it has been demonstrated that infants consuming a CME diet for CMA have significantly higher scores of feeding difficulties and fussy eating than a control group consuming an unrestricted diet. This may be due to the underlying disease process resulting in allergic symptoms, the restrictive nature of the CME diet or due to feeding practices adapted by the parent and child. The number of allergic symptoms was the factor that was most strongly correlated with feeding difficulties, however type of symptoms was also important, as was the volume of milk substitute consumed per day. However, it should be emphasised that the feeding difficulties and fussy eating scores across the whole group were within normal ranges and there was no effect seen on growth. This provides reassurance to health professionals who assess and advise parents of children with food allergy.

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