FIT Board Review Corner – January 2017

Welcome to the FIT Board Review Corner, prepared by Tammy Peng, MD, and Amar Dixit, MD, senior and junior representatives of ACAAI's Fellows-In-Training (FITs) to the Board of Regents. The FIT Board Review Corner is an opportunity to help hone your Board preparedness.

Review Questions

**Allergy and Immunology Review Corner:** Middleton's Allergy Principles and Practice, 8th Edition
N. Franklin Adkinson Jr., MD, Bruce S Bochner, MD, A Wesley Burks, MD, William W Busse, MD, Stephen T Holgate, MD, DSc, FMedSci, Robert F Lemanske, Jr., MD and Robyn E O'Hehir, FRACP, PhD, FRCPath

**Chapter 32 (pages 508-517):** Effect of the Food Matrix and Processing on the Allergenic Activity of Foods
Prepared by Malika Gupta, MD, The Children’s Hospital of Philadelphia

1. Which of the following food processing methods lead to an increase in the allergenic potential of the food?
   a. Canning of fish.
   b. Baking of milk.
   c. Baking of egg.
   d. Boiling of shrimp.

2. Which of the following is true regarding Bet v 1 and related food allergies?
   a. Bet v 1 homologs in plant-derived foods are generally thermolabile.
   b. Individuals with birch pollen-related fruit allergies may tolerate stored fruit but not freshly picked fruit.
   c. Individuals with Bet v 1-related fruit allergies cannot consume pureed fruit products.
   d. Individuals with Bet v 1-related food allergies cannot tolerate ultrahigh temperature processed fruit products.

3. Which of the following about lipid transfer protein (LTP) associated fruit allergens is true?
   a. Expression of LTP allergens is upregulated during storage.
   b. Peeling fruits can make them safe for consumption by certain individuals with LTP allergies.
   c. Preparation of pasteurized, ultrahigh temperature treated fruit juices is sufficient to make them safe for individuals with LTP fruit allergies.
   d. Fruit purees and fresh juices don’t trigger reactions in individuals with LTP fruit allergies.

4. Lipocalins are a class of inhalant allergens. Which of the following lipocalins is a food allergen in cow’s milk protein?
   a. Bos d 2
b. Bos d 3  
c. Bos d 4  
d. Bos d 5

5. Allergy to celery spice is associated with sensitization to which Bet v 1 homolog?
   a. Api g 1  
b. Arah2  
c. Bos d 4  
d. Met e 1

6. Which is of the following statements is true regarding fining agents added to alcoholic beverages?
   a. Certain alcoholic beverages contain residual levels of fining agents based on fish gelatin, milk casein or egg albumin.  
b. Fining agents and their residues are made up of raw, unprocessed foods.  
c. Individuals with allergies to fish and egg cannot react to alcoholic beverages when they are used as fining agents.  
d. Reactions to fining agents are common.

7. Which of the following statements is true regarding oil refining?
   a. Proteins are removed during the refining process, and highly-refined oils contain very low levels of residual protein.  
b. Highly-refined soybean oils are not considered safe for consumption by individuals with soy allergies in Europe.  
c. Highly-refined peanut oils have an EU labeling derogation.  
d. Most of the protein is still retained during oil refining.

8. Which of the following statements is true with regards to the roasting and frying of peanuts?
   a. Prolamin superfamily 2s albumin allergens lose their native structure after roasting and frying.  
b. Maillard modification of allergens can add to allergenicity with roasting and frying.  
c. Some cupin allergens become soluble with roasting.  
d. Peanuts lose their allergenicity upon roasting.

9. Which of the following statements is true of conformational and linear epitopes of food allergens?
   a. Linear epitopes are formed from segments of a polypeptide chain brought together by protein folding.  
b. Conformational epitopes comprise short regions of 8-15 amino acids which tend to adopt a secondary structure.
c. Linear epitopes are unstable in response to food processing.
d. Food processing procedures may affect the way in which proteins are folded and can either destroy conformational epitopes or reveal new epitopes previously hidden by protein folding.

