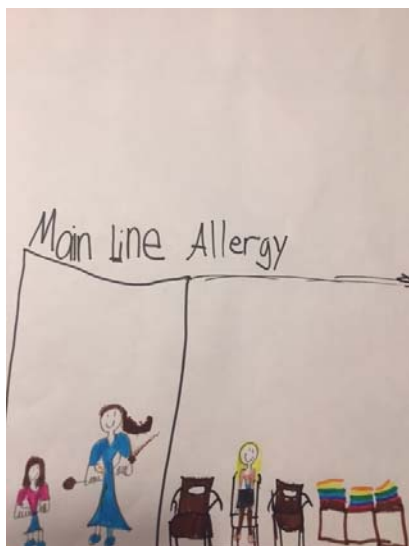


Food Challenges in the Office

Practical Advice



Why Challenge?

- ▶ Confirm a questionable allergic reaction to food
- ▶ Evaluate for resolution of a food allergy
- ▶ Unclear significance of a positive skin or blood test

National Jewish Data

Table II. OFC results on foods avoided due to immunoassay or PST

Food group	Avoiding on admission	OFC positive result	OFC negative result	Avoiding on discharge	% Negative
Egg	10	1	9	1	90%
Fruits	10	2*	8	2	80%
Meats	13	0	13	0	100%
Milk	9	0	9	0	100%
Oats	4	0	4	0	100%
Peanut	7	1	6	1	86%
Shellfish	2	0	2	0	100%
Soy	19	1	18	1	95%
Vegetables	6	0	6	0	100%
Wheat	13	3	10	3	77%
Other	18	0	18	0	100%
Totals	111	8	103	8	93%

Table III. OFC results on foods avoided due to previous reaction

Food group	Avoiding on admission	OFC positive result	OFC negative result	Avoiding on discharge	% Negative
Egg	23	5	18	5	78%
Fruits	11	0	11	0	100%
Meats	7	1*	6	1	86%
Milk	14	3	11	4†	79%
Oat	3	1	2	1	67%
Peanut	10	3	7	3	70%
Shellfish	1	0	1	0	100%
Soy	13	3	10	3	77%
Tree nuts	6	0	6	0	100%
Vegetables	7	1*	6	1	86%
Wheat	5	1	4	1	80%
Other	22	2*	20	2	91%
Totals	122	20	102	21	84%

Fleischer, J Peds 2011

Double-blind, placebo-controlled food challenge (DBPCFC) as an office procedure: A manual

- ▶ “There is now enough experience with the use of double-blind, placebo-controlled, food challenge (DBPCFC) to recommend its use as an office procedure for most patients complaining of adverse reactions to foods...
- ▶ For those foods to which challenges are positive, longitudinal evaluation with repeated challenge at appropriate intervals help to determine whether or not the problem will resolve over a period of time.”

Bock et al JACI 1988

Open Food Challenge

- ▶ Most cost and time efficient form of challenge but most subject to bias
- ▶ Unmasked and unblinded feeding of food in natural form
- ▶ Appropriate when objective symptoms are anticipated and concern for bias is low
- ▶ Typically used in office setting
- ▶ Negative rules out allergy
- ▶ Risk of false positive
 - ▶ Feel patient/family out on how far to push subjective symptom:
 - ▶ Patient/family may be comfortable avoiding
 - ▶ Potentially repeat challenge blinded



Factors to consider in deciding to challenge

- ▶ Patient's history
 - ▶ Medical history
 - ▶ History of reaction to food
- ▶ SPT size and food-specific IgE levels
- ▶ Nutritional importance of the food
- ▶ Quality of life factors associated with avoidance
 - ▶ Low dose food challenges or contact challenges can alleviate anxiety and help with school planning



CUTOFF VALUES For Food Challenges

Food	>50% React	>95% react	>95% (< age 1-2)
Milk	IgE 2 kU/L	IgE 15 kU/L SPT 8 mm	IgE 5 kU/L SPT 6 mm
Egg	IgE 2 kU/L	IgE 7 kU/L SPT 7 mm	IgE 2 kU/L SPT 5 mm
Peanut	IgE 2 kU/L (history) IgE 5 kU/L (no history)	IgE 14 kU/L SPT 8 mm Infant Australian population (IgE 34/SPT 8 mm)	SPT 4 mm
Fish	IgE 20 kU/L		
Walnut	IgE 18 kU/L		

Järvinen KM, Sicherer SH. Diagnostic oral food challenges: Procedures and biomarkers. J Immunol Methods. 2012; 383(1-2):30-8. Peters JACI 2013;132;874.

Peanut cutoffs Whole vs Ara h 2

sIgE	Thresh- old, kU/l	Sensi- tivity, %	Speci- ficity, %	PPV	NPV
Whole peanut	0.10	100.00	56.00	0.77	1.00
	0.35	97.22	72.00	0.83	0.95
	0.50	94.44	76.00	0.85	0.90
	1.00	86.11	84.00	0.89	0.81
	5.00	63.89	100.00	1.00	0.66
	15.00	36.11	100.00	1.00	0.52
Ara h 2	0.10	94.44	96.00	0.97	0.92
	0.35	94.44	100.00	1.00	0.93
	0.50	75.00	100.00	1.00	0.74
	1.00	63.89	100.00	1.00	0.66
	5.00	38.89	100.00	1.00	0.53
	15.00	25.00	100.00	1.00	0.48

