

Food Allergies Are Rarely a Concern When Considering Vaccines for Adolescents

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Routine immunization provides protection from numerous infectious diseases and substantially reduces morbidity mortality from these diseases. In the United States, vaccination programs focused on infants and children have successfully decreased the incidence of many childhood vaccine-preventable diseases. However, vaccination coverage among adolescents has remained stagnant. Contributing to this lack of coverage is that patients with food allergies might be advised unnecessarily to avoid certain vaccinations, thus potentially causing adverse personal and community health. Studies have shown that food allergies are rarely contraindications to vaccine administration. Most adolescents who avoid vaccination because of food allergy concerns are actually able to receive their appropriate vaccinations. However, there are situations when evaluation by an allergist is recommended. In the present article, the authors provide guidance for physicians when administering vaccines to patients with food allergies to prevent adverse events and improve disease protection.

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Adverse food reactions have been reported in up to 25% of the US population at some point in their lives, with the highest prevalence observed during infancy and early childhood.¹ Although reported adverse reactions to foods are common, true IgE-mediated food allergy represents only a small percentage of these reactions. Many studies indicate that the true prevalence of food allergy is between 2% and 5%.²⁻⁴ If someone is incorrectly diagnosed as having food allergy, unnecessary dietary restrictions may adversely affect his or her quality of life and nutritional status. Moreover, patients with true or assumed food allergies might unnecessarily be advised to avoid certain immunizations, which could have important adverse individual and population health consequences.⁵

There are approximately 220 million doses of vaccines distributed in the United States each year. Adverse reactions to vaccines are common; however, most of them are not allergic in nature. True anaphylaxis is rare and occurs after 1 per 1 million doses.⁶ Anaphylaxis can be caused by various food components of vaccines, including egg, gelatin, yeast, and chicken proteins. Most patients who avoid vaccination because of food allergy concerns to egg, gelatin, yeast, and chicken are able to receive all vaccinations without special precautions, although some may require evaluation by an allergist prior to administration. In some cases, desensitization may be required.

In the present article, we discuss which of the vaccines recommended for adolescents contain food allergens and what those allergens are for each

vaccine. We also provide guidance as to which patients need further allergy evaluation and which patients can safely receive their vaccines in the usual manner.

Adolescent Vaccination Recommendations

The Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) and others define adolescents as persons aged 11 to 21 years.⁵ The ACIP and the American Academy of Pediatrics recommend that adolescents aged 12 to 18 years receive the human papillomavirus (HPV), meningococcal, and tetanus, diphtheria, and acellular pertussis (Tdap) vaccines, as well as the yearly influenza vaccine. The ACIP recommends routine vaccination with a quadrivalent meningococcal conjugate vaccine for adolescents aged 11 or 12 years, with a booster dose at age 16 years.⁷ Routine hepatitis B vaccination is recommended for all adolescents not previously vaccinated and those who are at risk for hepatitis B. The 23-valent pneumococcal vaccination is recommended for adolescents who are at increased risk of pneumococcal disease or its complications (including patients with asplenia, nephritic syndrome, immunosuppressive conditions, and cerebrospinal fluid leaks).⁵

Some adolescents may also require less common vaccines, such as the yellow fever or rabies vaccines. According to the ACIP,⁸ the yellow fever vaccine should be considered if travel to an endemic area is planned. Postexposure rabies vaccination and immunoglobulin may be needed for animal bites, and

pre-exposure vaccination may be offered to those at high risk of rabies exposure, such as veterinary staff, animal handlers, or persons whose activities bring them into frequent contact with the rabies virus or potentially rabid bats, raccoons, skunks, cats, dogs, or other species at risk for having rabies. In addition, some international travelers might be candidates for pre-exposure vaccination if they are likely to come in contact with animals in areas where dog or other animal rabies is enzootic and immediate access to appropriate medical care, including the rabies vaccine and immune globulin, might be limited.⁹

Considering the number of vaccines and formulations, physicians caring for adolescents with reported food allergies may be concerned about administering recommended vaccines for fear of adverse reactions to food components in the vaccine. The *Table* lists various vaccines and their potentially allergenic food components.

Egg Allergy

Egg-containing vaccines include influenza, rabies, and yellow fever. Influenza vaccines are grown in chick embryo fibroblast cultures, leading to concern that residual egg protein (ovalbumin) could provoke an allergic reaction in patients with egg allergies. However, studies to date have suggested that the risk of a reaction is very low.¹⁰ Also, the newly available recombinant hemagglutinin influenza vaccine, trivalent (RIV3), does not contain egg protein. According to ACIP recommendations,¹¹ a person who can eat lightly cooked eggs without reaction may receive the

Table.
Vaccines and Their Potentially Allergenic Food Components

Vaccine	Food Component
Human papillomavirus	Yeast
Influenza	Egg ^a , gelatin ^b
Meningococcal conjugate	Yeast
Rabies	Egg ^a , gelatin ^b
Tetanus, diphtheria, acellular pertussis	Casein
Yellow fever	Egg ^a , chicken protein, gelatin

^a Ovalbumin.
^b Gelatin is present in some brands of the influenza and rabies vaccines.

influenza vaccine using the standard protocol. A person who experiences only hives after eating eggs or egg-containing food should receive either RIV3 (if aged 18 to 49 years) or inactivated influenza vaccine.² A person who experiences severe symptoms after eating egg or egg-containing foods (eg, cardiovascular changes, respiratory distress, gastrointestinal symptoms, reaction requiring epinephrine or emergency medical attention) should receive RIV3 if aged 18 to 49 years or be referred to an allergist for further evaluation and vaccine administration.

