

Nutrition in the food allergy clinic

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Aims and Objectives

1. Give an overview of factors which may contribute to nutrition risk
2. Identify nutrition interventions that can improve nutritional status in children with FA
3. Give guidance on how to find a dietitian that can support your practice

Factors which may contribute to nutrition risk

Number of foods avoided

SYSTEMATIC REVIEW

Avoidance of multiple foods (≥ 2 foods) associated with reduced height and weight



UK GROWTH SURVEY

Avoiding ≥ 3 foods affected weight-for-age, but not the other growth parameters



ANOTHER UK STUDY

Number of foods avoided did not affect growth parameters (but the children did see an RD)

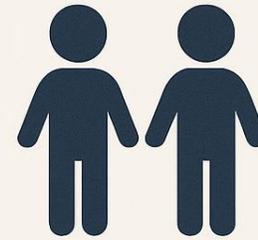


- Sova et al. Nutr Clin Pract 2013;28(6):669-75; Meyer et al. Clin Transl Allergy 2016;6:25 ; Meyer et al. J Hum Nutr Diet 2014;27(3):227-35

Specific food allergies and growth parameters

COW'S MILK ALLERGY AND GROWTH IN CHILDREN

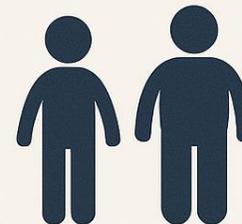
Cow's milk avoidance led to lower height-for-age z-scores compared to a healthy control group.



Children with cow's milk allergy:
7.7% were wasted
23% were underweight
vs. **0%**, **0%** and **3.3%**
in the control group



Children with cow's milk allergy:
height-for-age was
significantly lower in
the affected children vs. controls



Children avoiding cow's milk
were **significantly shorter
and weighed less** than
a matched control group
without food allergy

Irrespective of type of cow's milk allergy

Tuokkola et al. Acta Paediatr 2017;106(7):1142-1149; Medeiros et al. J Pediatr (Rio J) 2004;80(5):363-70; Jensen et al. Pediatr Allergy Immunol 2004;15(6):562-5; Sinai et al. J Allergy Clin Immunol Pract 2019;7(2):509-515; Mehta et al. J Pediatr 2014;165(4):842-8

Type of food allergy and nutritional risk

IgE mediated food allergies

- Finland: **both height-for-age and weight-for-height** were lower in children with IgE-FA (mainly CMA) compared to controls.
- US: more children with FA had **lower height-for-age** percentiles than children without FA.
- Other studies indicated **low weight-for-height, low weight- and height-for-age**, and increased numbers of malnourished children with IgE-FA.

Non-IgE mediated food allergies

- UK: 9% children were **stunted**, 2.2% **wasted** and 2.2% and 10% were **overweight** < 5 years and > 5 years of age, respectively.
- Brazil: 23.9% children were **stunted**, 11.3% **wasted** and 15.1% **underweight**.

Isolauri et al. J Pediatr 1998;132(6):1004-9 ; Christie et al. J Am Diet Assoc 2002;102(11):1648-51. ; Flammarion et al. Pediatr Allergy Immunol 2011;22(2):161-5; Meyer et al. Clin Transl Allergy 2016;6:25. ; Meyer et al. J Gastroenterol Hepatol 2014;29(10):1764-9; Vieira et al. BMC pediatrics 2010;10:25

Food Protein-Induced Enterocolitis Syndrome

Children with FPIES: avoiding **3 or more foods** have increased risk for food aversion and poor weight gain in acute and chronic FPIES.

The majority of children with FPIES react to a single food, **but some avoid additional foods due to parental concerns.**

- cohort of 410 children with FPIES, 69% avoided at least 2 food groups
- high psychosocial burden on caregivers can lead to delayed development of feeding skills and reduced intake.
- parents of children with FPIES reported **greater feeding difficulty** than those with children suffering from IgE-FA.
- Impaired absorption and excessive gastrointestinal losses can result from ongoing inflammation.
- Hematologic and metabolic disturbances is also seen

Eosinophilic Esophagitis/ Eosinophilic Gastrointestinal diseases

Growth restriction and faltering growth are seen in patients with eosinophilic gastrointestinal diseases (EGIDs),

Impairments in growth result from a variety of factors:

- recurrent gastrointestinal symptoms, such as pain and vomiting, prevent adequate nutritional intake
- feeding dysfunction because of dysphagia and/or esophageal strictures
- altered feeding behaviors, such as EoE symptoms can also trigger anxiety and/or eating disorders (including food aversions).
- chronic inflammation in itself is a state that may lead to impairments in growth.

