

Pediatric Food Allergies

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Disclosure

- Participated in Advisory Board Medexus (Rupall) 2022
- Participated in Advisory Board Bausch + Lomb (Emerade) 2021

Objectives

- Know the prevalence of most common pediatric food allergies
- Be aware of current recommendations for food allergy prevention
- Comprehend the use of Milk and Egg Ladders
- Understand what food oral immunotherapy is, and how it is done
- Appreciate the expected benefits from food OIT as well as the risks and drawbacks (using PN OIT as example)

Top 10 Food Allergies



Top 11 Food Allergies (90% of all food allergies)

Remit

- Milk
- Egg
- Wheat
- Soy

Persist

- PN
- TN
- Fish
- Shellfish
- Sesame
- Kiwi
- mustard



SPACE2SPACE PROBABLE FOOD ALLERGY PREVALENCE (Apr 2020)

TABLE 1: Estimated Food Allergy Prevalence among Canadian children and adults
(Probable food allergy self-reported through a nationwide AllerGen research survey)

Food allergen	% Canadians with food allergy ¹		Canadian population ²	# Canadians with food allergy ³
ANY FOOD	Children (0-17 years)	6.7%	7,029,310	470,963
	Adults (18+ years)	5.9%	28,122,405	1,659,222
1. Peanut	Children (0-17 years)	3.2%	Data sources: 1. 2016 nationwide AllerGen survey Clarke et. al, JACI: In Practice (Apr 2020) 2. 2016 Statistics Canada Census 3. Prevalence calculation The number of Canadian children or adults with a food allergy is calculated using prevalence percent (%) ¹ for ANY FOOD allergen multiplied by the population data ² . The number of Canadian children or adults with a food allergy cannot be estimated by summing figures for specific allergens, as these figures would count Canadians with multiple food allergies more than once.	224,938
	Adults (18+ years)	0.8%		224,979
2. Tree nut	Children (0-17 years)	2.1%		147,615
	Adults (18+ years)	1.3%		365,591
3. Shellfish	Children (0-17 years)	0.9%		63,264
	Adults (18+ years)	1.1%		309,346
4. Fish	Children (0-17 years)	1.1%		77,322
	Adults (18+ years)	0.5%		140,612
5. Egg	Children (0-17 years)	1.8%		126,527
	Adults (18+ years)	0.6%		168,734
6. Milk	Children (0-17 years)	1.2%	84,352	
	Adults (18+ years)	1.1%	309,346	
7. Wheat	Children (0-17 years)	0.2%	14,059	
	Adults (18+ years)	0.5%	140,612	
8. Sesame	Children (0-17 years)	0.3%	21,088	
	Adults (18+ years)	0.2%	56,245	
9. Soy	Children (0-17 years)	0.3%	21,088	
	Adults (18+ years)	0.3%	84,367	
10. Other	Children (0-17 years)	Not reported	--	
	Adults (18+ years)	Not reported	--	

Food Allergy Prevention

- Canadian Pediatric Society
 - Posted December 17, 2021

Recommendations for clinicians:

- Consider infants at high risk for food allergy when they have a personal history of atopy or a first-degree relative (at least one parent or sibling) with an atopic condition (such as asthma, allergic rhinitis, food allergy, or eczema).
- Promote and support breastfeeding for up to 2 years and beyond, regardless of issues pertaining to food allergy prevention.
- There is still insufficient evidence to recommend modifying the maternal diet to prevent food allergy (i.e., by avoiding or ingesting particular allergenic foods during pregnancy and while breastfeeding).
- For mothers who cannot or choose not to breastfeed, hydrolyzed formulas should not be recommended to prevent atopic conditions (e.g., eczema, asthma, allergic rhinitis) in either high- or low-risk infants.
- When cow's milk protein formula has been introduced in an infant's diet, make sure that regular ingestion (as little as 10 mL daily) is maintained to prevent loss of tolerance.