Supplies



FOOD PREPARATION	TREATMENT*
Microwave for heating food	Epinephrine (calculate dose)
Measuring cups and spoons	Antihistamine
Gram Scale	Albuterol
Disposable plates and utensils	Oxygen and supplies
Mortar and pestle	IV fluids
Preparation area free from other food	FPIES: Pedialyte and Ondansetron**

*Same emergency equipment for immunotherapy

**International consensus setting should have immediate access to IVF JACI 139 2017

Challenge food

- ▶ Brought from home by family
- ▶ Preferably single ingredient foods without risk of cross-contact
 - ▶ Can have family shell nuts at home
- ▶ Heating can change allergenicity
 - ▶ Least cooked/processed form should be challenged
 - ▶ Form that will be introduced at home
 - ▶ Steak vs ground beef
 - ▶ Fresh fruits and vegetables
 - ▶ Raw vs cooked seafood
 - ▶ Fresh vs canned tuna



Challenge to multiple foods

- ▶ Can challenge two foods in one day with a 2 hours break in between (as long as history is not of delayed reaction to the food)
- ▶ Can challenge cross-reactive foods together (seafood, tree nuts) either mixed or sequentially
 - ▶ Almond/hazelnut
 - ▶ Pistachio/cashew
 - ▶ Pecan/walnut
 - ▶ Crustacean shellfish (shrimp, crab, lobster)
 - ▶ Mollusk (oyster, scallop, clam, mussel)

Nowak-Wegrzyn et al JACI 2009

Dosing Schedule

- ▶ Total dose is administered in graduated increments
 - ▶ Lowers risk of reaction
 - ▶ Identify lowest provoking dose
- ▶ Every 15-20 minutes
 - ▶ Most acute reactions occur in this time period
 - ▶ Adjust based on history
- ▶ Followed by open feeding with age appropriate serving

Nowak-Wegrzyn et al JACI 2009

Challenge doses

- ▶ Total dose
 - ▶ 8-10 g dry food
 - ▶ 16-20 g meat or fish
 - ▶ 100 ml wet food
 - ▶ Should correspond with a serving (1 egg, 150 ml milk)
- ▶ Initial dose
 - ▶ 0.1-1% total dose
 - ▶ Lower than expected threshold dose if known
- ▶ Escalation
 - ▶ Graded challenge: double or semi logarithmic increase
 - ▶ 3, 10, 30, 100, 300, 1000, 3000 mg of food protein
 - ▶ Milk (cow's or soy): .1 ml, .3 ml, .9 ml, 3 ml, 9 ml, 30 ml, 90 ml

Nowak-Wegrzyn et al JACI 2009

Portion Size

- ▶ Milk/dairy
 - ▶ 6-8 oz milk or infant formula
 - ▶ ½-1 cup yogurt or cottage cheese
 - ▶ ½-1oz hard cheese
- ▶ Soy/legumes
 - ▶ ½-1 cup soy beverage
 - ▶ ½-1 cup tofu
 - ▶ ½-1 cup cooked beans (kidney, pinto, chickpeas, lentils)
- ▶ Egg
 - ▶ 1 slice of French toast (1 egg per 1 slice of bread)
 - ▶ 1 hard boiled or scrambled egg
- ▶ Grains (rice, corn, wheat, rye, barley, oat)
 - ▶ ½-1 cup pasta/rice
 - ▶ ½-1 oz cereal
 - ▶ ½-1 slice bread, muffin or roll
- ▶ Meats/Seafood
 - ▶ 2-3 oz cooked lean meat/poultry
 - ▶ 2-3 oz cooked fish
 - ▶ Shellfish 2-3 oz shellfish
- ▶ Peanut
 - ▶ 2 tablespoons peanut butter (30 g)
- ▶ Tree nuts
 - ▶ 30-40 g crushed tree nuts = 25-30 pieces
- ▶ Seeds
 - ▶ 10-15 g seeds = 1-2 teaspoons seeds

*Depending on the age of the patient, adjustment of portion size is recommended
Nowak-Wegrzyn et al JACI 2009

Example dosing schemes

- ▶ May use flours and powders (wheat flour, peanut flour, soy flour, egg powder, skim milk powder)
 - ▶ Allows precise measurements of pure food without fats to decrease absorption
 - ▶ Needs to be followed with serving of food in form that will be served
- ▶ Peanut butter
 - ▶ 1/64 tsp, 1/32 tsp, 1/16 tsp, 1/8 tsp, 1/4 tsp, 1/2 tsp, 1 tsp, 2 tsp, 1 Tbsp
- ▶ Egg (French toast, scrambled, hard boiled)
 - ▶ Divide into 8 pieces then:
 - ▶ 1/4 (=1/32), 1/2, 3/4, 1, 1 1/2, 1 3/4, 2 1/4 (can serve yolk last with hard boiled egg)
- ▶ Wheat
 - ▶ 1 slice wheat bread (divided as with egg)
 - ▶ Wheat Chex (1/2 cup)
- ▶ Other foods
 - ▶ Look at nutrition label for serving size and protein content
 - ▶ Work backwards with gradually increasing amounts starting with a dose unexpected to cause a reaction

Patient preparation

- ▶ Documental of informed consent
 - ▶ Review risks, benefits, outcome, implications of positive or negative challenge
 - ▶ Advise timing, potential for additional hours if positive reaction
- ▶ Patient must be in good health at the time
 - ▶ Allergic rhinitis, asthma, atopic dermatitis under control
 - ▶ Should not have medical condition that anaphylaxis or treatment would pose significant risk (cardiac, pregnancy)
 - ▶ Should not have any illness with symptoms that could confuse interpretation
- ▶ Discontinue medications that may interfere with results or treatment of anaphylaxis
 - ▶ Antihistamines (same timing as skin test instructions)
 - ▶ Short acting bronchodilator
 - ▶ NSAIDS, ACE inhibitors, antacids can increase reactivity
 - ▶ B-Blockers
- ▶ Food should be eliminated for at least 2 weeks