Atopic dermatitis (AD) and growth impairment

Associations between AD disease severity and growth have been reported, particularly in younger children.

Beck et al. J Allergy Clin Immunol Pract 2016;4(2):248-256 ; Yamamoto-Hanada et al. PLoS One 2021;16(12):e0260447 ; Johnston et al. Br J Dermatol 2004;150(6):1186-9 ; Webber et al. Br J Dermatol 1989;121(1):91-8 ; Sinagra et al. Pediatric dermatology 2007;24(1):1-6. ; Silverberg et al. JAMA Dermatol 2015;151(4):401-9 ; Nomura et al. Pediatr Allergy Immunol 2002;13(4):287-94. ; Brunner et al. J Am Acad Dermatol 2019;81(2):510-519. ; Ehlayel et al. Eur Ann Allergy Clin Immunol 2020;52(1):18-22

Possible Reasons for Growth Impairments

- Medically unsupervised dietary restrictions are often pursued by families of children with AD
- Interruption of growth hormone release due to poor sleep
- Severe AD can result in protein loss through the skin, and there are reports of hypoproteinemia as a complication of AD
- Chronic skin inflammation and superrinfection can negatively impact systemic metabolism

Food refusal in children with food allergies

- Food refusal is commonly reported in children with FA.
- Food refusal increases the risk for both macro- and micronutrient deficiencies.

Avoidant/Restrictive Food Intake Disorder criteria	Grading
Significant weight loss (or failure to achieve expected weight gain or faltering growth in children)	A1
Significant nutritional deficiency	A2
Dependence on enteral feeding or oral nutritional supplements	A3
Marked interference with psychosocial functioning	A4

DSM -V Criteria <https://www.ncbi.nlm.nih.gov/books/NBK519712/table/ch3.t18/>

Medications used in food allergies and nutritional risk

Corticosteroids in children with Eosinophilic Esophagitis

- Joint Task Force AAAAI/ACAAAI/AGA: **long-term use of swallowed inhaled corticosteroids was not associated with reduced growth or bone mineral density.**

Corticosteroids in children with Asthma

- Systematic review: inhaled corticosteroids did affect growth in children with persistent asthma, although the drug used and delivery device may impact the effect seen on growth.

Proton pump inhibitors

- Systematic review: long-term use of PPIs (more than 30 days) is associated with gut dysbiosis.
- PPI effects on magnesium, calcium, iron, and sodium absorption unclear.
- Vitamin B12 absorption may be a particular concern in patients with acid-related diseases, particularly those already with malnutrition.
- One study: negative association between chronic PPI use and bone mineral density.

Rank et al. Gastroenterology 2020;158(6):1789-1810 e15; Philpott et al. Aliment Pharmacol Ther 2018;47(8):1071-1078; Axelsson et al. Cochrane Database Syst Rev 2019;6(6):Cd010126; Castellana et al. Pol Arch Intern Med 2021;131(6):541-549; Scarpignato et al. BMC Med 2016;14(1):179; Henderson et al. J Pediatr Gastroenterol Nutr 2020;71(6):764-770

Social determinants of health and nutritional risk in children with food allergies

Keet et al. Ann Allergy Asthma Immunol 2014;112(3):222-229.e3; Dupius et al. J Allergy Clin Immunol 2023;151(1):37-41; Mahdavinia et al. J Allergy Clin Immunol Pract 2017;5(2):352-357.e1.; Tepler et al. Ann Allergy Asthma Immunol 2022;129(4):417-423; Shroba et al. J Allergy Clin Immunol Pract 2022;10(1):81-90; Coleman et al. J Allergy Clin Immunol Pract 2022;10(1):182-188.

FOOD INSECURITY AND FOOD ALLERGY



Food insecurity occurs in 10.5 % of US households with higher disparities noted in households with FA



Allergen-free foods are significantly more costly



Many of the current federal nutrition programs do not incorporate the increase in cost for food-allergic families



May lead to accidental ingestions and hospital visits

Does oral immunotherapy affect growth?