- For high-risk infants, encourage the introduction of allergenic foods (e.g., cooked (not raw) egg, peanut) early, at about 6 months and not before 4 months of age, in a safe and developmentally appropriate way, at home. In infants at low risk for food allergy, allergenic foods can also be introduced at around 6 months of age.
- New foods, including commonly allergenic foods, can be introduced on successive days, with no evidence of harm to this approach.
- When allergenic foods have been introduced, make sure that ongoing ingestion of age-appropriate serving sizes is regular (i.e., a few times a week), to maintain tolerance.
- Pre-emptive screening for infant food allergies is not recommended. Families should be counseled that the risk of a severe reaction on the first exposure to an allergen is extremely low. $0.08\% = 1/1,250$ babies
- There is currently insufficient evidence to recommend vitamin D, omega 3, or pre- or probiotic supplements to prevent food allergies in infants.

Produced under the
National Food Allergy Action Plan

Food Allergy Canada
Canadian Society of Allergy and Clinical Immunology

EAT EARLY. EAT OFTEN.

Help prevent food allergy in your baby

Feed your baby the foods that most commonly cause food allergy by around 6 months of age, but not before 4 months.

The most common causes of food allergy in babies are cow's milk, egg, peanut, tree nuts, sesame, fish, soy and wheat.

To help stop food allergy from developing, the Canadian Society of Allergy and Clinical Immunology and the Canadian Paediatric Society recommend that these common food allergens, in particular cooked egg and peanut, are fed early to babies who are at high-risk of developing food allergy.

High-risk babies have eczema or pre-existing food allergy, or an immediate family member with eczema, food allergy, asthma or hay fever.

This guidance will not stop all babies from developing food allergy, but it has been shown to drop the rates of food allergy quite substantially.

Remember, once your baby has eaten the food, and if there is no allergic reaction, it's very important to keep feeding that food to your baby about 2-3 times/week to help prevent the development of a food allergy.



HOW TO FEED YOUR BABY EARLY

Your baby must be developmentally ready for solid foods. They should be able to sit up well without support, and able and willing to chew.



Give your baby allergenic foods for the first time at home. Make sure it is a time when they will be awake for two hours afterwards in case allergy symptoms develop.



Feeding allergenic foods for the first time in most infants is safe. It rarely causes a serious allergic reaction.



You can feed your baby one food at a time to gauge reaction.

Although, some allergists advise that mixtures of these foods (e.g. mixed tree nut butter) can be given.



The food should have a smooth consistency. This helps to make sure your baby isn't at risk of choking.



Feed your baby, rather than having them self-feed (baby-led weaning).


This is because food smeared on a baby's skin may cause skin irritation that can be mistaken for allergy.





Remember, the risk of a baby having a severe reaction the first time they eat a food is extremely low.







0.08% (8/10,000 babies = 1/1250 babies)

WATCH FOR SIGNS OF AN ALLERGIC REACTION

 Allergy symptoms usually develop within minutes of eating a food but can occur up to 2 hours after ingestion.

 Symptoms can be mild such as hives. Note that redness around the mouth may be due to skin irritation rather than allergy.

 More severe symptoms can include:

-  Swelling of the lips, eyes, or face
-  Vomiting
-  Widespread hives on the body
-  Breathing symptoms such as repetitive cough, wheeze, or any difficulty breathing
-  A change in skin colour (pale, blue)
-  Sudden tiredness/lethargy/seeming limp

There can also be behavioural changes such as irritability, inconsolable crying or clinging to a caregiver.



Remember, if there are severe allergy symptoms, seek immediate medical attention/call 911. If the junior dose of an epinephrine auto-injector is on hand, it should be administered to an infant who is having an anaphylactic reaction.

RECIPES

Peanut variations can be made for tree nuts and sesame

ingredients

- Peanut



Whole peanuts are a choking hazard and should not be given to children under 4.

tip

Use a similar type of recipe for tree nuts, sesame (e.g. tahini), a condiment made from sesame, may be used).

directions

- 1 Take 2 tps of smooth peanut butter and add 2-3 tps of hot water.
- 2 Stir until dissolved and well blended.
- 3 Allow to cool.