Nowak-Wegrzyn et al JACI 2009

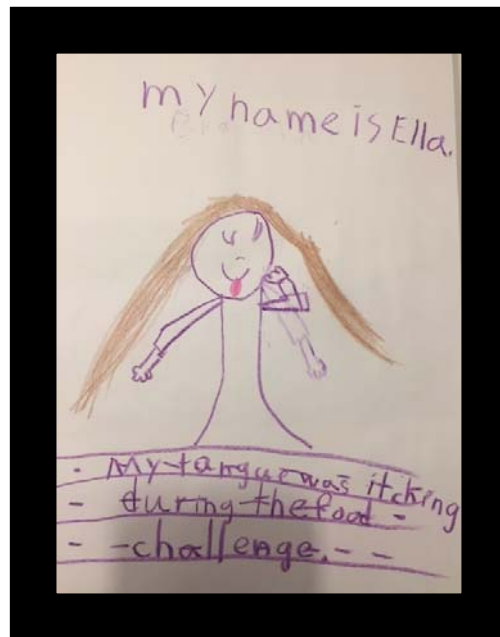
Patient Preparation

- ▶ Should not eat prior to challenge
 - ▶ Fasting enhances absorption of food
 - ▶ Light meal if needed in young children
- ▶ Parents should have provisions to keep child entertained
- ▶ Bring change of clothes in the event of vomiting (parent)
- ▶ Bring familiar cups, plates, utensils for child
- ▶ Bring flavorings and other food for picky eaters
 - ▶ Chocolate syrup
 - ▶ Ketchup
 - ▶ Maple syrup
 - ▶ Crackers
 - ▶ Apples
- ▶ Confirm family has epinephrine autoinjector with them



Challenge Procedure

- ▶ Baseline
 - ▶ Vital signs (RR, HR, BP)
 - ▶ Spirometry, especially asthmatics
- ▶ Calculate epinephrine dose, consider drawing up for higher risk challenges (or use autoinjector)
- ▶ Flow sheet to record dose, time, signs and symptoms, treatment
 - ▶ Include weight and calculated medication dosages
- ▶ Patient should be supervised by a physician and nurse throughout procedure
 - ▶ Supervising physician should be available in office
 - ▶ Patient should be re-examined before each dose
 - ▶ Food residue should be wiped off to avoid contact reaction



Symptoms during challenge

- ▶ Examine oropharynx, chest, skin with any signs of reaction
- ▶ Measure vital signs
- ▶ Spirometry if respiratory symptoms (lags behind clinical symptoms)
- ▶ With subjective symptoms (throat, mouth, skin itch; nausea, abdominal pain) observe for a period to allow resolution before administering subsequent dose
- ▶ Challenge should be stopped with objective symptoms
 - ▶ Transient perioral hives from contact, or vomiting with anxiety/distaste may not need to stop
 - ▶ Treatment is based on symptoms (mild vs anaphylaxis)
 - ▶ Vitals every 15 minutes (or less) and every 30-60 minutes after resolution
 - ▶ Depending on severity, patient may need to be transported to ER