Nutritional impact of 2 g of peanut protein

Table 2: Commercial options containing 2 g peanut protein							
Per approximately 2 g peanut protein	Bamba (17 g)	Peanut butter (10 g)	Peanuts (8 g)	Peanut butter powder (4 g)	Peanut flour† (4 g)	US cereal (140 g)	US chocolate/candy (21 g)
kcal	93	59	45	15	13	550	105
Sugar (g)	0.4	0.65	0.38	0.4	0.33	45	10.5
Salt (mg)	68	48	1	31	7	649	75
Fat (g)	6.1	4.95	3.94	0.49	0.02	7.5	6.5

Venter and Groetch. J Allergy Clin Immunol. 2016 Oct;138(4):1119-1121

- One small study (abstract) from Italy (n=16) only 25% consumed the advised food (milk). Food preferences were hard cheese (94%), soft cheese (75%), pizza (62%), yogurt (56%) and also lower preferences for chocolate, ice cream and desserts.¹
- Another abstract from Brazil (m=18) found >50% of participants 12 months post OIT preferred ultra processed foods for dosing and 17% had gained excessive weight.

Toniolo et al Allergy 2019 Vol. 74 Page 797 (abstract); Aquilante et al. Allergy 2019 Vol. 74 Pages 801 (abstract)

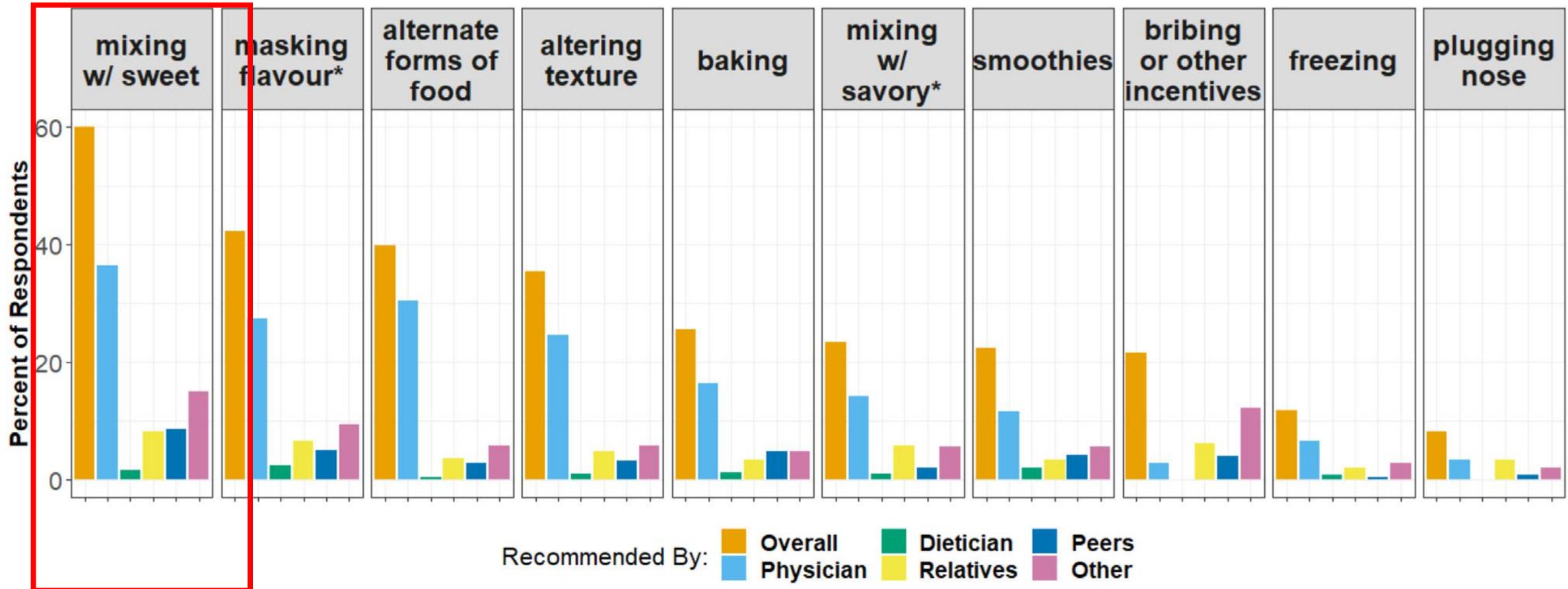
2 g peanut protein with vehicle



Nutritional Implications of different options of foods used as mixes for OIT regimens based on 2 g peanut protein from peanut butter

