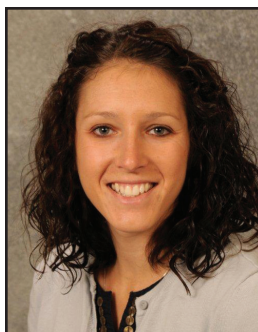


# Nutrition Guidelines for Treatment of Children with Eosinophilic Esophagitis



Michelle Henry

**Eosinophilic Esophagitis (EoE) is a chronic immune-/antigen-mediated disease characterized by clinical symptoms and histological changes induced by environmental and/or dietary triggers. Dietary intervention for EoE include food eliminations: elemental diet, an empiric approach and a tailored diet. EoE and its dietary treatment can put patients at risk for poor nutrition intake. A registered dietitian is integral in assessing growth, micronutrient intake, providing guidance to increase compliance and providing appropriate substitutions for implementing any elimination diet. An understanding of the typical presentations in patients with EoE will help determine nutrition risk and target evaluation. Education and regular follow-up are key to treating the patient with EoE.**

## BACKGROUND

**S**ince the original description of eosinophilic esophagitis (EoE) in the early 1990s, a number of guidelines for the diagnosis and treatment of the disease have been developed.<sup>1-3</sup> EoE is defined as a chronic immune-/antigen-mediated disease of the esophagus characterized by both clinical symptoms and histological changes. Estimated prevalence of EoE is at least 56.7 in every 100,000 persons and is more common in males than females.<sup>4</sup> Symptoms of EoE vary with age of presentation, from feeding refusal in infants and toddlers to dysphagia and abdominal pain in adolescents. The histological findings in patients with EoE are increased eosinophilic infiltration of the

esophageal lining (>15/hpf) that is not attributable to reflux or any other cause of inflammation. At this time it is understood that EoE is a chronic disease that is not usually outgrown.

## EoE and Food Allergies

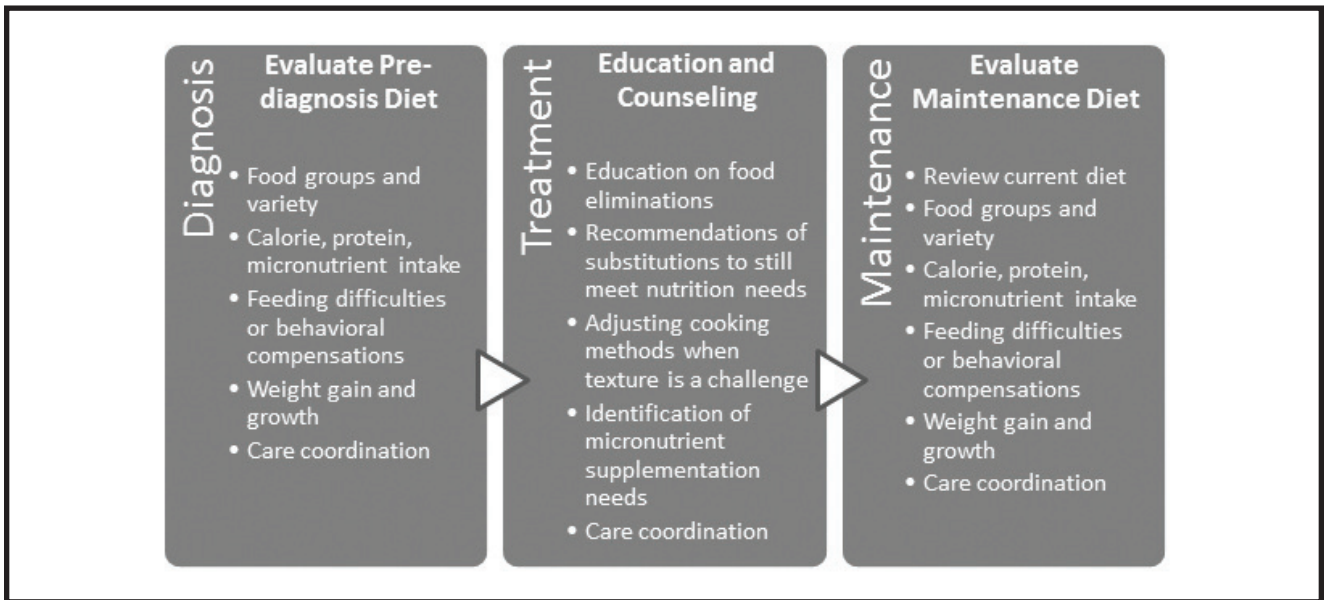
Explanations of the three major categories of food allergies and intolerances are summarized in Table 1. To date, the exact pathophysiological mechanism(s) by which food allergies cause EoE are not certain, but it is likely that both IgE-mediated and non-IgE-mediated processes are involved.<sup>3</sup> Clinical evidence supporting a role for food allergies as an underlying cause of EoE has been provided using three dietary approaches: an elemental diet, an empiric approach and a tailored diet. The elemental diet involves complete avoidance of food in lieu of taking in only elemental