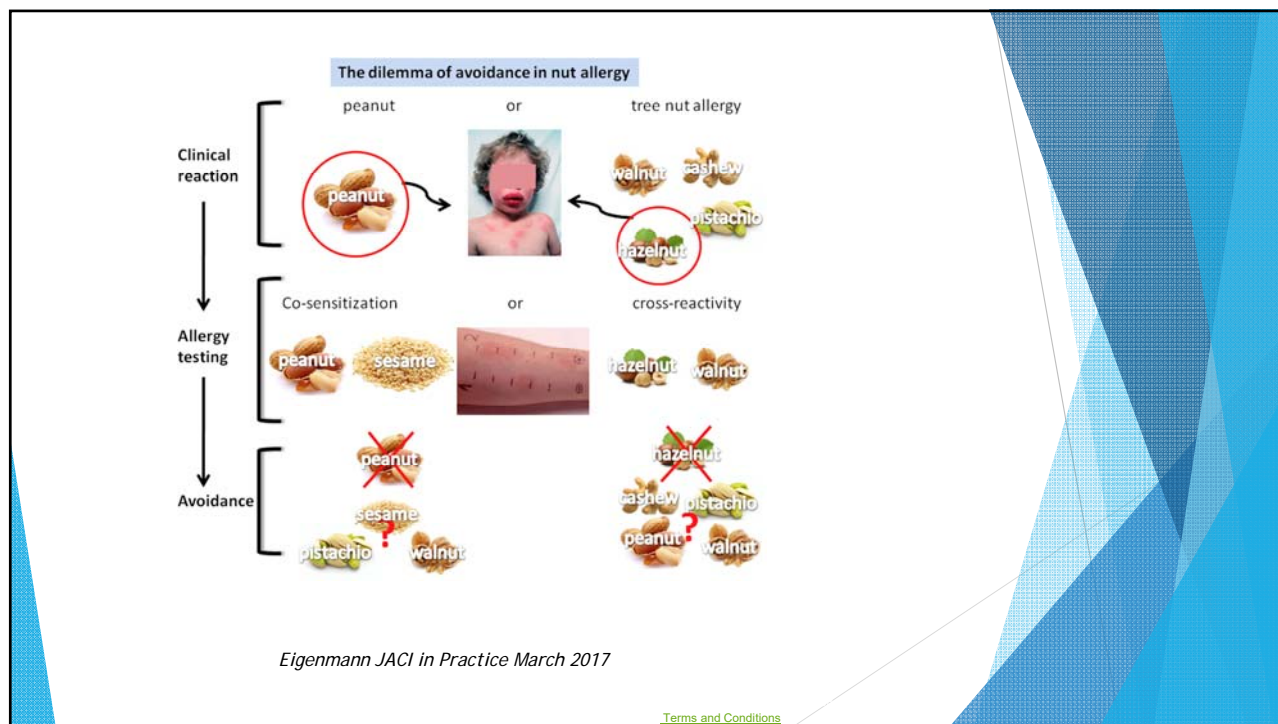
Discharge

- ▶ Negative challenge
 - ▶ 1-2 hours of observation for immediate-type reactions
 - ▶ 4 hours for FPIES
 - ▶ Food should be regularly ingested at home
- ▶ Positive challenge
 - ▶ Observe patient after symptoms have resolved with treatment for the duration based on clinical judgement
 - ▶ 2-4 hours after resolution for immediate-type reactions and 6 hours for FPIES usually recommended
 - ▶ Biphasic reactions rare after food challenges, but review action plan and way to contact physician on call

8-year-old with peanut allergy

- ▶ Hives and facial swelling with peanut butter cracker at 3 years of age
 - ▶ Eating Nutella (hazelnut) and drinking almond milk
- ▶ Skin test positive to peanut
 - ▶ Advised to avoid peanut and all tree nuts
- ▶ Age 5 tested to peanut and tree nuts
 - ▶ Positive to peanut, cashew and pistachio





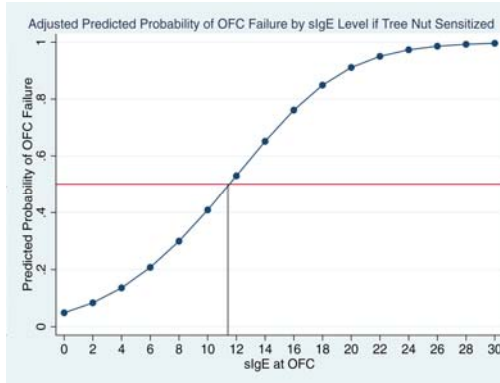
Current options in the management of nut allergy

Options	Pro	Con
Avoid index nut	No other safe option	
Avoid all nuts, including clinically tolerated nuts	<ul style="list-style-type: none"> Decreases the risk of accidental reactions due to cross-contamination Easier avoidance of all nuts than specific ones 	<ul style="list-style-type: none"> Extensive dietary restriction possibly decreasing the quality of life Possibly increased risk of becoming allergic to nuts previously tolerated
Continue eating nuts previously tolerated, and introduce nuts likely to be tolerated after OFC	<ul style="list-style-type: none"> Tailored avoidance diet may increase quality of life Possibly decreases the risk of also becoming allergic to these nuts 	<ul style="list-style-type: none"> Increases the risk of accidental reactions due to cross-contamination, or confusion in identifying nuts Possibly increases the risk of becoming allergic to these nuts

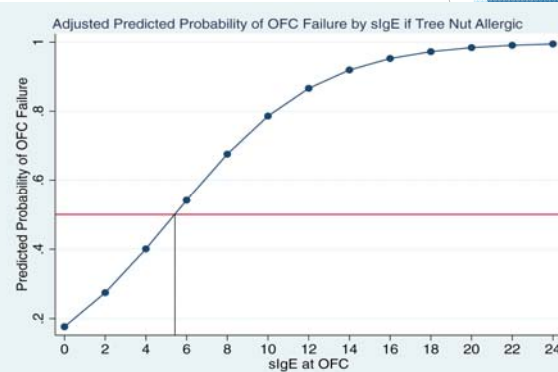
Eigenmann JACI in Practice March 2017

50% NPV with Tree Nut Sensitization or Tree Nut Allergy (to other TN)

