

Feeding Disorders in Food Allergic Children

Angela M. Haas

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Abstract Feeding disorders are increasingly being recognized in children with food allergy. For some children, symptoms of feeding dysfunction may persist after allergens are removed from the diet secondary to learned associations with food and discomfort and reinforcement of maladaptive feeding behaviors. Many food allergic children require care from a multidisciplinary team of specialists, which includes allergists, gastroenterologists, mental health professionals, and feeding specialists. Early referral for feeding assessment by a pediatric feeding specialist can be a critical component of the food allergic child's care. This article reviews and discusses the recent literature regarding feeding disorders in food allergic children. A literature review was conducted using the PubMed database for English language articles published between January 1980 and February 2010. Additional information was obtained via review of recent textbooks and review of the general information web page of several established pediatric feeding programs.

Keywords Feeding disorders · Feeding difficulties · Food allergy · Pediatrics · Children · Food refusal · Behavioral feeding difficulty · Oral motor · Oral sensory · Developmental delay

Introduction

Feeding can be one of the most satisfying activities involved with caring for a child. Conversely, it also can

be the most frustrating. From infancy, food acceptance is exclusively under a child's control, at times much to the frustration of the child's caregivers [1]. As many as 25% to 45% of parents report feeding as "problematic" during visits to their child's primary care provider [2]. Although mealtimes certainly can be problematic for typically developing children and their caregivers, the reported frustration is often in the context of a child with typical growth and no underlying medical condition. For some children, however, problematic feeding may be one of the first symptoms of an underlying organic etiology that is driving maladaptive mealtime behaviors and warrants deeper exploration. Feeding disorders have long been associated with a variety of medical conditions, including gastrointestinal disorders, chronic lung disease, cardiac conditions, and neuromuscular disorders [3–7]. Of late, a growing number of pediatric health care providers are recognizing food allergy as yet another condition associated with feeding disorders; however, very few peer-reviewed studies have been published on this topic. Currently, three studies have been identified. Mukkada et al. (unpublished data) reported that 16.5% of children with identified food allergen sensitization and eosinophilic gastrointestinal disease exhibited maladaptive feeding behaviors (93.9%) and immature diets selection (40%). In this study, 88% of the participants with feeding disorders were sensitized to multiple food allergens and 62% required direct feeding treatment following treatment of their esophageal disease and diet management. A growth disturbance classified as failure to thrive by a pediatric dietician was also identified in 21% of the children diagnosed with a feeding disorder. Pentiuk et al. [8] described a series of 15 children with eosinophilic esophagitis who presented with food refusal, oral aversion, vomiting, and poor weight gain. A subset of these children were diagnosed with food allergy. In this

A. M. Haas (✉)
The Children's Hospital Denver,
13123 East 16th Avenue, B030,
Aurora, CO 80045, USA
e-mail: haas.angela@tchden.org

series, 67% also had concomitant neurological or developmental disease, which may have had a negative effect on feeding. A third study highlighted food refusal as the presenting symptom in two patients in whom protein energy malnutrition and food allergy were identified. However, food refusal was the only descriptor used to describe feeding difficulty [9]. Despite the lack of research on this topic, a review of the websites of well-established pediatric feeding and swallowing programs across the United States found food allergy listed in the diagnoses associated with referral for feeding assessment and treatment in their respective programs.

Food allergy prevalence is now being cited in as much as 5% of the population [10], with more than 90% of food allergies caused by cow's milk, fish, shellfish, egg, peanut, tree nut, soy, and wheat [11]. Symptoms commonly associated with food allergy in children include gastrointestinal discomfort (vomiting, diarrhea, abdominal pain, constipation), asthma, rhinitis, conjunctivitis, atopic dermatitis, oropharyngeal pruritus and edema, dysphagia, poor growth, and anaphylaxis [10, 11]. As our experience in working with food allergic children evolves, it is becoming evident that feeding disorders can be a prevalent and oftentimes the initial presenting symptom of food allergy [12•]. This symptom can impact ongoing feeding skill development and, ultimately, growth and overall development.

