Original Article

Racial Differences in Food Allergy Phenotype and Health Care Utilization among US Children

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What is already known about this topic? There is a paucity of data in the epidemiology of food allergy (FA) as it relates to race and/or ethnicity. The limited existing data show that African American children are at an increased risk for FA and its associated morbidities, and there are no data on Hispanic children with FA.

What does this article add to our knowledge? We found that African American (AA) and Hispanic children had different food allergen profiles, higher rates of associated atopic conditions, and increased rates of FA-associated anaphylaxis and emergency department visits than white children.

How does this study impact current management guidelines? The higher rates of asthma and anaphylaxis among minority children are concerning, especially when considered in the context of increased anaphylaxis in AA children. These findings highlight the need for culturally sensitive educational programs to improve FA outcomes in these children.

BACKGROUND: Food allergy (FA) is a prevalent condition in the United States, but little is known about its phenotypes in racial minority groups.

OBJECTIVE: The objective of this study was to characterize disease phenotypes and disparities in health care utilization among African American (AA), Hispanic, and white children with FA.

METHODS: We conducted a large, 2-center, retrospective cohort study of children aged 0-17 years with FA seen in allergy/immunology clinics at 2 urban tertiary care centers in the United States. We used multiple logistic regression analyses adjusted for age, gender, and insurance.

RESULTS: The cohort of 817 children was composed of 35% AA, 12% Hispanic, and 53% non-Hispanic white. Compared with non-Hispanic white children, AA children had significantly higher odds of having asthma and eczema ($P < .01$), and significantly higher odds of allergy to wheat, soy, corn, fish, and shellfish ($P < .01$). Compared with non-Hispanic white children, Hispanic children had significantly higher odds of allergy to corn, fish, and shellfish ($P < .01$), and higher odds of eczema ($P < .01$), but a similar rate of asthma ($P = .44$). In this cohort, 55%, 18%, and 11% of AA, Hispanic, and white children were covered by Medicaid, respectively ($P < .00001$). Compared with whites, AA and Hispanic children had a shorter duration of follow-up for FA with an allergy specialist and higher rates of FA-related anaphylaxis and emergency department visits ($P < .01$).

CONCLUSIONS: FA phenotypes and health care utilization differ among children of different racial and/or ethnic backgrounds in the United States that put AA and Hispanic children at higher risks of adverse outcome than white children. These differences include coexistent atopic conditions, less well recognized food allergens, and higher rates of anaphylaxis. **(J Allergy Clin Immunol Pract 2017;5:352-7)**

Key words: *Food allergy; Race; Ethnicity; African American; Hispanic; Asthma; Anaphylaxis*

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C. James is supported by National Institute of Allergy and Infectious Diseases T32 AI60515-01 grant. M. Mahdavinia is supported by Cohn Scholarship from Rush University Mentoring Office.

Conflicts of interest: B. M. Smith has received research support from Mylan. A. Assa'ad has received travel support from American College of Allergy, Asthma, and Immunology (ACAAI); is on the American Academy of Allergy, Asthma, and Immunology Board of Directors; has received consultancy fees from Aimmune; is employed by Cincinnati Children's Hospital Medical Center; has received research support from DBV Technologies, Aimmune, Stanford Foundation, TEVA Pharmaceuticals, GlaxoSmithKline, National Institutes of Health (NIH), Astellas, and Food Allergy Research & Education (FARE); and has received lecture fees from ACAAI. R. S. Gupta has received consultancy fees from BEFORE Brands and DBV Technologies; has received research support from NIH, FARE, and Mylan LLC; has received lecture fees from Grand Rounds; and receives royalties for a book. The rest of the authors declare that they have no relevant conflicts of interest.

Received for publication August 31, 2016; revised September 27, 2016; accepted for publication October 10, 2016.

Available online November 23, 2016.

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2213-2198

http://dx.doi.org/10.1016/j.jaip.2016.10.006

Abbreviations used
AA- African American
AD- Atopic dermatitis
CCHMC- Cincinnati Children's Hospital Medical Center
ED- Emergency department
FA- Food allergy
HDM- House dust mite
NIH- National Institutes of Health
RUMC- Rush University Medical Center

