Original Article

Risk Factors for Food Allergy in Early Adolescence: The SchoolNuts Study

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What is already known about this topic? Genetic and environmental factors are associated with the development of early childhood food allergy. However, it is unclear whether these factors are equally important for food allergy present later in childhood.

What does this article add to our knowledge? Many of the previously reported associations with early childhood food allergy, such as the effect of ethnicity, family history, early onset eczema, and pet exposure, appear to remain relevant to adolescent food allergy.

How does this study impact current management guidelines? This study provides further support for the involvement of genetic and environmental factors in food allergy, and provides potentially modifiable targets to reverse the rise in the prevalence of childhood food allergy.

BACKGROUND: Despite the rising rates of anaphylaxis in older children and adolescents, risk factors for food allergy among this age group are understudied.

OBJECTIVE: The objective of this study was to investigate the risk factors for current adolescent food allergy using a population-based sample.

METHODS: The SchoolNuts study was a questionnaire survey among 10- to 14-year-old adolescents and their parents, followed by clinic evaluation including oral food challenge when food allergy was suspected from questionnaire response. We investigated the association between food allergy and demographic and environmental factors among a total of 4,991 adolescents using multiple logistic regression.

RESULTS: Males and those with early-onset eczema had a higher risk of current food allergy in adolescence (adjusted odds ratio [aOR], 1.55; 95% confidence interval [CI], 1.12-2.15 and aOR, 14.08; 95% CI, 10.25-19.33). Those with Asian parents had increased risk compared with those with Caucasian parents (aOR, 2.82; 95% CI, 1.91-4.16), whereas being born in Asia compared

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Abbreviations used
aOR- Adjusted odds ratio
CI- Confidence interval
OFC- Oral food challenge
OR- Odds ratio
SEIFA- Socio-Economic Indexes for Areas
SPT- Skin prick test

with being born in Australia had decreased risk (aOR, 0.16; 95% CI, 0.04-0.67). Family history risk was higher for those with multiple members versus only 1 member (aOR, 4.62; 95% CI, 2.75-7.74 and aOR, 2.32; 95% CI, 1.36-3.97, respectively). Dog exposure during the first 5 years of life was associated with a decreased risk (aOR, 0.58; 95% CI, 0.38-0.91).

CONCLUSIONS: Early-onset eczema, Asian background, and family history of allergic disease were associated with an increased risk of food allergy, whereas dog exposure in early life reduced the risk in 10- to14-year-old adolescents. Factors predicting food allergy risk in an adolescent population-based cohort appear remarkably similar to those predicting early-onset food allergy in infancy. **(J Allergy Clin Immunol Pract 2017;■:■-■)**

Key words: *Food allergy; Adolescence; Risk factor; Ethnicity; Environment; Family history; Population*

Food allergy is common and rising with long waiting lists to see a specialist especially in the developed countries such as the United States and Australia. In our population-based cohort of 5,000 infants in Melbourne (the HealthNuts study), the prevalence of challenge-proven food allergy was alarmingly high at approximately 10%, and supports our clinical experience of overwhelmed waiting lists to see an allergist in Australia.[1] The trend of hospital anaphylaxis admission rates, often used as a surrogate marker of the changing food allergy prevalence, has shown 2- to 7-fold increases in studies from the United Kingdom and the United States in the 1990s to early 2000s.[2,3] A further Australian study reported a 1.5-fold increase in the food-related anaphylaxis rate from 1998-1999 to 2011-2012, with the highest rates occurring in children aged 0 to 4 years.[4]

Food allergy usually develops in the first few years of life. Although the majority of egg and milk allergies are expected to resolve by school age, allergies to peanut or tree nuts, which tend to cause severe reactions, are likely to persist into adolescence and beyond.[5] We previously reported from the population-based SchoolNuts study that 4.5% of 10- to 14-year-old school students in Melbourne had clinically confirmed food allergy, with the most common allergens being peanut and tree nut, both having a prevalence of over 2%.[6] Recent Australian data show that food anaphylaxis admission rates in older children and adolescents are rising more rapidly than for any other age group.[4] However, despite the rising rates of anaphylaxis and the potentially severe nature of reactions that has also been known in adolescence,[7,8] food allergy in this age group is understudied. Very few studies have investigated food allergy in later childhood at the population level using objective clinical data, including the gold-standard oral food challenge (OFC) to measure food allergy.[9-11]

Previously reported factors associated with the development of food allergy include family history of allergic diseases, personal history of eczema, ethnicity, and environmental factors such as pet exposure, family size with recent focus on the association with vitamin D status, and the timing of introducing solids.[12-17] However, most of these factors were investigated for food allergy in infancy, among cohorts which are likely to include a substantial proportion of children with transient food allergy. Because there are no previous studies extensively examining food allergy risk factors in older children and adolescents, the questions remain if these genetic and early life environmental factors are equally important for food allergy in this age group, which are likely to be persistent.

In this report, we describe the risk factors for food allergy among early adolescence (age 10-14 years) in the SchoolNuts population-based sample in Melbourne, Australia.

METHODS

SchoolNuts study methods

A detailed report of the study method has been previously published.[6] Briefly, a school-based, cross-sectional cluster sampling of primary (years 5 and 6) and secondary (years 7 and 8) school students in greater metropolitan Melbourne was used to recruit a sample of 10- to 14-year-old adolescents. Researchers visited schools to administer a questionnaire to students (Student Questionnaire) regarding their history of allergic diseases. A separate questionnaire was distributed to parents (Parent Questionnaire), which obtained family demographics and environmental factors, together with a detailed history of any student's food allergy or food-related reactions.

On the basis of the assumption that parents have a better understanding regarding the past history of the student's food allergy, we identified students with possible current food allergy through the response in the Parent Questionnaire, which was a positive response to any of the following questions:

(1) "Does your child currently have food allergy?"
(2) "Has your child ever had food allergy, a food reaction, or food-related anaphylaxis?"

We also identified students with possible food allergy based on having no known tolerance to any of the common allergens, which was having a negative response to the following question:

(3) "Has your child ever eaten the following common allergens: egg, cow's milk, sesame, fish, shellfish, soy, peanut, tree nuts?"

Trained allergy research nurses telephoned parents to collect further information on the possible reaction or allergy. When the history was suggestive of current IgE-mediated food allergy, students were invited for clinical evaluation including skin prick test (SPT) and food challenges when indicated. SPT was conducted to a panel of 15 food allergens (egg white, cow's milk, soy, peanut, cashew, almond, hazelnut, walnut, pistachio, macadamia, pecan, brazil nut, pine nut, sesame, shellfish), a positive and a negative saline control (ALK-Abelló SA, Madrid, Spain), and any other food allergens that were reported by the student or parent using prick-to-prick testing when allergen extracts were not available. SPT was performed by an allergy research nurse using a single tine lancet (Stallergenes, Antony, France) on the student's volar forearm. If the history and SPT results suggested a possible current allergy, and there was no known history of ingestion and tolerance, an OFC was performed.