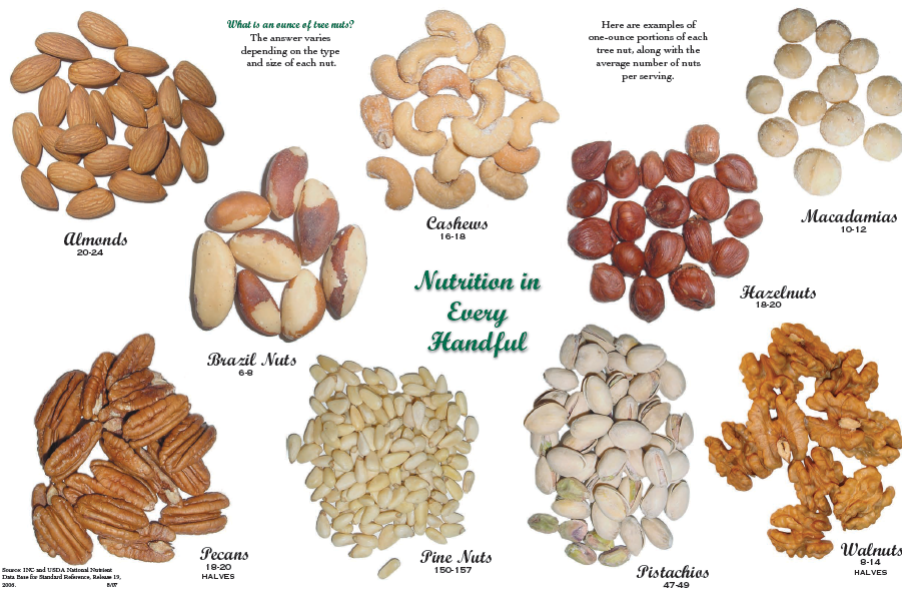
Sensitized to tree nut



Allergic to other tree nut



Couch et al *Annals of Allergy, Asthma & Immunology* 2017 118, 591-96



Tree nuts/Peanut

Nut	Nuts per 1 oz serving	Grams Protein
Almond	22	6
Brazil nut	6	4
Cashew	18	5
Hazelnut	21	4
Macadamia	11	2
Pecan	19 halves	3
Pine Nut	167 (<1/4 cup)	4
Pistachio	49	6
Walnut	14 Halves	4
Peanut	32	8

USDA National Nutrient Database

ImmunoCAP Nut components

	Profilin	PR-10 protein	LTP	Storage Proteins
PEANUT 	Profilin	Ara h 8	Ara h 9	Ara h 1 Ara h 2 Ara h 3
HAZEL NUT 	Profilin	Cor a 1	Cor a 8	Cor a 9 Cor a 14
WALNUT 	Profilin		Jug r 3	Jug r 1
BRAZIL NUT 	Profilin			Ber e 1
CASHEW NUT 	Profilin			Ana o 3

Extensively heated milk and egg



- 70-75% of egg and milk allergic children tolerate milk or egg in a baked good (such as a muffin)
- Tolerance to baked milk and egg precedes tolerance to unheated milk and egg
- Baked milk-tolerant children have milder allergy than baked milk-reactive children
- Baked egg-tolerant children tend to develop tolerance more quickly
- Incorporating baked milk and egg to diet appears to accelerate tolerance

Nowak-Węgrzyn, et al, *JACI* 2008; Kim J, et al, *JACI* 2011

Lemon-Mule, et al, *JACI* 2008; Leonard, et al, *JACI* 2012

Suggested Cut-off Values

▶ Baked Milk

- ▶ Casein IgE < 5 kUA/L
- ▶ Cow's Milk IgE < 5-10 kUA/L
- ▶ Casein < 0.35 kUA/L 100% NPV
- ▶ CM Skin test < 5-7 mm 100% NPV
- ▶ CM Skin test > 15 50-100% PPV

▶ Baked Egg

- ▶ Egg white IgE 1.23-7.38 kUA/L
- ▶ Egg white skin test 8-11 mm
- ▶ Ovomucoid IgE 0-4.4 kUA/L

Leonard et al *JACI in Practice* January-February 2015

Baked Egg and Baked Milk Challenges

- ▶ Recipe provided by office for parents to prepare
- ▶ Challenge dose is usually 1 muffin
- ▶ Milk: each muffin contains 1.3 oz/g milk (1 cup per 6 muffins)
- ▶ Egg: each muffin contains 1/3 egg (2 grams or 2 eggs per 6 muffins)
- ▶ Divide muffin in 8 and administer 1/8 muffin every 15 minutes
- ▶ Accelerated schedule: 1/8 muffin, 1/8 muffin, 1/4 muffin, 1/2 muffin

Egg Muffin Jaffe

- ▶ 1 cup flour (or flour substitute)
- ▶ 1/4 tsp salt
- ▶ 2 Tbsp of rice milk (or soy milk, cow's milk, almond milk)
- ▶ 1 tsp baking powder
- ▶ 1/4 tsp cinnamon
- ▶ 2 eggs
- ▶ 1/2 cup sugar
- ▶ 1/4 cup corn oil
- ▶ 1/2 tsp vanilla
- ▶ 1 cup ripe banana or apple

Preheat oven 350° F, 30-35 minutes, combine dry ingredients and mix with wet ingredients. Pour in 6 prepared muffin cups and bake for 30 minutes.

Simple Egg Muffin

- ▶ Jiffy Muffin Mix
- ▶ 2 eggs instead of 1
- ▶ Yield 6 muffins
- ▶ Bake 350° F 30 minutes



Baked Milk Muffin Jaffe

- ▶ 1 cup cow's milk
- ▶ 2 Tbsp canola oil
- ▶ 1 tsp vanilla
- ▶ 1 egg or 1 ½ tsp egg replacer (e.g. Ener-G brand)
- ▶ 1 ¼ cup flour
- ▶ ½ cup sugar
- ▶ ¼ tsp salt
- ▶ 2 tsp baking soda
- ▶ Preheat oven to 350° F. Combine dry ingredients and mix with wet ingredients. Pour into muffin cups and bake for 30-35 minutes, or until golden brown and firm to the touch. Yields 6-12 muffins (dose 1-2 muffins)

Banana Milk Recipe

- ▶ 2 cups flour
- ▶ 2/3 nonfat dry milk powder (1/3 dry milk = 1 cup milk)
- ▶ 2 teaspoons baking powder
- ▶ 1/2 teaspoon cinnamon
- ▶ 2 eggs (or substitute if egg allergic)
- ▶ 2 cups (about 4 medium) mashed ripe bananas
- ▶ 1 cup sugar
- ▶ ½ cup vegetable oil
- ▶ Preheat oven to 350°F. Grease 12 muffin tins. In medium bowl, stir together flour, dry milk, baking powder and cinnamon. In large bowl, beat eggs, bananas, sugar and vegetable oil. Gradually add flour mixture. Spoon into prepared pan. Bake for 30 minutes or until wooden pick inserted near center comes out clean. Dose will be 1 muffin.