Food Allergy and its Impact on Feeding

Maladaptive Learned Behaviors

Feeding is a learned behavior that occurs in a predictable, sequential progression that involves motor skills, sensory systems, behavior, psychosocial components, and communication [1, 5, 7]. A child acquires feeding skills via observation and practice, paired with developmentally appropriate food choices in supportive environments. Table 1 provides a summary of typical feeding development, specifically food type, positioning, oral patterns, and self-feeding [1, 5, 12•]. This progression can be interrupted by acute or chronic discomfort, illness, or environmental stress. The interruption can derail not only feeding skill acquisition but alter motivation and acceptance on the part of the child, and lead to frustration, anxiety, and altered feeding practices on the part of the caregiver. Children learn to eat and successfully participate in family mealtimes through modalities of operant conditioning and associative learning, both of which are elements of learning theory [3, 6, 13]. The same application of this theory can teach children not to eat. Eating followed by feelings of satiety reinforces continued eating on the part of the child and

reinforces the caregiver to continue the typical, successful mealtime process. Conversely, eating followed by vomiting, abdominal pain, or oral discomfort reinforces feeding avoidance and conditions the caregiver to alter mealtime practices in search of success. Additionally, discomfort associated with mealtimes can not only teach a child to avoid mealtimes but also the associated environments and tools such as spoons, bottles, and cups. Food allergic children may engage in maladaptive feeding behaviors such as food refusal, mealtime tantrums, and volume limiting in an effort to avoid pain, discomfort, or anxiety. These children may experience acute symptoms of food allergy, such as anaphylaxis, vomiting, and abdominal pain, whereas others may experience a chronic symptom profile, such as esophageal inflammation, or eczema. Of note is that both profiles can result in a similar maladaptive feeding profile.

Anxiety can also play a role in food refusal [3, 6]. Some children may exhibit food refusal based on fear related to previous uncomfortable or painful experiences. This anxiety may “spill over” to foods that have not been identified as allergens yet provoke anxiety nonetheless because of novelty, similar characteristics to an allergenic food, or unfamiliarity resulting from selective avoidance of that food. Caregiver anxiety regarding accidental exposure to food allergens has been identified in quality-of-life studies [14]. This anxiety may be communicated to the child verbally or nonverbally, with facial expression, tone of voice, and actions communicating fear to the child regarding food items or even environments in which food is present. Such anxiety may serve as another reinforcer for inflexibility and food refusal in some children.

Additionally, the food allergic child may have reduced opportunities to participate in the typical social routines surrounding eating, which can be highly reinforcing from a social standpoint and for the observation of desired mealtime behaviors. Caregivers may limit the child's exposure to peer settings such as play groups or preschool secondary to concerns regarding accidental exposure to food allergens. This practice, although understandable, also limits opportunities to learn about eating and practice the associated developmental skills.

Oral Motor/Oral Sensory Function

The development of oral motor and oral sensory skills also occurs in a predictable sequence [1, 5]. Opportunities to learn these skills are dependent on the alignment of experiences and environment, typically between birth and 24 months of age [1, 5]. If a child's experience is altered by learned food refusal, a potentially limited diet based on allergen sensitization, limited mealtime environments, and altered feeding practices on the part of the caregiver, the