Numerous studies have demonstrated that the influenza vaccine can be safely administered in 1 full dose, even to patients with a history of anaphylaxis to egg ingestion, as long as appropriate precautions are taken. The American Academy of Asthma, Allergy, and Immunology 2012 practice parameter update on adverse reaction to vaccines⁶ recommends that patients with

egg allergy receive influenza vaccinations. The benefits of vaccinating these patients outweigh the risks. Inactivated influenza vaccine should be used.⁶ Live attenuated influenza vaccine (nasal flu vaccine), which also contains egg allergen, has not been studied in patients allergic to eggs; therefore, it is currently not recommended for use in this population. The ACIP guidelines¹² for yellow fever vaccine recommend that if a patient with egg sensitivity requires the yellow fever vaccine for travel purposes, a skin test may be done to the vaccine itself. If positive, or if the egg allergy is “severe,” desensitization may be performed. To our knowledge, there are no studies or formal guidelines for the administration of the rabies vaccine in egg-allergic patients. In all of these cases, referral to an allergist would be warranted for testing and desensitization if necessary.

Chicken Allergy

Chicken proteins other than those found in eggs may be present in the yellow fever vaccine and could be responsible for reactions in patients with chicken allergy.⁶ According to ACIP guidelines,¹² known hypersensitivity to vaccine components is a contraindication to the yellow fever vaccine. The guidelines do not address chicken allergy as they do egg allergy; however, we would apply the same recommendations noted in the previous section to those with chicken allergies.

Kelso et al⁶ analyzed data from the Vaccine Adverse Event Reporting System (VAERS) between 1990 and 1997 and found 40 cases described as probable or possible anaphylactic reactions

to the yellow fever vaccine. In 22 of these 40 cases, the yellow fever vaccine was the only vaccine administered. There were 5,236,820 doses of yellow fever vaccine distributed in the United States during this period.⁶ Using all 40 cases, the rate of yellow fever vaccine–related anaphylaxis would be about 1 in 131,000.⁶ This rate includes all patients, not just those with allergy to the vaccine components. Therefore, the ACIP recommends observing all patients who receive the yellow fever vaccine for 15 minutes, and to have epinephrine available in case of anaphylaxis.¹²

Gelatin Allergy

Gelatin is added to many vaccines as a stabilizer. Gelatin-containing vaccines include some brands of influenza vaccines, some brands of rabies vaccines, and yellow fever vaccines. If a patient has not had a reaction on ingesting gelatin, the vaccine may be administered as usual without special precautions. If there is a history of severe (anaphylactic) gelatin reaction on ingestion, allergy evaluation prior to vaccine administration is advised. If reaction to gelatin is mild or vague (non–IgE-mediated reaction), a gelatin-containing vaccine can be administered as usual but with a 30-minute observation after vaccination.

Some patients who are allergic to beef or pork meat can be sensitized to beef or pork gelatin. Of beef and pork meat–allergic children, 16% and 38%, respectively, have cross-reactive IgE antibodies to gelatin.¹³ The presence of anti-gelatin IgE may place these patients at risk for allergic reactions after exposure to gelatin-containing foods, vaccines, or other

medical products. Both bovine- and porcine-derived gelatin are used in gelatin-containing vaccines and are extensively cross-reactive. There are no official CDC recommendations on beef or pork allergy and gelatin-containing vaccines regarding when to refer to an allergist. However, on the basis of data from multiple studies,^{14,15} it is suggested that if a patient has a history of an IgE-mediated allergy to pork or beef, an allergist evaluation before vaccine administration is advised.

Yeast Allergy

There are 2 vaccines—hepatitis B and the quadrivalent HPV vaccines—that are grown in *Saccharomyces cerevisiae* (baker's or brewer's yeast) and contain residual yeast protein. One type of meningococcal conjugate vaccine (Menveo; Novartis) also contains yeast protein.⁶ Severe reactions to yeast (baker's or brewer's yeast) are rare, if any. Only 11 cases of probable or possible anaphylaxis after the hepatitis B vaccine have been reported in VAERS.¹⁶ If a patient has a history of severe yeast reaction, allergist evaluation prior to hepatitis B and HPV vaccine administration is recommended.

Milk Allergy

Vaccines for tetanus, diphtheria, and acellular pertussis (Tdap and DTaP) may contain nanogram quantities of casein from the medium in which they are produced. Anaphylaxis to these vaccines is rare.^{6,17} There is no need for allergy evaluation or special precautions for patients with milk allergy prior to Tdap or DTaP vaccination.

Conclusion

Food allergies are rarely a concern when considering vaccines for adolescents, and most patients with food allergies are able to receive the appropriate vaccinations even without an allergy evaluation prior to administration. Patients with mild reactions (such as hives to egg), may be given the vaccine in the primary care office with a 30-minute observation. Physicians should ensure that the proper equipment, training, and medications are available in the office to manage anaphylaxis when administering vaccines. Even when the anticipated risk of an allergic reaction is low, proper preparation is essential.

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