Baked Milk with Cake Mix

- ▶ Yellow Cake Mix
- ▶ Replace water with 1 cup milk PLUS 1/3 cup dried milk powder (mix the powdered milk into the cup of wet milk)
- ▶ 1/3 cup Vegetable Oil
- ▶ 3 large eggs or egg-replacer equivalent
- ▶ Preheat oven to 350°F . Place 24 baking cups in cupcake tins. BLEND dry mix, milk, milk powder, oil and eggs (or egg replacer) in large bowl at low speed until moistened (about 30 seconds). BEAT at medium speed for 2 minutes. POUR batter in pans.. BAKE for 18-21 minutes or until toothpick inserted in center comes out clean. COOL in pan on wire rack for 15 minutes. Dose will be 2 muffins.

Baked Egg Diet Instructions

Your child MAY NOW EAT the following:

- ▶ Store-bought baked products with egg/egg ingredients listed as the third ingredient or further down the list of ingredients.
- ▶ Home-baked products that have no more than one third of a baked egg per serving. For example, a recipe that has 2 eggs/batch of a recipe that yields 6 servings.
- ▶ All baked products must be baked throughout and not wet or soggy in the middle.

Your child SHOULD CONTINUE TO AVOID unbaked egg and egg-based foods such as the following:

- ▶ Baked products with egg listed as first or second ingredient
- ▶ Caesar salad dressing
- ▶ Custard
- ▶ Eggs in any form such as hard- or soft-boiled, scrambled, or poached
- ▶ Egg noodles
- ▶ French toast/pancakes
- ▶ Homemade waffles
- ▶ Frosting containing egg
- ▶ Ice cream
- ▶ Mayonnaise
- ▶ Quiche

Leonard et al JACI in Practice January-February 2015

Baked Milk Diet Instructions

Your child MAY NOW EAT the following:

- ▶ Store-bought baked products with CM/CM ingredient listed as the third ingredient or further down the list of ingredients.
- ▶ Home-baked products that have no more than one-sixth cup of CM per baked milk serving. For example, a recipe that has 1 cup CM per batch of a recipe that yields 6 servings.
- ▶ Remember to check store-bought products and ingredients on the basis of your child's food allergies to avoid a reaction to other allergens.
- ▶ All baked products must be baked throughout and not wet or soggy in the middle.

Your child SHOULD CONTINUE TO AVOID unbaked milk and CM-based foods such as the following:

- ▶ Baked products with CM listed as first or second ingredient
- ▶ Products that may have a CM ingredient that has not been baked such as a CM ingredient containing frosting on a cookie or cupcake or a cheese flavoring on a cracker that may not have been baked (eg, flavorings may be applied topically after the product is baked)
- ▶ Milk chocolate chips that will melt during baking but not "bake." Please continue to use CM-free chocolate chips
- ▶ Regular milk or dairy in any form including whole, low-fat, nonfat, or skim CM, lactose-free products, dry milk powder, yogurt, sour cream, butter, hard and soft cheeses, ice cream/sherbet, butter, etc
- ▶ Frostings with a CM ingredient
- ▶ French toast/pancakes
- ▶ Homemade waffles
- ▶ Cooked milk products that are not baked such as puddings

Leonard et al JACI in Practice January-February 2015

Baked Cheese

- ▶ After 6-12 months of baked milk ingestion can offer a baked cheese challenge'
- ▶ Amy's pizza cooked 425° F 13 minutes
- ▶ Serving is 1/3 pizza



INFANTS

- ▶ In the LEAP study, high risk infants (egg allergy, eczema) had a decreased rate of peanut allergy if introduced between 4-11 months
- ▶ 2016 NIAID recommendations include supervised open feeding or graded food challenge in high risk infants with 3-8 mm peanut skin test



Infant preparation

- ▶ Light meal (1/2 normal size) may be given 2 hours before challenge
- ▶ Schedule challenge at normal meal time
- ▶ Do not schedule at nap time
- ▶ LEAP
 - ▶ 3.9 g cumulative if skin test positive
 - ▶ 2 g open feeding if skin test negative
- ▶ Texture:
 - ▶ Liquids and soft purees by 4-6 months
 - ▶ Thicker purees and foods that dissolve between 7-9 months
 - ▶ Verify what textures is tolerated at home
- ▶ Oral aversion
 - ▶ Food preference vs allergy
 - ▶ Parents should provide different food options

Bird et al JACI in Practice 2016

Emergency Medications for Infants

Medication	Dose
Epinephrine (1:1000 concentration)	0.01 mg/kg IM in the mid-outer thigh in health care settings OR 0.15 mg autoinjector IM in the mid-outer thigh in community settings ¹
Albuterol nebulization	0.15 mg/kg every 20 min × 3 doses (minimum of 2.5 mg per dose) over 5-15 min
Albuterol MDI inhalation	2 puffs, 90 mcg/puff, with face mask
Oxygen	8-10 L/min via face mask
Diphenhydramine	1.25 mg/kg/dose PO/IM/IV
Cetirizine	2.5 mg PO
Normal saline (0.9% isotonic solution) or lactated ringers	20 mL/kg/dose administered over 5 min
Steroids	Prednisolone 1 mg/kg PO OR Solu-Medrol 1 mg/kg IV

Bird et al JACI in Practice 2016

Anaphylaxis in infants

Age	Vitals
When is it hypotension?	Systolic blood pressure (mm Hg)
Infants (1-12 mo)	<70
1-10 y	(Age × 2) + 70
When is it tachypnea?	Respiratory rate
2-12 mo	≥50 breaths/min
1-4 y	≥40 breaths/min
When is it tachycardia?	Heart rate
<2 y	>160 beats/min

Bird et al JACI in Practice 2016

General instructions:

There are 5 incremental doses in the observed challenge. Doses may be given 15 to 20 minutes apart. Observe for symptoms of reactivity before giving the subsequent dose.