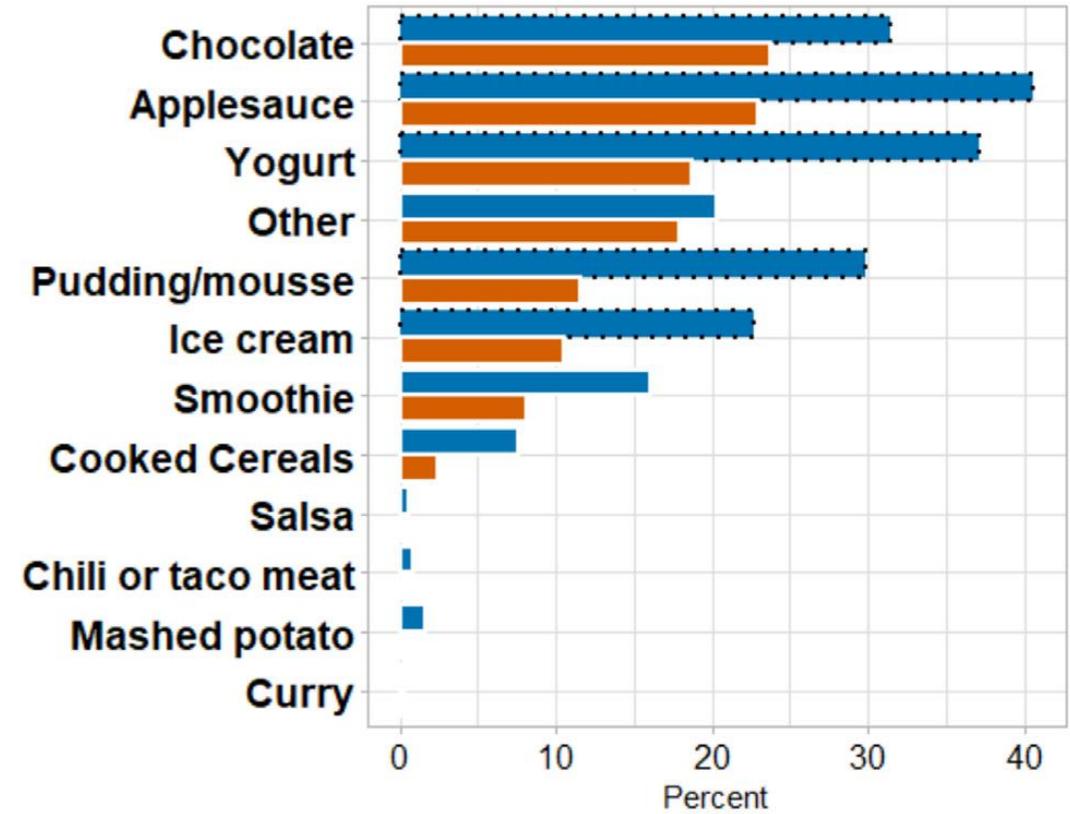
		Typical child diary 18 months old Peanut allergic – no peanut in their diet		Child diary with 2g peanut protein		Child diary with 2g peanut protein and ½ banana		Child diary with 2g peanut protein and 15g chocolate syrup (1 tablespoon)		Child diary with 2 g peanut protein and 1 scoop ice cream (60 g)	
		total	%	total	%	total	%	total	%	total	%
Kcal	Upper limit 1000	1115	111.5	1174	117.4	1226	122.6	1263	126.3	1366	136.6
Added Sugars	<10%	31 g	11	31g	10.8	31 g	10.4	45 g	15	55 g	17.2
Salt	800mg	1985mg	248	2002mg	250	2002mg	250	2009mg	251	2054mg	256
Fat	30-40%	43g	34.7	45g	35.6	46g	34.7	45 g	33.9	52.3 g	37

Proportions of the survey respondents indicating different oral immunotherapy taste improvement methods



