

Clinical Communications

The associations between eczema and food and inhalant allergen-specific IgE vary between black and white children

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Clinical Implications

- The relationships between eczema and IgE and allergen-specific IgEs differ between some black children and white children at age 2 years. This difference suggests that there may be different allergic disease phenotypes that emerge in very early life.

TO THE EDITOR:

The Wayne Tri-county Health & Environment Allergy Study (WHEALS) birth cohort recruited pregnant women without regard to their allergic status. Previous WHEALS analyses demonstrated that by age 2 years black children were more likely than white children to develop eczema/atopic dermatitis (AD); have higher total IgE levels; and be atopic.¹ Black children were also more likely to be sensitized to each tested allergen (food and inhalant).² The goal of the present analyses was to investigate whether the associations between eczema/AD and IgE levels (total IgE and food and inhalant allergen-specific IgEs [sIgEs]) differed for black children and white children in WHEALS.

At age 2 years, children underwent a clinical examination by a study-trained doctor. Blood was collected for measurement of sIgE

TABLE I. Relationship of the sIgEs with eczema, by race of child with additional models adjusted for child sex and age at clinic visit*

	Eczema (ever)		Adjusted* OR (95% CI)	Adjusted* P value
	Yes	No		
	Geometric mean (95% CI) Black: n = 108 White: n = 19	Geometric mean (95% CI) Black: n = 282 White: n = 141		
Total IgE (kU/L)				
Black child	27.2 (19.2-38.4)	22.3 (18.7-26.7)	1.08 (0.91-1.28)	.39
White child	45.0 (15.3-131.7)	13.5 (10.5-17.3)	1.61 (1.13-2.31)	.009
Sum of food sIgE (kU/L)				
Black child	0.86 (0.59-1.26)	0.52 (0.42-0.64)	1.21 (1.04-1.42)	.014
White child	0.94 (0.29-3.04)	0.28 (0.23-0.34)	1.80 (1.20-2.69)	.004
Sum of inhalant sIgE (kU/L)				
Black child	0.97 (0.54-1.77)	0.57 (0.51-0.64)	1.40 (1.11-1.77)	.005
White child	0.86 (0.63-1.18)	0.47 (0.42-0.52)	3.86 (1.70-8.77)	.001
Sum of food sIgE as a % of total IgE				
Black child	3.35 (2.64-4.24)	2.18 (1.86-2.56)	1.43 (1.13-1.81)	.003
White child	1.31 (0.61-2.81)	1.94 (1.56-2.40)	0.76 (0.46-1.25)	.28
Sum of inhalant sIgE as a % of total IgE				
Black child	3.18 (2.32-4.36)	2.37 (1.98-2.82)	1.20 (0.98-1.46)	.071
White child	1.15 (0.43-3.10)	3.59 (2.70-4.77)	0.56 (0.34-0.92)	.023
	Median (IQR)		Median (IQR)	
Total IgE (kU/L)				
Black child	26.5 (10.0-65.6)		26.9 (8.2-57.2)	
White child	34.4 (11.4-243.0)		10.7 (4.8-41.4)	
Sum of food sIgE (kU/L)				
Black child	0.59 (0.15-2.67)		0.35 (0.15-1.03)	
White child	0.50 (0.15-2.49)		0.15 (0.15-0.43)	
Sum of inhalant sIgE (kU/L)				
Black child	0.35 (0.35-1.59)		0.35 (0.35-0.65)	
White child	1.07 (0.35-1.62)		0.35 (0.35-0.55)	
Sum of food sIgE as a % of total IgE				
Black child	3.28 (1.53-6.85)		2.26 (0.97-4.85)	
White child	1.96 (1.32-2.57)		2.22 (1.09-3.56)	
Sum of inhalant sIgE as a % of total IgE				
Black child	3.27 (1.11-9.78)		2.36 (0.94-5.83)	
White child	2.08 (0.26-4.25)		3.80 (1.32-9.00)	

IQR, Interquartile range; OR, odds ratio.

Each interaction term between IgE/sIgE and race was $P < .10$; therefore, separate models for black children and white children are presented. IgE units in kU/L.

*Models adjusted for age and sex.