The measurement of a "level" measuring teaspoon used in this protocol is recommended over the measurement of a "rounded" teaspoon used in Du Toit et al² to promote consistency and ease of measurement. The peanut protein content is however similar.

OPTION 1: Smooth Peanut Butter Puree Recipe (3.96 g peanut protein)

Option 1 Instructions:

1. Measure peanut butter dose 1.
2. Add measured dose 1 previously tolerated infant puree fruit or vegetable to the measured peanut butter dose. Stir until well blended.
3. May adjust the infant puree amount to achieve desired consistency.
4. Label dose 1.
5. Repeat steps 1-3 for doses 2-5; labeling the finished dose with the appropriate dose number.
6. Feed dose 1 and observe for symptoms of reactivity for 15-20 minutes.
7. If no symptoms, repeat with doses 2-5 observing for symptoms of reactivity for 15-20 minutes between each dose.

Dose	Peanut butter (teaspoon)*	Equivalent weight (g), (Peanut protein content [g]) [†]	Pureed fruit or vegetable volume (teaspoon)	Total volume (teaspoons)
1	1/8	0.67 (0.15)	1/2	5/8
2	1/4	1.33 (0.29)	3/4	1
3	1/2	2.67 (0.59)	1	1 1/2
4	1	5.33 (1.17)	2	3 1/4
5	1 1/2	8 (1.76)	4	5 1/2
		Total protein: 3.96 g		

OPTION 2: Smooth Thinned Peanut Butter Recipe (3.96 g peanut protein)**Option 2 Instructions:**

1. Measure peanut butter dose 1.
2. Slowly add measured dose 1 hot water and stir until peanut butter is dissolved, thinned and well blended.
3. May adjust water volume (or add previously tolerated infant cereal) to achieve desired consistency.
4. Label dose 1.
5. Repeat steps 1-3 for doses 2-5, labeling the finished dose with the appropriate dose number.
6. Check the final temperature of the thinned peanut butter before serving. It should no longer be hot.
7. Feed dose 1 and observe for symptoms of reactivity for 15-20 minutes.
8. If no symptoms, repeat with doses number 2-5 observing for symptoms of reactivity for 15-20 minutes between each dose.

Dose	Peanut butter (teaspoons)*	Equivalent weight (g), (Peanut protein content [g])	Volume of hot water (teaspoons)	Total volume (teaspoons)
1	1/8	0.67 (0.15)	1/8	1/4
2	1/4	1.33 (0.29)	1/4	1/2
3	1/2	2.67 (0.59)	1/2	1
4	1	5.33 (1.17)	1	2
5	1 1/2	8 (1.76)	1 1/2	3 1/2
		Total protein: 3.96 g		

OPTION 3: Peanut flour or peanut butter powder (3.88 g peanut protein)**Option 3 Instructions:**

1. Measure peanut flour or peanut butter powder dose 1.
2. Slowly add dose 1 of previously tolerated pureed fruit or vegetable to dose 1 peanut flour or peanut butter powder and stir until well-blended. You may increase or reduce volume of puree to achieve desired consistency. Note: increasing the volume may increase the difficulty of getting through the entire protocol with a young baby.
3. Label dose 1.
4. Repeat steps 1-3 for doses 2-5, labeling the finished dose with the appropriate dose number.
5. Feed dose 1 and observe for symptoms of reactivity for 15-20 minutes.
6. If no symptoms, repeat with doses number 2-5 observing for symptoms of reactivity for 15-20 minutes between each dose.

Dose	Peanut flour or peanut butter powder (teaspoon)*	Equivalent weight (g), (Peanut protein content [g])	Pureed fruit or vegetable volume (teaspoon)	Total volume (teaspoon)
1	1/8	0.25 (0.13 g)	1/2	~3/4
2	1/4	0.5 (0.25 g)	1	1 1/2
3	1/2	1.0 (0.5 g)	2	2 1/2
4	1	2.0 (1.0 g)	3 1/2	4
5	2	4.0 (2.0 g)	6	8
		Total protein: 3.88 g		

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OPTION 4: Bamba peanut snack (Osem) (3.9 g peanut protein)**Option 4 Instructions:**

1. Measure Bamba sticks for dose 1.
2. Prepare the first dose:
 - a. Slowly add hot water to measured Bamba and stir until peanut solution is dissolved, thinned, and well blended. You may increase or decrease the water volume to achieve desired consistency.
3. Label dose 1.
4. Repeat steps 1-3 for the remaining doses 2 through 5, labeling the finished dose with the appropriate dose number.
5. Check the final temperature of the thinned Bamba solution before serving. It should no longer be hot.
6. Feed dose 1 to infant and observe for symptoms of reactivity for 15-20 minutes.
7. If no symptoms appear, repeat with doses 2-5 observing for symptoms of reactivity for 15-20 minutes between each dose.