Table 1 Developmental acquisition of feeding skills

Age	Food type	Positioning	Oral patterns	Self-feeding
1 mo	Liquid from bottle or breast	Semi-reclined or side lying with neck slightly flexed	Sucking pattern, loses some liquid Sequences 2 or more sucks before pausing to breathe or swallow	Brings hands to mouth
4–6 mo	Liquids, baby cereals, pureed foods	Supported semi-sitting or sitting positions	Sucking pattern No longer loses liquid Uses a sucking pattern with pureed foods with tongue protrusion past the lips Integrates tongue protrusion with practice	At 4 mo, infant pats bottle and holds both hands on the bottle Infant holds bottle independently at 6 mo Cup may be introduced at 6 mo
9 mo	Liquids and coarsely chopped table foods, including easily chewed meats	Sitting unsupported in a highchair or similar seat	Sucking pattern for liquids Tongue may protrude slightly for stability Can bite a soft cookie Minimal loss of food from mouth with spoon feeding Lips can clear utensil of food and contain food while chewing	Holds cup and drinks with some spilling Can finger feed well Brings filled spoon to mouth with spilling
18 mo	Liquids and coarsely chopped table foods, including most meats and some finely chopped and peeled raw fruits and vegetables	Sitting unsupported at the family table or at a small child's chair and table	Able to form a good seal for drinking Uses controlled, sustained bite on a hard cookie Diagonal rotary jaw movements are smooth and well-coordinated	Scoops food onto spoon, can stab with fork, and brings it to the mouth Can self-feed entire meal Typically weaned from bottle or breast
24 mo	Liquids, wide variety of table foods, except for some raw fruits, vegetables, nuts, and hard candy, which are still a choking risk	Sitting at table	Chewing is variable, includes diagonal rotary and circular rotary movements Can manage solids and combination of textures	Brings spoon or fork to mouth with the hand palm up and does some finger feeding
3–4 y	Liquids and all table foods, with continued attention to foods that pose choking risk secondary to oral skill and attention to task	Sitting at table	Fully integrated. chewing, can chew with mouth closed most of the time	Assistance with cutting high texture Understands what is edible/inedible
5 y	Liquids and all table foods, variability with regard to choking risks secondary to attention to task	Sitting at table	Can chew with mouth closed all the time	Assistance with cutting high texture

result can be delayed or immature oral motor skill progression. A 10-month-old child may learn that the formula in his or her bottle is “safe” as he or she drinks it without adverse effect; however, if this child experiences an

allergic reaction with the introduction of spoon feeding, he or she may then refuse spoon feeding. When allergens are identified and removed from this child's diet, the child continues to refuse spoon feeding of nonallergenic

foods and will only drink from a bottle. Over time, due to lack of experience secondary to refusal, this child may not develop an oral motor pattern for spoon feeding consistent with his or her chronological age. This lag in skill acquisition is possible at any point in the oral motor skill continuum, impacting texture advancement and chewing [12•]. In children with immature oral motor skills for chewing, caregivers may continue to present age-typical foods, which if attempted by the child may result in gagging and vomiting (secondary to gag), which then further reinforces food refusal and brings skill progression to a halt.

Oral sensory skills also may be impacted by interruption of the developmental continuum. Children use their mouths to learn about their world, progressing from mouthing their own hands to toys and objects as preparation and practice for differentiated oral motor function and oral sensory experiences [1, 5]. This sensory input supports successful oral feeding and texture acceptance for many children. Gagging, vomiting, or uncomfortable oral sensations may lead to avoidance of oral sensory motor exploration. Altered oral sensory function may be based on lack of experience due to behavioral refusal or an inability to progress to advanced textures due to identified allergens, or it may be part of a larger, global sensory-processing difficulty. Sensory-processing difficulties may be exclusive to any input, nutritive or non-nutritive, to a child's mouth or be limited to food items and feeding-related tools. Table 2 presents a summarized list with definitions of commonly cited symptoms that occur when a feeding disorder is present [1–6, 12•].

General Development and Behavior

Feeding difficulties can have a significant impact on a child's growth and nutritional status [1, 5, 7]. Compromised nutritional status in turn may adversely affect behavior and development. Additionally, chronic discomfort may contribute to a depressed developmental profile in some children. Anecdotal reports of increased energy, affect, language, and behavioral improvement have been reported by caregivers of food allergic children when they are placed on a diet free of foods to which they are allergic.