This mixture can be offered alone or added to an already tolerated infant food (e.g. cereal, pureed fruit).

Another option is a peanut puff product (e.g. Bamba), which can be softened for younger infants.

Egg, soy, fish, & other solids

ingredients

- Egg
- Soy (e.g. tofu), fish, other solids



directions

Boil it, puree it, and mix it with a tolerated infant food.

tip

Both the egg white and egg yolk can be served.

Wheat

ingredients

- Wheat-based cereal for infants



directions

Mix in liquid as directed on package.

tip

Serve as is or warm.

More Tips



Do not place the food on the skin first, as the food may cause an irritant effect that could be misinterpreted as an allergic reaction.



Offer your baby a small amount on the tip of a spoon. Wait 10 minutes. If no symptoms develop, continue to give the rest of the food at your baby's usual pace of eating.



The texture or size of any food should be age-appropriate to prevent choking.

More information

Speak to your doctor if you have any personal questions.



Download more detailed FAQs at foodallergycanada.ca/earlyintro



Email us at info@foodallergycanada.ca



Watch our early intro webinar at foodallergycanada.ca/webinars



Call us at 1 866 785-5660



Learn more about the National Food Allergy Action plan at foodallergycanada.ca/nationalplan



Find an allergist at csaci.ca

04-21E1S

Desensitization

- Process by which you introduce small amounts of a given allergen, progress slowly to try to increase tolerance
- Done with aeroallergen immunotherapy (SCIT&SLIT), done with medications (ASA, etc)
- Now done with foods (OIT)

Milk and Egg

- Known: 75% of children allergic to milk or to egg will tolerate baked forms (heating changes conformational epitopes of the proteins)
- Unknown: long term effects of baked milk inclusion in diet

Dietary baked milk accelerates the resolution of cow's milk allergy in children

Jennifer S. Kim, MD,* Anna Nowak-Węgrzyn, MD,* Scott H. Sicherer, MD, Sally Noone, RN, Erin L. Moshier, MS, and Hugh A. Sampson, MD *New York, NY*

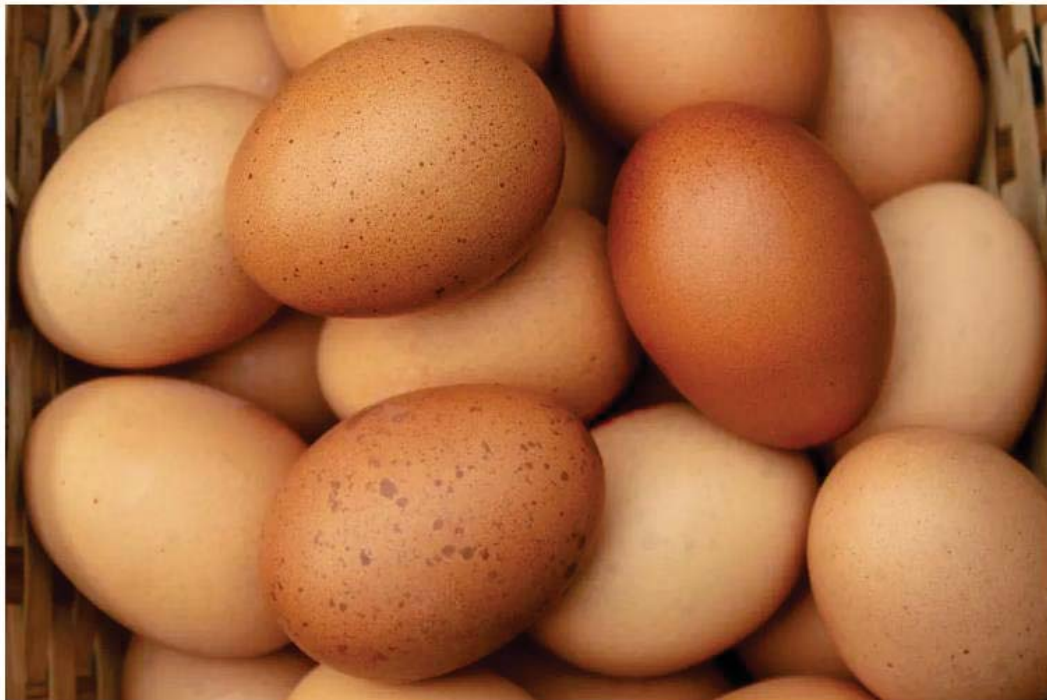
- 88 pts – avg age 6.6yo (2.1-17.3y)
 - 70 passed baked milk challenge
 - 18 others continued to strictly avoid all milk
 - Those who passed ate baked milk 1-3 servings per day
 - After 6 months, were challenged to baked cheese (cheese pizza serving)
 - After 6 months were challenged to unheated milk
- Natural hx control group – 60 pts