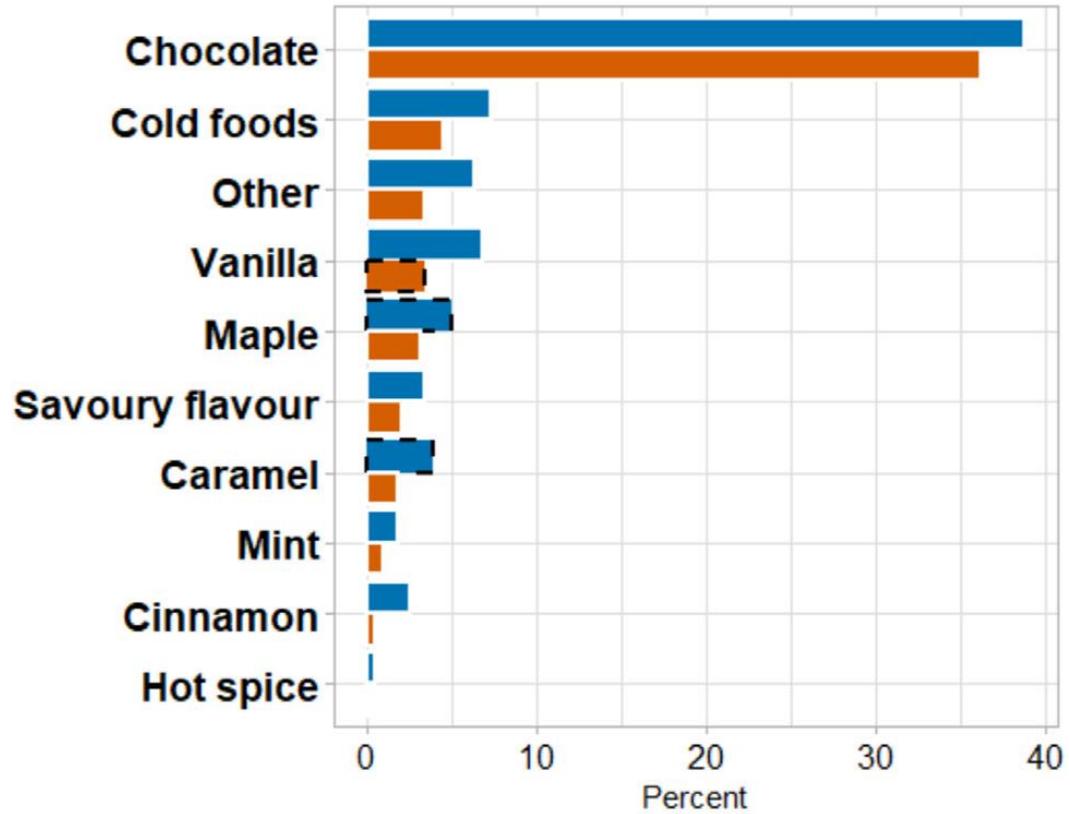
Trevisonno et al. J Allergy Clin Immunol Pract. 2024 Jul;12(7):1809-1818.e3

Foods used as mixing agents for oral immunotherapy



A

Mixing Preferred Tried



B

Masking Effective Tried

Trevisonno et al. J Allergy Clin Immunol Pract. 2024 Jul;12(7):1809-1818.e3

Factors associated with increased risk

- 1) Nutritional risk increases with number of foods avoided
- 2) All types of food allergies can increase nutritional risk
- 3) Food refusal may increase nutritional risk
- 4) Long term medication use may increase nutritional risk
- 5) Social determinants of health such may increase nutritional risk

Identify nutritional
assessments that can identify
those as nutritional risk

Micronutrient intake

Micronutrients are important co-factors for growth and general well-being

Children with FA have an increased risk for a variety of vitamin and mineral deficiencies:

- Vitamin D
- Calcium
- Phosphate
- Retinol
- Iodine
- Iron
- Zinc
- Essential fatty acids
- Protein
- Energy

- Ideally only targeted nutritional biomarkers should be performed, following from assessment of dietary intake, the foods eliminated, and growth status.
- **Core biochemical markers for FA include the bone profile with 25 [OH] Vitamin D, Phosphate, iron profile including hemoglobin, MCV, HCT, ferritin and c reactive protein; in the presence of failure to thrive zinc status.**

Sova et al. NutrClinPract 2013;28(6):669-675; Boaventura et al. Allergol Immunopathol (Madr) 2019;47(6):544-550; Lima et al. Rev Paul Pediatr 2018;36(2):176-185; Normado et al. Br J Nutr 2023;1-24; Thomassen et al. J Pediatr GastroenterolNutr 2017;64(5):806-811; PM:27741063); Aldamiz-Echevarria et al. Acta Paediatr 2008;97(11):1572-6; Noimark et al. Noimark L, Cox HE. Nutritional problems related to food allergy in childhood. PediatrAllergy Immunol 2008;19(2):188-195; Ojuawo et al. ast AfrMedJ 1996;73(4):236-238

Assessing growth

- 'Faltering growth': decrease in the velocity of weight gain, which results in the child "falling off" the expected weight curve on the growth charts
- 'Malnutrition' (or undernutrition) is primarily defined by a low weight-for-height (wasting) or a low height-for-age (stunting) as defined by the World Health Organization (WHO).

- Weight, length/height and head circumference (< 2 years of age) should be regularly assessed and plotted on the appropriate growth chart.