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**Table 1. Risks, Testing Modalities, and Treatments for Food Allergy and Food Intolerance**

	IgE-mediated Food Allergy	Non IgE-mediated Food Allergy	Food Intolerance
Risks	Broad range of symptoms Potential for anaphylaxis	Broad range of symptoms with the more severe being enterocolitis-type	Typically limited to discomfort (eg. abdominal pain, transient diarrhea, flushing)
Testing	Blood testing, skin-prick testing, gold standard = double blind supervised challenge	Testing more challenging; symptom based; reproducible	Some have formal testing methods (eg. Lactase); otherwise symptom based
Treatment	Avoidance	Avoidance	Avoidance, however not necessary to be as strict



**Figure 1.**

(amino acid-based) formula for complete nutrition (see Table 2). The empiric approach is to provide a diet free of the top six (milk, soy, egg, wheat, peanut/tree-nut, fish/shellfish), or top four (milk, soy, egg and wheat) most likely allergens with or without elemental formula supplementation. Lastly, the tailored diet is a diet that is crafted utilizing allergen test data and a detailed history for the individual, which may or may not be excluding the top known allergens, also with or without elemental formula supplementation. The benefits and challenges to each dietary approach are outlined in Table 3.

Dietary therapy was first identified as effective treatment with a diet consisting of only an elemental formula, which established a clinicopathological remission in children with EoE.<sup>5,6</sup> Later using an empiric approach by removing the six most common food allergens in the United States (milk, soy, wheat, egg, fish/shellfish, peanut/tree-nut) yielded similar results.<sup>7</sup> Further, empiric elimination of only the top four most common food allergens (milk, soy, wheat and egg) has also proven effective.<sup>9,10</sup> The third commonly

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used diet therapy, the tailored diet, is documented to be the lesser of the effective dietary treatments, yet results in similar levels of clinicopathological remission in a smaller percentage of patients.<sup>11</sup> In comparison, the literature suggests that the elemental diet remains the most effective followed by the empiric elimination and finally the tailored diet approach.<sup>3</sup> Taken together, these studies demonstrate the role of food antigens in the pathogenesis of EoE and a high response rate with each approach chosen. The clinician should use this information to help decide which treatment approach would be best, or most feasible, for each individual patient or family.

There are obvious practical limitations to each of the three dietary approaches. The elemental diet may pose the greatest challenge, especially for those who previously ate a regular diet. Though improvements have been made in the palatability and variety of available amino acid-based formulas (Table 2), they can also be expensive and difficult to maintain as exclusive nutrition intake. The empiric elimination diets can be hard for those with limited access to allergen-free alternatives and for families with skill and affinity for home cooking tend to report an easier transition to this diet. Tailored elimination diets may pose similar challenges as with the empiric elimination diet. Though, in some cases foods removed are more difficult to identify on food label in the tailored elimination diet, since current regulations on food labeling only require clear indication of presence of the top six allergens. Of all the dietary approaches, it is ideal to work with the patient and family to provide the guidance needed to make the changes work for them.

### EoE Nutrition Risks

A number of challenges exist if any of the dietary treatments for EoE are pursued. Nutritional adequacy, medication-nutrient interactions, practical implementation challenges, and costs all play a role. Because of these potential barriers to success, the expertise of a pediatric dietitian specializing in food allergies is ideal.