TABLE I. Follow-up status of milk allergy

Final follow-up status	Initially baked milk tolerant (n = 65)	Initially baked milk reactive (n = 23)	Active intent-to-treat (n = 88)	Active per-protocol (n = 70)	Comparison (n = 60)
Unheated milk tolerant	39 (60%)	2 (9%)	41 (47%)	41 (59%)	13 (22%)
Baked milk/cheese tolerant	18 (28%)	3 (13%)	21 (24%)	21 (30%)	13 (22%)
Avoiding strictly	8 (12%)	18 (78%)	26 (29%)	8 (11%)	34 (56%)

- Tolerance of baked milk is a favorable px indicator for tolerance of unheated milk
- Introduction of baked milk appears to accelerate the tolerance to unheated milk when compared to avoidance
- Baked milk introduction is safe, convenient, well accepted
- **Prescribing baked milk products represents an important shift in the tx paradigm for milk allergy**

Same for baked egg



- Baked milk and baked egg introduction are considered modified forms of desensitization which can be started or continued at home, done at family's own rhythm

THE MILK LADDER

THE MAP GUIDELINE
MILK ALLERGY IN PRIMARY CARE

STEP	Item	AMOUNT	Notes
STEP 12	Pasteurised milk/ infant formula (powder)	100 mls 200 mls	
STEP 11	Sterilised milk/infant formula (tetra packs)	100 mls 200 mls	
STEP 10	Cheese	25g cheese	Use hard cheese such as Cheddar
STEP 9	Yoghurt	1 pot yoghurt (125ml)	
STEP 8	Milk chocolate (milk chocolate buttons)	10g chocolate Milk chocolate buttons (1/2 bag or 35g)	
STEP 7	Pizza	PURCHASED 1/2 mini pizza 1 mini pizza	HOME-MADE 1/2 pizza 1 pizza
			Choose a pizza that does not contain milk in the base
STEP 6	Lasagne	PURCHASED Lasagne (200g)	HOME-MADE 1 child's portion
STEP 5	Shepherds Pie	PURCHASED Shepherds Pie (200g)	HOME-MADE 1 child's portion
STEP 4	Scotch pancakes	PURCHASED 1 scotch pancake 3 scotch pancakes	HOME-MADE 1/2 scotch pancake 2 scotch pancakes
			Use Scotch pancakes containing milk protein rather than whey powder
			NOTE THAT SCOTCH PANCAKES CONTAIN LESS MILK THAN MUFFINS BUT THEY ARE BAKED FOR A MUCH SHORTER TIME
STEP 3	Mini muffins/ cup cakes	PURCHASED 1/2 muffin/cake (15g) 1 muffin (30g)	HOME-MADE 1/2 muffin 1 muffin
STEP 2	Garibaldi biscuits/ Digestives	PURCHASED 1 biscuit	HOME-MADE 1 biscuit 2 biscuits
			Choose biscuits that contain milk
STEP 1	Malted milk biscuits	PURCHASED 1 biscuit 2 biscuits	HOME-MADE 1/2 biscuit 1 biscuit
			Use malted milk biscuits that contain milk powder rather than whey powder