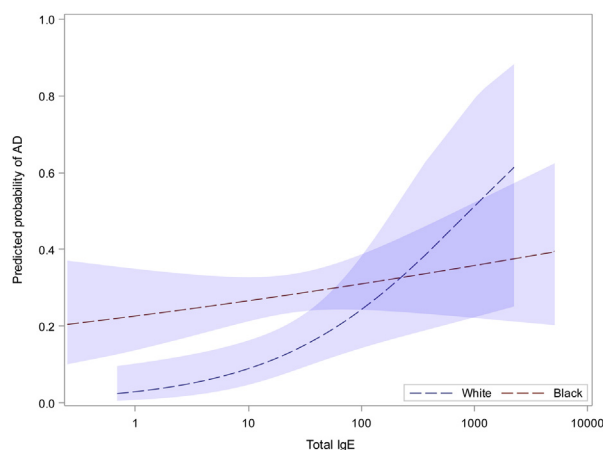


FIGURE 1. The graph demonstrates the modifying effect of race on the relationship between total IgE and the predicted probability of the child having eczema. The shaded blue line is for white children. The dashed red line is for black children. The solid lines represent 95% confidence bands. IgE units are in kU/L.

for the following allergens: milk, egg, peanut, *Alternaria*, cat, cockroach, dog, *Dermatophagoides farinae* (Der f), short ragweed, and timothy grass. Physicians responded to the following question: “By your clinical evaluation do you believe that this child has or has had atopic dermatitis or eczema?” (hereafter called eczema). Child race was based on maternal report. Further study details have been published.^{1,3} WHEALS participants included and excluded from these analyses are compared in Figure E1 and Table E1 in this article’s Online Repository at www.jaci-inpractice.org. Exclusions were due to incomplete data and our focus on the comparison of black and white children.

There were 550 children included in these analyses: 390 black children ($n = 108$ [27.7%] with eczema) and 160 white children ($n = 19$ [11.9%] with eczema). Summary details appear in Table E2 in this article’s Online Repository at www.jaci-inpractice.org. Race modified the associations between IgE and eczema for all IgE variables (all interaction $P < .10$, likelihood ratio test) (Table I). Total IgE level was higher in white children with eczema than in those without eczema, but this difference was not seen when black children with and without eczema were compared. The sum of food sIgEs and of inhalant sIgEs was higher in those with eczema in both black and white children. However, the sum of the sIgEs/total IgE ratios for both food and inhalant allergens (calculated to allow for simultaneous consideration of the sum of the sIgEs and total IgE) differed between black and white children. Specifically, the ratios of both food and inhalant sIgEs were higher in black children with eczema (vs no eczema) but lower in white children with eczema (vs no eczema). Adjusted odds ratios reflect similar patterns (Table I). Figure 1 shows that black children are more likely to have eczema than white children at lower levels of total IgE, whereas at higher levels of total IgE, data suggest that white children are equally or more likely to have eczema.

Although we have reported in WHEALS that black children had higher total IgE levels than did white children, these analyses demonstrate that this racial difference was present only among children without eczema.¹ Results in Figure 1 suggest that at

lower concentrations, total IgE is associated with an increasing probability of eczema in black but not white children. Other evidence suggests that the relationship between total IgE and asthma varies by race. Previous work from our group studying another cohort found that serum IgE was related to methacholine reactivity in European American (EA), but not African American (AA) children aged 6 to 8 years.⁴ However, among children without an asthma diagnosis, the AA children had significantly higher total IgE than the EA children.

This body of evidence highlights the importance of the need to consider endotypes—phenotypes with different underlying etiologies—in allergic diseases.^{5–10} Eczema is caused, in part, by defects in the skin barrier. These defects, which likely have multiple and various underlying etiological causes, then leave the child vulnerable to IgE sensitization.^{5,10} In data presented here, there are differences in total IgE and food sIgEs and inhalant sIgEs within those children with eczema and those differences vary by race.

A reliable assessment of severity was unavailable and could account for the observed racial differences. sIgE panels were limited to 13 allergens. Statistically significant differences in IgE levels may not indicate clinically important differences; however, this work provides a unique contribution to investigations of racial differences in allergic diseases. In future studies, it will be important to further identify the various endotypes associated with eczema/AD and determine whether they differ in frequency between race groups, as well as examine whether the observed patterns hold for severe eczema and more allergens.