Further definitions of importance

An online z-score calculator can be located at: <https://www.calculator.net/z-score-calculator.html>

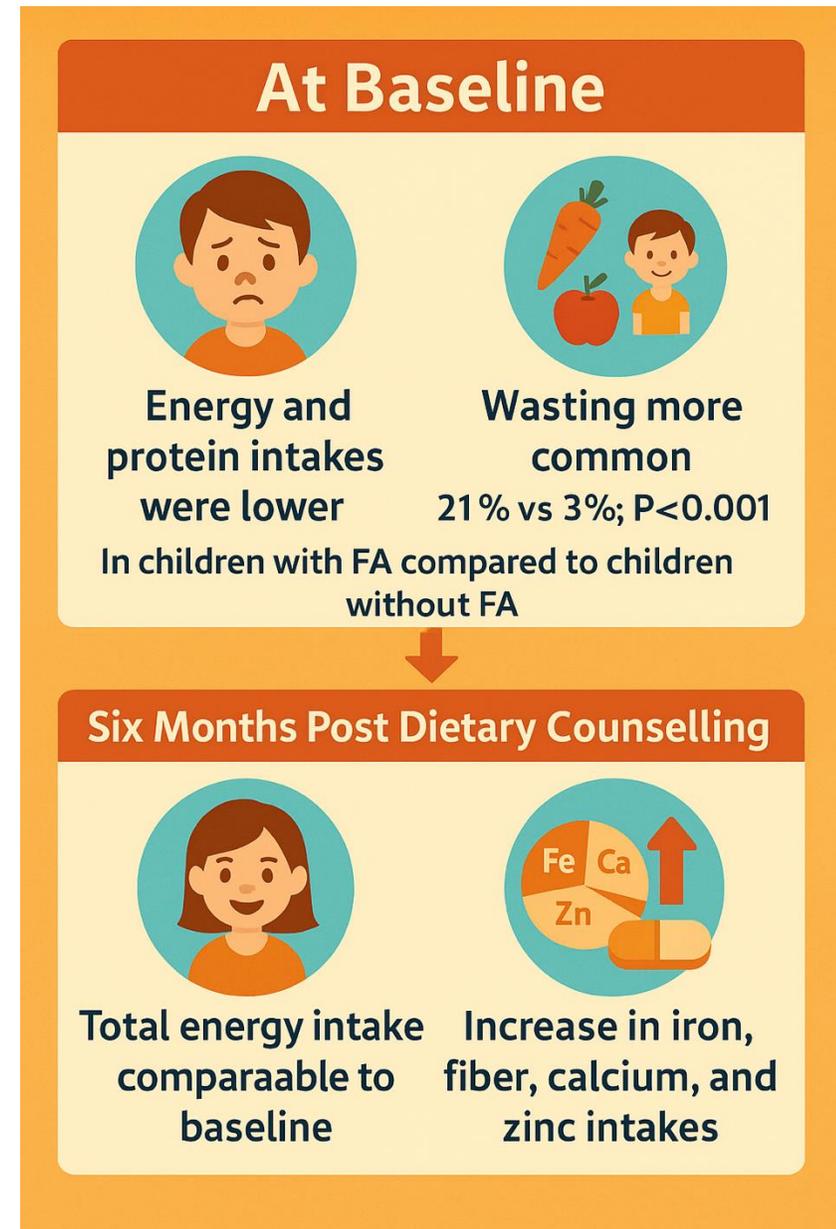
Terminology		Definition
Faltering Growth/Failure to Thrive		Whilst there is no consensus on the definition, the following is the most common one used: a sustained decrease in growth velocity, in which weight for age or weight for length/height falls by two major percentiles over time
Malnutrition - Undernutrition	Wasting	-2 to -2.9 z-score weight-for-height (moderate undernutrition) - 3 and below z-score weight-for-height (severe under nutrition)
Malnutrition - Undernutrition	Stunting	-2 to -2.9 z-score height-for-age (moderate undernutrition) - 3 and below z-score height-for-age (severe under nutrition)
Malnutrition	Mid upper arm circumference	-2 to -2.9 z-score (moderate undernutrition) - 3 and below z-score (severe under nutrition)

The WHO uses z-scores to define undernutrition as defined above. However, some authors refer to weight-for-height, weight-for-age and height-for-age using percentiles. A z-score of 0 refers to the 50th percentile; the percentiles relating to other z-scores will depend on the growth chart being used. The z-scores above are universally applicable, irrespective of the growth chart being used.