MAP GUIDELINE

Oct 2013
UK Version

PLEASE SEE OVERLEAF FOR LINK TO ALL HOME-MADE RECIPES

Egg ladder



- Cracked eggshell
- Utensils with raw cake mixture or raw egg
- Processed meat/burger/sausage ↑
- Teacakes™ Milky Way™ Mars™ Snickers™ ↑
- Crème Egg™ Chewits™ ↑
- Hollandaise, Horseradish & Tartar sauces ↑
- Royal™ icing ↑
- Sorbet & Mousse ↑
- Mayonnaise/salad cream ↑
- Marshmallow-with egg (check label) ↑
- Meringue/fresh ice-cream ↑
- Crème caramel & Crème Brûlé ↑
- Scrambled egg ↑

STEP 3 ALMOST RAW

- Omelette ↑
- French Toast ↑
- Quiche ↑
- Yorkshire pudding-with egg (check label) ↑
- Fried/hardboiled egg ↑
- Cooked batter/tempura/breadcrumbs ↑
- Fresh egg pasta & fresh egg noodle ↑

STEP 2 LIGHTLY COOKED

- Pancake ↑
- Dried egg pasta ↑
- Waffle biscuit ↑
- Boudoir™ & Lady's finger™ biscuits ↑
- Baked sponge/muffin/cake/biscuit ↑

STEP 1 WELL COOKED

This ladder is a 2-page guide intended as an educational aid and is designed with the aim of working towards inducing tolerance in those who are egg allergic. Please consult both pages. www.ifan.ie IFAN 2018

Chomyn *et al.*
Allergy Asthma Clin Immunol (2021) 17:83
<https://doi.org/10.1186/s13223-021-00583-w>

Allergy, Asthma & Clinical Immunology

LETTER TO THE EDITOR

Open Access

Canadian food ladders for dietary advancement in children with IgE-mediated allergy to milk and/or egg



Alanna Chomyn^{1*}, Edmond S. Chan¹, Joanne Yeung¹, Timothy K. Vander Leek², Brock A. Williams^{1,3}, Lianne Soller¹, Elissa M. Abrams^{1,4}, Raymond Mak¹ and Tiffany Wong^{1*}

Abstract

Food ladders are clinical tools already widely used in Europe for food reintroduction in milk- and egg-allergic children. Previously developed milk and egg ladders have limited applicability to Canadian children due to dietary differences and product availability. Herein we propose a Canadian version of cow's milk and egg food ladders and discuss the potential role that food ladders may have in the care of children with IgE-mediated allergies to cow's milk and/or egg, as either a method of accelerating the acquisition of tolerance in those who would outgrow on their own, or as a form of modified oral immunotherapy in those with otherwise persistent allergy.

Keywords: Food ladders, Food allergy, Cow's milk allergy, Egg allergy, Oral immunotherapy

To participate in our study on food ladders go to <https://bit.ly/244Tn3C>, or access our survey by scanning the QR code with your mobile phone camera:



CANADIAN MILK LADDER for cow's milk allergy

INSTRUCTIONS

- Start at Step 1 and work your way up to Step 4
- Give the food daily. May be taken with a meal
- Start with a grain or pea sized amount, and over several days or weeks gradually increase to an age appropriate amount
- Once at an age appropriate amount, spend a minimum of 1-3 months in each category, before advancing on to the next category
- If after advancing to the next category there are allergic symptoms, then go back to the lower category for a month before re-trying the higher category

Step
4.


Cheese


Yogurt


Ice Cream


Milk

Step
3.


Pizza


Boiled Milk
(boiling on low for at least 3 minutes)

Step
2.


Waffle


Pancake or Crêpe

Step
1.