Assessment

A referral to a pediatric feeding specialist may be an integral component of the food allergic child's care. For some children, resolution of discomfort may lead to the resumption of typical feeding. For others, the development of maladaptive learned behaviors, oral motor, and/or oral

sensory dysfunction may persist beyond the resolution of symptoms and require skilled assessment and treatment in order to resume typical skills and mealtime patterns [3, 4, 6, 12•]. An early referral for a feeding assessment and subsequent treatment may minimize or avoid the development of maladaptive feeding behaviors or resultant skill deficits. Collaboration with treating professionals in nutrition, allergy, mental health, and gastroenterology is critical to ensure that accurate information is gathered regarding a child's history and current course of medical treatment. Assessment should include analysis of the complex interplay of developmental function experiences and learning gathered via caregiver interview, a mealtime observation of preferred and nonpreferred foods, and analysis of overall development [5, 7]. In addition to observations regarding oral motor and oral sensory function, observations should be made regarding muscle tone, postural alignment and stability, breathing, global sensory processing, communication, and their resultant impact on feeding and mealtimes.

Treatment

Many different forms of feeding treatment are available. Determining the appropriate treatment depends on the severity and type of feeding difficulty and the commitment of the family to a treatment regimen. Success of any feeding treatment program is largely dependent on caregiver commitment and eventual carryover into the home setting. Treatment may take the form of intensive, daily one-on-one sessions; group feeding treatment; or a monitored home program. Caregiver education regarding treatment strategies and their application in the home setting should be an integral component of any type of treatment program. In a treatment setting outside the home, caregivers may be reluctant to bring their children to a facility that provides feeding treatment for a variety of children secondary to the fear of accidental exposure to a food allergy. This concern should be acknowledged and respected and may be mitigated with clear guidelines for safety in the therapeutic setting. These guidelines may include specific rooms designated for feeding treatment, separate storage for food items and utensils, a cleaning protocol, and a safety plan for each child depending on his or her specific needs.

Special consideration must be given to the specific needs of the food allergic child in feeding treatment. In some cases, a child may be on an extremely limited or elemental diet that reduces variety and possible skill development. Despite this, predictable mealtime opportunities with utensils, family members, and any safe food (even ice chips) should be encouraged and supported to build a

Table 2 Symptoms associated with feeding disorders

Symptom	Description
Difficulty swallowing	Child complains of sensation of food getting “stuck” when swallowing, coughing, wet vocal quality, food or liquid coming out nose.
Preference to drink rather than eat	Child primarily accepts liquids in his or her diet.
Immature diet	Child has preference for foods that are not age-appropriate (ie, accepts purees but refuses higher textures of solids, such as meats) in the presence of typical oral motor function.
Gagging	Child engages in gagging before, during, or after mealtimes or in response to sight, smell, or touch of food item.
Vomiting	Child vomits; may be a result of gagging, coughing, gastroesophageal reflux, food allergy, or other gastrointestinal problem.
Oral motor skill deficit	Child presents with difficulty manipulating food due to altered muscle tone, strength, or coordination.
Oral sensory skill deficit	Child presents with an overresponse (hypersensitive) or underresponse (hyposensitive) to the sensory properties of foods (taste, look, smell, feel).
Excessive chewing	Child engages in prolonged chewing of solids prior to swallowing; may also prolong mealtimes.
Low variety of intake	Child presents with a limited number of foods in his or her accepted diet; entire food groups may be eliminated.
Low volume of intake	Child’s consumption is below recommended requirements and insufficient for normal growth/development.
Food refusal	Child will not eat in the presence of functional oral motor skills and opportunities.
Prolonged feeding time	Mealtimes last >30 min.
Holds food or liquid in mouth	Child does not readily swallow food or liquid but rather holds it in his or her mouth prior to swallowing.
Spits out food	Child may willingly take a bite but does not swallow the food.
Grazing	Child eats or drinks small amounts frequently and does not have regular schedule for meals and snacks.
Unstructured mealtimes	Child does not have a regular schedule or location for meals.
Poor acceptance of new foods	Child may eat preferred foods but shows resistance to trying new food.
Requires prompting to eat	Child does not initiate or sustain independent eating and requires attention from a caregiver; is easily distracted from eating during mealtimes.
Inconsistent patterns of eating	Child has variable and unpredictable intake from day to day or meal to meal.
Developmental differences	Child diagnosed with delay or disorder identified by developmental evaluation. Examples include speech-language delay, sensory-processing disorder, or motor skill delays.
Anxiety	Child shows pronounced anxiety at mealtimes or in social eating situations, which disrupts meal and impacts intake.