Identify nutrition interventions
that can improve nutritional
status in children with FA

Nutrition counselling

Berni-Canani et al. J Acad Nutr Diet 2014;114(9):1432-9



Nutrients provided by food containing common food allergens

Eliminated Food	Nutrients at Risk											
	Protein	Carbo- hydrate	Fat	Fiber	Calcium	Vitamin D	Vitamin B12	Folate	Iodine	Biotin	Iron	Omega-3 fatty acids
Milk	x	x	x		x	x	x		x			
Egg	x					x				x	x	
Wheat		x		x				x			x	
Soy	x		x	x	x			x		x	x	
Peanuts, Tree nuts and seeds	x	x	x	x								x
Seafood	x		x			x	x		x			x

AGE GROUP



INFANTS AND CHILDREN

Increased nutritional requirements

- energy, protein, essential fatty acids, Iron, calcium > 1 years*

Increased risk

- Delayed introduction of foods
- Cow's milk allergy
- Multiple food allergies
- Family inability to manage the food allergy

Feeding difficulties

- Food aversions /phobia
- Family inability to manage the food allergy
- Feeding difficulties



CHILDREN

Increased risk

- Delayed introduction of foods
- Cow's milk allergy
- Multiple food allergies
- Family inability to manage the food allergy

Family inability to manage the food allergy

- Nursery inability to provide nutritious safe foods
- Feeding difficulties

Food aversions/phobia

- Family inability to manage the food allergy
- Nursery/Pre-school inability to provide nutritious safe foods



TEENAGERS

Longer term

- Food aversions
- Food aversions
- Not consuming food allergen that have been outgrown
- Increased requirements with increased activity (sports)
- Family inability to manage the food allergy
- Social events where safe food is not available

Social events where safe food is not available

- Longer term food aversions
- Not consuming food allergen that have been outgrown

Changes in food intake nutrient requirements over the lifespan

*a risk for iodine deficiency has been found specifically in children with CMA

Venter et al. J Allergy Clin Immunol Pract. 2024;12(3):579-589.

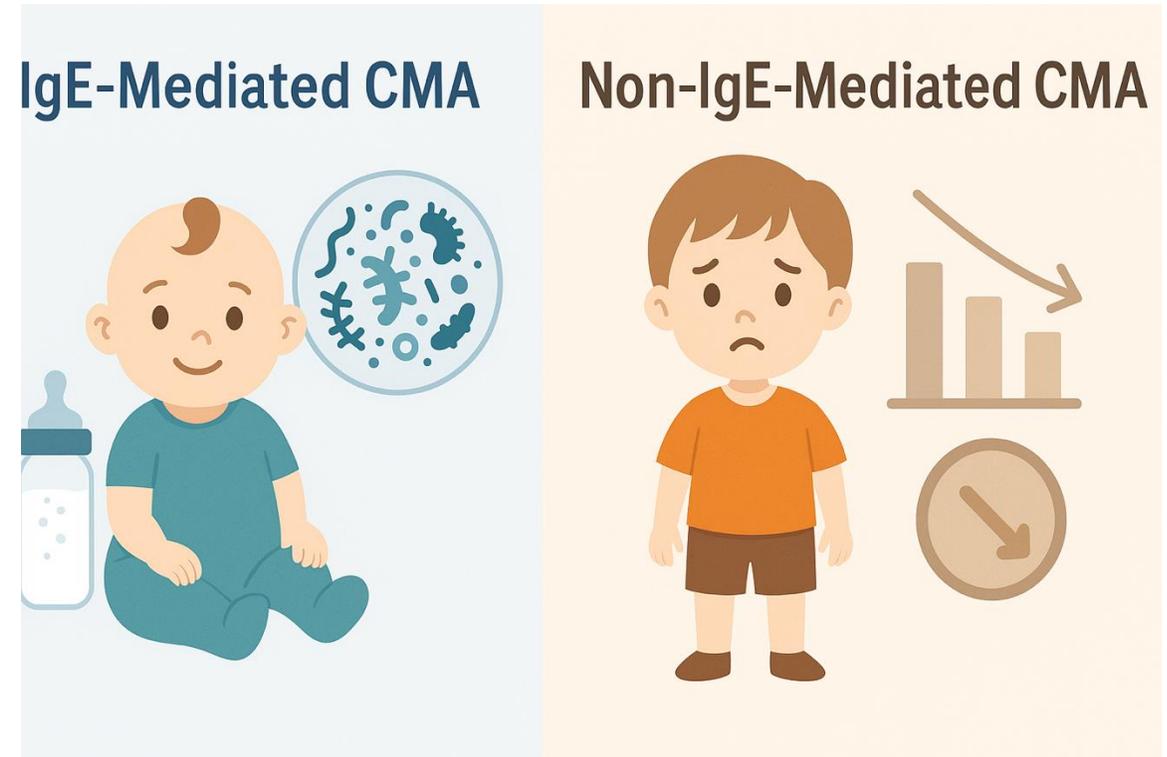
Food sources of important nutrients

Venter et al. J Allergy Clin Immunol Pract. 2024 ;12(3):579-589.