Baked Goods with Milk Ingredients


muffin or cupcake


well-baked cookie

Fig. 2 Canadian milk ladder

To participate in our study on food ladders go to <https://bit.ly/244Tn3C>, or access our survey by scanning the QR code with your mobile phone camera:



CANADIAN EGG LADDER for hen's egg allergy

INSTRUCTIONS

- Start at Step 1 and work your way up to Step 4
- Give the food daily. May be taken with a meal
- Start with a grain or pea sized amount, and over several days or weeks gradually increase to an age appropriate amount
- Once at an age appropriate amount, spend a minimum of 1-3 months in each category, before advancing on to the next category
- If after advancing to the next category there are allergic symptoms, then go back to the lower category for a month before re-trying the higher category

Step
4.
(OPTIONAL)


Sunny Side Up, Soft Boiled,
or Lightly Scrambled Egg


Raw Egg
(e.g. ice cream, meringue, buttercream,
cookie dough, mayonnaise)

Step
3.


Hard Boiled or
Steamed Egg


Well-Cooked
Scrambled Egg


French Toast

Step
2.


Pancake or
Crêpe


Waffle


Fresh Egg
Noodles/ Pasta


Egg as a
Binder
(e.g. hamburger
patty, dumplings)

Step
1.

Baked Goods with Egg Ingredients


muffin or cupcake


well-baked cookie


Dried Egg
Noodles/Pasta

Fig. 1 Canadian egg ladder

HOWEVER...

- Other foods do not change significantly with cooking (some may increase their allergenicity such as peanuts with roasting or shrimps with boiling) so these types of informal or modified desensitization cannot be done

Formal Food Oral Immunotherapy

- Regular ingestion of gradually increasing doses of one's allergen over time, to reduce reactivity and increase reaction threshold
- Initially studied in older age groups (≥ 6 yo)
- Goal: prevent reactions to accidental exposures & increase QOL
 - Extensively studied
 - 85-90% success rate for **desensitization**
- **Once started, must continue indefinitely**
- Goal \neq cure
 - Sustained unresponsiveness (?tolerance) may be obtained, but much less frequently

- Burden: allergic rxns, immediate and delayed, can occur during all phases of OIT
 - Must be prepared to tx allergic rxns , willing to use epi
 - May increase anaphylaxis in short term compared with avoidance, appears to decrease over longer time horizon
 - Must take into account cofactors which can change reactivity thresholds
 - Exercise (30-60 minutes before and 2 hours post dose), sleep deprivation, ROH, NSAIDs, fever and viral infections, menses, etc.

- Absolute contra-indications:
 - Poorly controlled asthma
 - Pregnancy
- Relative contra-indications:
 - Active severe AD
 - Pre-existing EoE or EGID
 - Heart disease
 - Use of beta-blockers, ACE inhibitors

- Added degrees of difficulty:
 - Unreliable adherence to protocol
 - Reluctance to use epi
 - Language barrier
 - Severe anxiety
 - Psychiatric barriers
 - Non-collaborative family dynamics
 - Lack of schedule flexibility for dosing
 - Lack of commitment from patient or caregivers

Food, drug, insect sting allergy, and anaphylaxis

Early oral immunotherapy in peanut-allergic preschool children is safe and highly effective



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- 37 PN allergic patients, aged 9-36 months (pos challenge)
- Randomized 1:1 to receive early OIT with 300mg or 3000mg PN protein
- Sustained unresponsiveness at 4weeks = outcome
- ITT - 29/37 achieved SU₄ (78%)
- Per protocol - 29/32 achieved SU₄ (91%)

- 19X more likely to consume dietary PN than matched control grp
- 1 pt received epi, overall safe
- Advantages:
 - Less food aversion/fear
 - Immune system possibly more malleable than in older pts