Nutrition risk associated with presentation of disease differs by age of presentation. Younger patients are more likely to present with feeding difficulties, while adolescents and adults are more likely to present with dysphagia and food impactions. Table 4 delineates the most common presentations of EoE and how they

may result in nutrition risk. The presenting symptoms associated with EoE may require special attention prior to initiating a dietary treatment. For example, in the case of a young child presenting with poor growth, it may be ideal to establish adequate weight gain and linear growth prior to initiating a dietary treatment of eliminating foods in the diet.

Prior to starting an elimination diet, a full diet assessment is warranted to identify inadequacies in the current diet. If any are identified, it would be important to address them within the confines of the prescribed diet. Following this, considerations for new deficiencies that may develop as a result of the prescribed diet would also need to be addressed. For example, elimination of dairy from a toddler's diet may result in lower calcium, vitamin D, possibly vitamins A and E and fat intake. Providing education that will target replacement of key nutrients in the diet is imperative. Table 5 describes a few potential nutrients impacted by food elimination diets. Laboratory evaluation may be necessary to determine if supplementation is necessary and if so, is necessary for determining how much is needed. When prescribing supplements, the clinician must take extra care in ensuring that the supplement is also allergen free. Confirming active and inactive ingredient content of over-the-counter supplements with the manufacturer or pharmacist should be done to be sure the supplement does not contain the allergens the patient is avoiding.

Patients prescribed an elemental diet will require recommendations for the goal amount of formula to take to meet calorie, protein and micronutrient needs. In addition, recommendations for fluid and electrolyte intake should also be provided as some patients choose to concentrate the formula to combat early satiety while keeping caloric intake at goal. For example, the recommended intake of a standard complete amino acid formula will contain 20-22 mEq sodium for 1000 calories. Suppose a 20 kg child at 6 years of age is taking this formula at a goal of 65 calories/kg/day, he/she will only receive about 1.4 mEq/kg sodium where the recommended range is 2-6 mEq/kg/day. It is important to ask how the patient/family is mixing formula to ensure they are receiving the adequate macro and micronutrients.

Empiric or tailored elimination diets can pose nutrition risk if appropriate dietary substitutes are not recommended or not accepted. When removing wheat from a child's diet, attention should be paid to sources of B-vitamins through alternative grains or

Table 2. Elemental Diets Used in Those with EoE

Formula*	Indication/Unique Characteristics	Standard Dilution (kcal/oz)	Pro/L (g)	CHO/L (g)	Fat/L (g) % MCT	Website	Phone
<b>Elecare Infant</b>	Formulated for infant use	20	31	71.3	32.0 33%	www.abbottnutrition.com	(800) 227-5767
<b>Elecare Junior</b>	Formulated for ages 1 and up; unflavored and vanilla available	30	20.6	106.7	49.1 33%	www.abbottnutrition.com	(800) 227-5767
<b>Neocate EO28 Splash</b>	Formulated for ages 1 and up; ready to feed box with straw; three flavor varieties	30 (Ready to Feed)	24.9	146	37.5 35%	www.nutricia-na.com	(800) 365-7354
<b>Neocate Infant</b>	Formulated for infant use	20	18.7	72	34.0 33%	www.nutricia-na.com	(800) 365-7354
<b>Neocate Junior</b>	Formulated for ages 1 and up; chocolate, vanilla, and strawberry flavors	30	33-35	104-110	47-50 35%	www.nutricia-na.com	(800) 365-7354
<b>PurAmino</b>	Formulated for infant use 0-6 months of age; supplementation up to 24 months of age.	20	18.7	68.7	35.3 0%	www.meadjohnson.com	(812) 429-6399

For an easy calculation table for the above products based on calorie requirements desired, go to: [www.ginutrition.virginia.edu](http://www.ginutrition.virginia.edu) under Resources for the Nutrition Support Professional, "Pediatric Hypoallergenic Formulas."