Nutrient	Allergen	Alternative sources
Protein	Milk, egg, fish, peanut, tree nuts, soy	Meat, poultry, seeds, legumes
Calcium	Milk	Fortified plant-based beverages, calcium fortified tofu and other foods
Long chain polyunsaturated fatty acids	Fatty fish	Marine algae oils, refined fish oil supplements and supplemented foods
Vitamin D	Cow's milk and fortified dairy products	Fortified plant-based beverages, salmon, trout, fortified cereals, mushrooms exposed to ultraviolet light
Iodine	Milk, fish	Iodized salt, seaweed
Selenium	Brazil nut, fish, egg	Beef, poultry, enriched macaroni, long grain rice, oats, beans
Choline	Egg, soy, wheat germ, cod	Beef liver, beef, chicken, potato

Formulas and growth: DRACMA guidelines

- **IgE mediated CMA: Amino acid-based formula shows improved growth when compared to extensively hydrolyzed (milk) formula.**
- **Non-IgE mediated CMA: Compared to amino acid-based formulas, there may be reduced length growth seen with extensively hydrolyzed (milk) formula.**



Plant-based beverages

[https://www.worldallergyorganizationjournal.org/article/S1939-4551\(24\)00062-0/fulltext](https://www.worldallergyorganizationjournal.org/article/S1939-4551(24)00062-0/fulltext)

Factors to consider that may indicate a toddler is ready to transition to a plant-based beverage are the child:



Is at least one year of age



Eats a varied solid food diet with a variety of foods from each food group;



Gets at least 2/3 of their energy from the varied solid food diet;



Consumes no more than 2 servings/day (1 serving = 8 ounces/240 mls of milk substitute day or yogurt substitute):



Eats age-appropriate textures



Gets enough protein and fat and micronutrients in the diet from the solid foods and the available milk substitute



Has no feeding difficulties that may reduce food variety



Has no known micronutrient deficiencies; AND



Has no religious/cultural dietary requirements that reduces the variety of foods consumed

Factors that may reduce risk or improve nutritional status

- 1) Appropriately prescribed elimination diets
- 2) Nutrition counselling
- 3) Nutrition support and assessment during breast feeding if an avoidance diet is required
- 4) Appropriate choice of supplemental formulas and vitamin mineral supplements if needed
- 5) Nutrition assessment before commencing plan- based beverages
- 6) Timely introduction of nutrient dense complementary foods

Practical pointers for physicians

- Measure height, weight, and plot on growth chart at every appointment to assess growth over time.
- Timely referral to registered dietitian nutritionist for assessment of nutrient intake.
- Timely referral for feeding therapy if concerns for feeding difficulties/refusal/aversions.
- Consider iron studies (including serum ferritin), 25 [OH] vitamin D, zinc, in sera in children with multi-food avoidance and/or picky eating/ food phobia.

Find a dietitian who can support your practice

- For food allergy trained dietitians, click the “FARE trained dietitians” link [FARE Trained Registered Dietitians - FoodAllergy.org](#)
- The Academy of Nutrition and Dietetics “Find a Nutrition Expert” link [Find a Nutrition Expert \(eatright.org\)](#)
- Note: Many dietitians provide telehealth. Dietitians are nationally accredited however some states also have licensure for dietitians and therefore a dietitian can provide telehealth only if they are licensed in the state where the patient is located.

Many states however do not have specific licensure restrictions, so any dietitian can provide telehealth services. If you practice in a state that has licensure restrictions, a dietitian may be willing to apply for licensure in your state to support your patients.

+ Arizona	+ New Jersey
+ California	+ New Mexico
+ Colorado	+ New York
+ Connecticut	+ North Carolina
+ District of Columbia	+ Ohio
+ Florida	+ Oregon
+ Georgia	+ South Carolina
+ Maryland	+ Texas
+ Massachusetts	+ Virginia
+ Michigan	+ Iowa
+ Montana	+ Pennsylvania

Summary and Conclusion

- FA is a growing public health concern that affects dietary intake.
- It is important to support nutritional needs and quality of life in patients with FA.
- Nutrition care is especially important for infants and young children as inadequate nutritional intake can directly impact growth and development.
- Clinicians should assess growth in children with FA as indicated by national guidelines and be aware of the indicators of nutritional risk.
- Moving forward, FA teams would benefit from including a RDN with additional training and/or experience in managing FA, as the complexity of management is ever-evolving and stretches beyond simply avoiding the allergen.
- Further research is needed to determine the impact of emerging food allergy therapies on nutritional status.