Original Article

First Real-World Safety Analysis of Preschool Peanut Oral Immunotherapy



Lianne Soller, PhD^{a,b}, Elissa M. Abrams, MD^{b,c,d}, Stuart Carr, MD^e, Sandeep Kapur, MD^{f,g}, Gregory A. Rex, MD^{f,g}, Sara Leo, MD^{b,h}, Per G. Lidman, MD^e, Joanne Yeung, MD^{b,i}, Timothy K. Vander Leek, MD^e, Mary McHenry, MD^{f,g}, Tiffany Wong, MD^{a,b}, Victoria E. Cook, MD, MSc^{b,j}, Kyla J. Hildebrand, MD, MScCH (HPTE)^{a,b}, Thomas V. Gerstner, MD^{c,d}, Raymond Mak, MD^b, Nicole J. Lee, MSc^{a,b}, Scott B. Cameron, MD, PhD^{b,i,*}, and Edmond S. Chan, MD^{a,b,*} *Vancouver and Victoria, BC, Canada; Winnipeg, MB, Canada; Edmonton, AB, Canada; and Halifax, NS, Canada*

JACI In Pr 2019;7:2759-67

- 270 pts 9-71 mo, with PN allergy
- Given PN OIT, daily dosing, increases in hosp Q 2 wks
- Target dose 300mg (=1 peanut)
- 270 pts – 243 reached maintenance
 - 27 dropped out
- 67.8% had rxns during build-up
 - 36.3% grade 1
 - 31.1% grade 2
 - 0.4% grade 4

Original Article

First Real-World Effectiveness Analysis of Preschool Peanut Oral Immunotherapy



Lianne Soller, PhD^{a,b}, Elissa M. Abrams, MD^{b,c,d}, Stuart Carr, MD^e, Sandeep Kapur, MD^{g,h}, Gregory A. Rex, MD^{g,h}, Sara Leo, MD^{b,j}, Mary McHenry, MD^{g,h}, Timothy K. Vander Leek, MD^{e,f}, Joanne Yeung, MD^{b,j}, Victoria E. Cook, MD^{b,k}, Tiffany Wong, MD^{a,b}, Kyla J. Hildebrand, MD^{a,b}, Raymond Mak, MD^b, Thomas V. Gerstner, MD^{c,d}, Scott B. Cameron, MD, PhD^{b,k,s}, and Edmond S. Chan, MD^{a,b,*} Vancouver and Victoria, BC, Canada; Winnipeg, MB, Canada; Edmonton, AB, Canada; and Halifax, NS, Canada

JACI In Pr 2021;9:1349-56

- Aim: determine effectiveness of preschool PN-OIT after 1 year of maintenance
- 117 pts successfully completed 1 year of PN-OIT and underwent cumulative 4000mg FU OFC(=13-15 peanuts)
 - 92/117 (=78.6%) had negative OFC
 - 115/117 (=98.3%) tolerated cumulative dose \geq 1000mg (= 3-4 peanuts) ****This provides 99% protection from accidental exposures****
 - 25 who reacted increased threshold 3376mg from baseline to FU (2884-3868mg)

- *“We hypothesize that once preschoolers have eaten PN regularly post-OIT for roughly a decade before reaching the less-adherent adolescent years, tolerance will probably occur.”*

Real-world peanut OIT in infants may be safer than non-infant preschool OIT and equally effective



Lianne Soller, PhD^{a,b}, Stuart Carr, MD^c,
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and Edmond S. Chan, MD^{a,b,*}

Palförzia
Peanut (*Arachis hypogaea*)
Allergen Powder-dnfp

**FDA U.S. FOOD & DRUG
ADMINISTRATION**



The U.S. Food and Drug Administration has approved the first ever drug to treat peanut allergy, a life-threatening condition mainly for kids. Aimmune Therapeutics Inc.'s Palförzia [Peanut (*Arachis hypogaea*) Allergen Powder-dnfp] can now be used to treat patients aged 4 through 17 years.

- Approved Jan 2020, \$890US/month (\$11,000/year!!!)

Food for thought...