10. Which of the following processes increases the allergenicity of foods?
   a. Acid-treated gluten
   b. Baking of eggs
   c. Baking milk
   d. Cooking fruits and vegetables

Answers
1. D.
   Tropomyosin is a well-studied allergen in crustacean and molluscan shellfish. Tropomyosin from the greasy back shrimp (Met e 1) is a heat-stable allergen and is found in many crustacean species. Boiling can enhance the allergenicity for some individuals. Therefore, boiled shrimp extracts can be used for diagnosis. The other three processes mentioned reduce (although do not abolish) allergenic activity of the listed foods.

2. A.
   “Bet v 1 homologs in plant derived foods are generally thermolabile. This is why individuals with birch pollen-fruit allergy syndrome can usually eat cooked fruits and vegetables without experiencing the symptoms they have when eating fresh produce.

   Individuals with birch pollen-related fruit allergies may be able to tolerate freshly picked fruit but not stored fruit. Individuals with Bet v 1 related fruit allergies usually can consume pureed fruit products. Individuals with Bet v 1-related food allergies usually can tolerate ultrahigh temperature processed fruit products.”

3. B.
   “Removal of outer layers by physical or chemical peeling leads to loss of LTPs located in the outer layer. Thus, peeling fruits makes them safe for consumption by certain individuals with LTP allergies.

   Expression of lipid transfer protein (LTP) allergens is downregulated during storage. Levels are higher in fresh fruits and decreased with storage but that still does not necessarily make these fruits safe for consumption. Preparation of pasteurized, ultrahigh temperature treated fruit juices is NOT sufficient to make them safe for individuals with LTP fruit allergies as the fruit LTPs retain a native-like structure. For this reason, fruit purees and fresh juices CAN trigger reactions in individuals with LTP fruit allergies.”
4. D.
“The only member of the lipocalin class that is a food allergen is the cow’s milk protein B-lactoglobulin (Bos d 5). This is a lipid binding protein with a beta barrel structure stabilized by two disulfide bonds, giving the protein it’s stability.”

5. A.
Api g 1. This homolog is also stable to thermal processing.

6. A.
Some alcoholic beverages contain residual levels of fining agents based on fish gelatin, milk casein, or egg albumin. These fining agents and their residues are highly modified compared with the raw foods. Individuals with diagnosis of allergies to fish and egg can have reactions to alcoholic beverages when they are used as fining agents. These reactions to fining agents in alcoholic beverages are rare.

7. A.
Proteins are removed during the refining process, and highly-refined oils contain very low levels of residual protein. Highly-refined soybean oils are considered safe for consumption by patients with soy allergies in Europe. Although, highly-refined peanut oils don’t appear to cause a reaction in peanut allergic individuals, these oils DO NOT have an EU labeling derogation.

8. B.
“Maillard modification of allergens can add to allergenicity with roasting and frying. Prolamin superfamily 2s albumin allergens retain their native structure after roasting and frying. Some cupin allergens (7S and 11S seed storage proteins) become insoluble with roasting. The peanut 2S albumin allergens retain their allergenic activity after roasting, which also explains why roasted peanuts possess significant allergenicity.”

9. D.
“Conformational epitopes are formed from various segments of a polypeptide chain that are brought together by protein folding. Many food processing procedures affect the way in which proteins are folded and can either destroy conformational epitopes found in proteins in unprocessed or raw foods or reveal new epitopes previously hidden by protein folding. Linear epitopes, which comprise short regions of about 8 to 15 amino acid residues and tend to be mobile, adopt a disordered secondary structure. They are likely to be stable in response to food processing procedures.”

10. A.
Allergy to deamidated gluten was described as a separate entity from wheat allergy by Denery-Papini et al. Deamidated gluten can thus cause severe allergic reactions in individuals who can otherwise consume wheat-containing foods. This was demonstrated by strong IgE binding to deamidated gliadins or peptides of the type QPEEPFPE.

(Denery-Papini S, Bodinier M, Larré C, et al.: Allergy to deamidated gluten in patients tolerant to wheat: specific epitopes linked to deamidation. Allergy (2012); 1023-32)