**Table 3. Nutrition Concerns Associated with Dietary Treatment Approaches**

Dietary Treatment	Approach	Benefits	Challenges
Elemental Diet	Intent is to provide 100% of nutrition through amino acid-based supplement	Highest likelihood of resolution of disease with a nutrition therapy approach.  Improved product taste and flavors since 1990s.	Sometimes difficult to transition to 100% elemental diet when foods were previously tolerated.  Not all formulas created equal (micronutrient content); not a safety-net, must analyze intake for each patient.  Patients often complain that they are unable to take the goal amount due to various factors: early satiety, other vomiting/volume intolerance issues.
Empiric elimination diet	Six-food elimination (milk, soy, wheat, egg, fish/shellfish, peanut/tree-nut) Or Four-food elimination (milk, soy, wheat, egg)	May initiate without pursuing allergy testing.*  Increasingly more resources for the diet (specialty foods, cookbooks, etc).	May require extensive education for family to achieve elimination for complete avoidance.  Depending on age and feeding-skill level of the child, may require additional supplementation with amino acid-based supplementation or micronutrient supplementation.
Tailored elimination diet	Dietary eliminations determined by allergist's testing and patient history.	Tailored to the individual; sometimes able to keep foods/food groups in the diet when other dietary approaches would have eliminated them.	Usual allergy testing is not conclusive for EoE.  May lead to even more eliminations from diet than if had pursued empiric elimination diet.

**\*Note: For patients with an established IgE-mediated food allergy, this must also remain out of the diet despite treatment course pursued.**

wheat-free fortified grain products. If milk is removed, a dairy-free fortified alternative should be provided or a supplement identified to meet Calcium and Vitamin D needs. In some cases, an amino acid-based formula can accompany the empiric or tailored elimination diet to better meet nutrient needs.

Children with EoE may also be treated with other medical treatments such as proton-pump inhibitors for concomitant gastroesophageal reflux disease. An emerging body of data suggests that some adults may be prone to problems with calcium absorption and potential bone mineralization when on long-term proton-pump

inhibitors.<sup>12</sup> Topical swallowed steroids carry potential, but unmeasured, risks including decreased bone mineralization.<sup>3</sup> Thus, monitoring of adequate calcium and Vitamin D intake is important for pediatric EoE patients on these medications.

A meta-analysis of studies evaluating the nutrition risks of patients on multiple food allergy elimination diets highlighted the benefits of dietitian counseling for these patients.<sup>13</sup> This analysis suggests that children with multiple food allergies are at higher risk for poor growth and inadequate vitamin and mineral intakes.

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**Table 4. Nutrition Risks Associated with the Typical Presentations of EoE**

Age Group	Typical Presentation	Nutrition Risks	Possible Nutrition Diagnoses
Infants and Toddlers	Feeding difficulties	Poor growth, delayed transition to solid food or advancing to textures appropriate for age, suboptimal micronutrient intakes	Underweight Inadequate weight gain Inadequate macronutrient intake Inadequate micronutrient intake Inadequate oral intake Difficulty feeding Impaired nutrient utilization Swallowing difficulty
School Age	Vomiting and Pain	Feeding refusal, poor growth, inadequate micronutrient intakes	Underweight Inadequate weight gain Inadequate macronutrient intake Inadequate micronutrient intake Inadequate oral intake Impaired nutrient utilization Swallowing difficulty
Adolescents and Adults	Dysphagia, chest pain, food impaction, upper abdominal pain	Inadequate micronutrient intakes, food avoidance, underweight	Underweight Inadequate micronutrient intake Impaired nutrient utilization Swallowing difficulty

Though the number of studies in this analysis was few, it does indicate that monitoring and evaluating the growth and nutrient intakes of these children is of the utmost importance.

**Role of the Clinician in EoE Treatment**

The clinician, (often a dietitian) plays several integral roles in the management of EoE related to instituting a therapeutic diet. This role includes providing guidance for an individualized dietary plan. Figure 1 identifies the different nutrition evaluation components for each stage in treatment. The initial evaluation should include a review of the full diet intake including actual intakes for each food group, textures preferred, possible preferences for liquids, ability to swallow pills (if multivitamin supplement needed). Objective evaluation metrics should include previous growth patterns, and any parent concerns for growth, development, or physical findings.