Dose	Bamba dose (sticks)	Equivalent weight (g), (Peanut protein content [g]) ^a	Volume of hot water ^a (teaspoons) (approximate – will need to be adjusted for each child)	Total volume (teaspoons)
1	1	0.81 (0.1)	1/2	~3/4
2	3	2.43 (0.3)	1	~1 1/2
3	5	4.05 (0.5)	1 1/2	~2 1/4
4	10	8.1 (1.0)	3 1/2	~4
5	21	17.01 (2.0)	6	~7 1/2
		Total protein: 3.9 g		

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Interpreting challenge

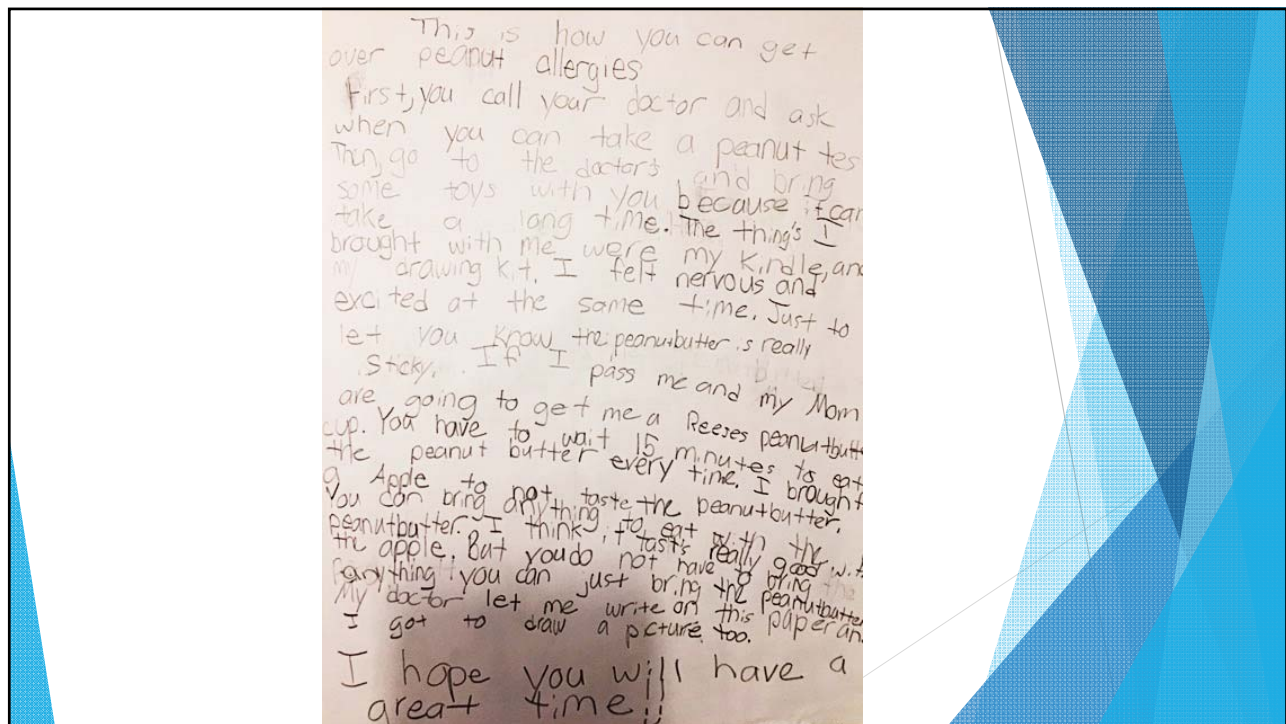
- ▶ Because infants are nonverbal, results may be equivocal
- ▶ Subtle symptoms:
 - ▶ Ear picking
 - ▶ Tongue rubbing
 - ▶ Hand in mouth
 - ▶ Neck scratching
 - ▶ Irritability
 - ▶ Clinging to caregiver
 - ▶ Inconsolable crying
 - ▶ Somnolence
- ▶ LEAP study experience
 - ▶ Predominantly skin symptoms
 - ▶ No wheeze or hypotension
 - ▶ Epinephrine not required

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Infant peanut challenge outcome

- ▶ Infant ingests full amount without reaction
 - ▶ 6 g divided three times per week (5 tsp peanut butter, 2 bags Bamba)
- ▶ Infant ingests more than half (completes dose 3) but refuses remainder without reaction
 - ▶ Give equivalent amount at home and increase to 2 g if tolerated
- ▶ Infant only completes dose 1 and 2
 - ▶ Inconclusive, continue to avoid and repeat challenge at another time
- ▶ Infant reacts
 - ▶ Review avoidance
 - ▶ Action Plan
 - ▶ Epinephrine Rx

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Resources

Standardizing double-blind, placebo-controlled oral food challenges: American Academy of Allergy, Asthma & Immunology-European Academy of Allergy and Clinical Immunology PRACTALL consensus report

- ▶ J Allergy Clin Immunol 2012;136(6):1260-74

Food allergy: A practice parameter update - 2014

- ▶ J Allergy Clin Immunol 2014;134(5):1016-25

Work Group report: Oral food challenge testing

- ▶ J Allergy Clin Immunol 2009;123(6Suppl):S365-83

Baked Milk- and Egg-Containing Diet in the Management of Milk and Egg Allergy

- ▶ J Allergy Clin Immunol Pract 2015;3(1):13-23

Conducting an Oral Food Challenge to Peanut in an Infant

- ▶ J Allergy Clin Immunol Pract 2017 Mar - Apr;5(2):301-311