foundation for possible diet expansion in the future. When a child does have a large enough repertoire (typically more than six foods), the group feeding treatment model can be a highly effective method to support and encourage improved intake, model a home program strategy, and provide the opportunity for caregivers to come together to share their child’s story and support one another. The benefit also can be seen in the child, from the positive influence of peer modeling in the

young child to solidarity regarding lifestyle and social challenges surrounding food allergy in the older child. Group menus require creativity on the part of the treating therapists but are possible with the support of a growing number of cookbooks, commercially available food items, and caregiver input.

It bears noting that success in any feeding treatment program also depends on the impact of any coexisting diagnoses that also may be a factor influencing feeding

success. This impact should be factored into the feeding treatment program for the food allergic child [1, 4, 5, 7].

Considerations for Allergy Testing

The food allergic child with feeding difficulty may present with challenges with allergy testing, specifically food challenges. A trial of a specific food may evoke anxiety on the part of the child, caregiver, or both [14]. Support from a mental health professional may be required before or even during the food trial to ensure successful completion. Food refusal behaviors also may impact the success of the food challenge. Prior to the food challenge, feeding treatment using systematic desensitization, applied behavioral analysis, and/or social stories may be warranted. Systematic desensitization may be used to approach food in small, successive steps with the eventual goal of eating the food. The child may be encouraged to smell, touch, pick up, then lick a food item prior to actually taking a bite or spoonful and swallowing. These steps may be different for each child but often result in eventual success. Applied behavioral analysis is the use of a reinforcer, which is then faded over time. For children, the reinforcer may be varied, ranging from 10 s of a favorite video following a desired behavior to 10 s of interaction with a highly desirable toy [5, 6, 12]. Social stories are also an effective tool, particularly in the time prior to what may be anticipated as an anxiety-provoking event. These stories are constructed with the child as the main character moving toward and experiencing success involving an upcoming event, such as a mealtime or a food challenge. These strategies may be used in combination with one another or separately, depending on the needs of the child. All of them can be highly effective in achieving success and diminishing aversion and anxiety. These techniques may need to be used during the challenge itself, facilitated by the child's feeding specialist or trained caregiver.

As mentioned previously, food allergic children with feeding disorders may present with immature oral motor skills. This can also impact the success of a food challenge. If a 2-year-old child is presented with sweet potato in a baked, cubed form (appropriate for a 2-year-old) but secondary to a longstanding refusal pattern has oral motor skills that are the developmental equivalent of those of a 7-month-old (adequate for liquids and smooth purees only), the child may attempt to try the food, gag appropriately as the food is not properly broken down prior to swallowing (secondary to the immature oral motor pattern), and subsequently refuse the food. For optimal success, food presented during the food challenge should match the developmental rather than age-expected oral motor pattern of the child.

Conclusions

Learning to eat is a highly integrated, dynamic experience that can be disrupted by discomfort resulting in maladaptive feeding behaviors and practices. Although little research is currently available, clinical observations reveal that food allergic children can present with feeding disorders that have a detrimental impact on growth, development, and mealtime dynamics.

Many children need no further intervention after being placed on appropriate elimination diets. However, a subset of children require the support of a multidisciplinary team to manage the persistence of associated symptoms that impact feeding. Early referral to a feeding specialist, working in the context of a multidisciplinary team, may circumvent the potential impact of feeding disorders, improve growth, and in some cases support successful food challenge and reintroduction of foods into the diet.

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