When dietary therapy is initiated, it is most often not the “final” diet prescription for the patient. With the direction of the allergist and gastroenterologist, foods are methodically reintroduced until the maintenance

diet is reached. In some cases, patients will “fail” reintroductions, and when no additional foods or food groups will be introduced, the patient is deemed to be on their maintenance diet. Most patients are able to successfully reintroduce foods and will have a very limited number of foods removed on their maintenance diet.<sup>10</sup> To achieve nutrition goals, the dietitian should provide dietary education for food elimination as needed, including skills for label-reading, substitutions, cooking, supplementation (vitamins, minerals and/or formula as needed) and texture modification. When providing diet education, one should consider that dietary adherence can be challenging and many of the barriers to adherence can be addressed by the dietitian and the care team.<sup>14</sup>

As the patient with untreated EoE, or EoE not yet in remission, may experience the need for softer textures, the dietitian should aim to help the patient achieve adequate intake within the confines of the skill with feeding. While this would not be a long-term issue, it is important to meet the nutrition goals in the interim to help bridge the patient to their goal feeding skill with

**Table 5. Potential Nutritional Impact of Food Eliminations**

<b>Foods Avoiding</b>	<b>Major Nutrient(s) Potentially Altered</b>
Dairy	Calcium, Vitamin D, Vitamin A, Protein, Fat
Fruits	Fiber, Vitamin C, Potassium, Beta-carotene, Folic acid
Vegetables <ul style="list-style-type: none"> <li>• Leafy greens</li> <li>• Orange/Yellow</li> </ul>	Fiber, Folic Acid, Vitamin K, Potassium, Iron Fiber, Beta-carotene/Vitamin A, Folic Acid
Meats	Protein, Fat, Iron, Zinc, B12
Eggs	Protein, Fat, Vitamin A, Choline
Beans, Peas, Lentils	Protein, Folic Acid, Fiber, Potassium, Zinc, Phosphorus
Nuts, Seeds	Protein, Essential Fats, Vitamin E, Niacin
Grains	Fiber, Protein, Zinc, Iron, Folic Acid, Thiamin, Riboflavin

**Table 6. Examples of Food Preparations for Varied Texture Acceptance**

<b>Foods</b>	<b>In order of increasing texture acceptance/ability → → →</b>		
Sweet potato	Puree (from nectar thickness to honey depending on amount of liquid added)	Peeled and steamed – cubed (mechanical soft)	Fries (from peeled and soft to unpeeled and crispier)
Apples	Applesauce	Peeled and steamed/baked with juice (mashable but holds shape)	Raw cut without skins to whole with skins
Chicken	Pureed with broth (not always age-accepted)	Cubed and cooked in broth (eg. soup) or casserole; boiled and cubed served with dip (ketchup, dressing, etc)	Dry-cook such as grilling or baking

adequate nutrient intake. Table 6 shows examples of different ways to prepare some common foods based on the patient’s ability or comfort level with textures.

In the maintenance phase, the dietitian should focus on helping the patient achieve a reasonable variety in the diet. As much as possible, the diet should be designed

to help meet all macro- and micronutrient needs for growth as well as fluid and electrolyte needs, with supplementation as necessary. Patients and families should be educated in recognizing signs of disease recurrence such as increased or excessive water to drink with meals to wash food down, preference for

softer foods or purees, and avoidance of social eating. These signs are important for recognizing when the disease may not be controlled and they should see their doctor for evaluation. Lastly, while in the maintenance diet phase, periodic review of the patient's growth is important.

### CONCLUSION

The clinician plays an integral role in the assessment and treatment of patients with EoE. A well versed understanding of the three dietary elimination diets used for EoE is essential. Expertise of nutrient deficiency signs and symptoms are important to guide assessment in the child with multiple food allergies. In addition, educating patients and their parents to label-read, cook with limited ingredients, and use of food substitutions are an important component of the educational process. Long-term close follow up is ideal as patients and families work through the implementation phase of elimination diets. Reevaluation of diet intakes for variety and overall nutrient intake is necessary in each stage of treatment. ■

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