Food allergy (FA) is a major public health concern affecting approximately 8% of children in the United States[1] with an estimated economic burden of $24.8 billion annually.[2] It has been well documented that the prevalence of FA has been increasing among children of all races and/or ethnicities[3,4]; however, there is a paucity of data in the epidemiology of FA as it relates to race and ethnicity in the United States. Previous studies that have investigated FA among African American (AA) children found them to be at an increased risk for FA and its associated morbidities.[5,6] An analysis of the National Health and Nutrition Examination Survey 2005-2006 showed that AA race is associated with higher odds of possible and likely FA compared with whites based on specific IgE measurements.[5] Furthermore, an analysis of death certificates from the US National Mortality Database showed a higher rate of food-related fatal anaphylaxis among AAs than whites and a significant increase in the rate of fatal FA-related anaphylaxis among AAs from 1999-2001 to 2008-2010.[7] Whether the increase in fatalities is due to differences in access to care, greater disease severity, and/or associated comorbidities is unclear and merits further research. It has been well documented that FA and food sensitization are risk factors for other common allergic conditions such as atopic dermatitis (AD) and asthma. Importantly, food-allergic reactions can result in life-threatening asthma attacks, leading to hospitalization, intubation, or death.[8,9] AA and Hispanic children are known to be at higher risk for severe AD[10] as well as uncontrolled severe asthma resulting in emergency department visits.[11] Therefore, understanding FA in these minority groups may decrease not only the burden of FA itself, but also its potential detrimental effects on AD and asthma in these children. This is especially important in the context of data that AA children with FA have lower odds of having a physician confirmed diagnosis of FA compared with whites.[1]

Individuals of different racial backgrounds have diverse diets based on their cultural background; these differences may affect rates of sensitization to different foods as well as the impact of FA on their daily lives. Therefore, it is important to study the profile of sensitization and allergies to different foods in association with race and ethnicity. Limited existing data suggest that there are differences between ethnic and racial groups with regard to sensitization to specific foods. In a study of FA-related ambulatory care visits, AA children were found to have higher rates of sensitization to peanut, milk, and shrimp than white children.[4] However, to date, there have been no studies evaluating differences in allergen profiles among racial and/or ethnic groups in physician confirmed FA. Furthermore, most previous FA studies have focused on limited lists of foods. Many common allergens that have not been studied are ubiquitous that can make strict avoidance harder. Therefore, it is crucial to have a comprehensive understanding of the differences of FA between different racial and ethnic groups in association with other patient-related variables.

The objective of this study was to characterize racial and/or ethnic differences in fFA phenotype and health care utilization among food-allergic children. Specifically, we aimed to determine the prevalence of severe allergy, atopic comorbidities, and allergy to a more comprehensive list of allergens (the aforementioned foods as well as fin fish, soy, wheat, and corn) among AA, Hispanic, and white children. We also aimed to describe differences in rates of subspecialist visits among these groups.

METHODS

Subjects

The study was approved by the Institutional Review Boards of Rush University Medical Center (RUMC), Northwestern University Feinberg School of Medicine, and Cincinnati Children's Hospital Medical Center (CCHMC). A search of the electronic medical records of RUMC and CCHMC was performed by their respective information technology departments to identify children aged 0-17 years with a diagnosis of FA who were evaluated in RUMC or CCHMC Allergy clinics between October 2008 and December 2014. All data were deidentified for the statistical analysis. In both institutions, a standard electronic history and physical examination form (including results of skin prick tests and laboratory testing) specific for FA was completed during clinical encounters. This information was entered into Research Electronic Data Capture databases. Identical Excel files were created from these databases; data for each clinic were first analyzed separately and then pooled for further analyses. Patients for whom all main data points for the study were completed and retrievable were included in this analysis. Specific precaution was implemented to improve the accuracy of the data; all data were reviewed by 2 separate investigators to ensure accuracy and reliability of FA and atopic diagnoses and other health-related information. Diagnosis of FA required convincing symptoms (cutaneous, respiratory, gastrointestinal, or systemic) of an IgE-mediated reaction to a specific food and either an elevated serum-specific IgE measured by the ImmunoCAP assay (Phadia AB, Uppsala, Sweden) or a positive skin test measured by the standard skin prick test using Greer allergen extracts (Greer Laboratories Inc., Lenoir, NC) to that specific food(s). In case of tree nuts, fish, and shellfish, that are food groups, evidence of allergy to one or more types of food allergens within the group was considered a positive allergy history to that food group. For example, allergy to shrimp was considered shellfish allergy and allergy to almond was considered tree nut allergy. Diagnostic criteria for comorbidities are detailed in Table E1, available in this article's Online Repository at www.jaci-inpractice.org. In terms of food-related anaphylaxis and emergency department (ED) visits, the ED visit and/or the subsequent follow-up outpatient visits in the chart were carefully reviewed. This was to ascertain that the FA-related reaction was the primary diagnosis for that ED visit and determined as the cause of anaphylaxis and/or other severe reactions at discharge. Two centers have similar processes for follow-up appointments. At both centers, patients are called before their follow-up appointment as a reminder; both clinics will refer acute severe food-related reactions to ED and are accommodative in terms of adding patients to the clinic for follow-up of FA-related reactions.

Definitions of race used in this study were based on the National Institutes of Health (NIH) recommendation to divide individuals into 5 racial categories (American Indian or Alaska Native, Asian,