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Conflicts of interest: G. Wegienka, A. Sitarik, D. Ownby, C. C. Johnson, and S. Havstad have received research support from the National Institutes of Health. G. Bassirpour and E. M. Zoratti have received research support from the National Institute of Allergy and Infectious Diseases.

Received for publication March 28, 2017; revised July 11, 2017; accepted for publication July 25, 2017.

Available online ■■

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<http://dx.doi.org/10.1016/j.jaip.2017.07.037>

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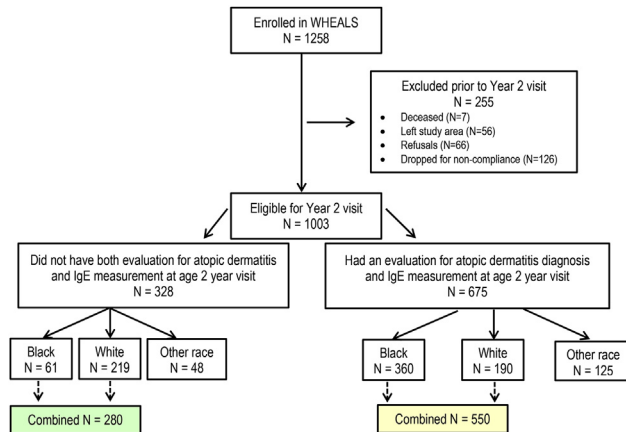


FIGURE E1. The exclusion steps for creation of the analytical data set.

TABLE E1. Comparison of women from WHEALS whose children were included and excluded from the current analyses*

	Women with a Child Included in the Analyses	Women with a Child Excluded from the Analyses	P value†
N	550	280	
Ever breastfed the child (n(%) yes)	412 (77.7%)	180 (72.0%)	.081
Mother had an indoor dog during pregnancy	156 (28.4%)	65 (23.2%)	.11
Child lived with an indoor dog in the first year of life	157 (29.7%)	68 (31.0%)	.72
Mother sensitized to allergens	315 (59.4%)	152 (55.9%)	.33
Child's gender			.031
Male	289 (52.5%)	125 (44.6%)	
Female	261 (47.5%)	155 (55.4%)	
Race			.024
Black	390 (70.9%)	219 (78.2%)	
White	160 (29.1%)	61 (21.8%)	
Delivery type			0.72
Vaginal	350 (63.6%)	174 (62.4%)	
C-section	200 (36.4%)	105 (37.6%)	
Child was firstborn	205 (37.3%)	113 (40.4%)	.39

*There are some missing data.

†P values are for a Chi-square test comparing those included and those excluded.

TABLE E2. Racial differences in demographics, IgE (in kU/L), sensitization and eczema

	Black children (N=390 [§])	White children (N=160 [§])	P value
Age at 2 year clinic visit, mean (s.d.)	2.3 (0.3)	2.2 (0.2)	.001*
Gender, n (column %)			
Female	185 (47.4%)	76 (47.5%)	.99†
Male	205 (52.6%)	84 (52.5%)	
Total IgE - GM ² (95% CI)	23.6 (20.1-27.7)	15.8 (12.2-20.6)	.004‡
Median (Interquartile range=IQR)	26.9 (8.3, 60.2)	13.2 (5.4, 43.2)	
Sum of the food sIgE - GM (95% CI)	0.60 (0.50-0.73)	0.33 (0.26-0.41)	< .001‡
Median (Interquartile range=IQR)	0.40 (0.15, 1.37)	0.15 (0.15, 0.46)	
Sum of the inhalant sIgE - GM (95% CI)	0.64 (0.57-0.72)	0.51 (0.45-0.57)	.39‡
Median (Interquartile range=IQR)	0.35 (0.35, 0.70)	0.35 (0.35, 0.60)	
Sum of food sIgE as % of Total IgE - GM (95% CI)	2.47 (2.16, 2.83)	1.85 (1.50, 2.27)	.052‡
Median (Interquartile range=IQR)	2.53 (1.14, 5.32)	2.20 (1.16, 3.50)	
Sum of inhalant sIgE as % of Total IgE - GM (95% CI)	2.58 (2.21, 3.01)	3.16 (2.40, 4.17)	.16‡
Median (Interquartile range=IQR)	2.67 (0.97, 6.39)	3.60 (1.25, 8.20)	
Child sensitized to at least 1 food allergen, n (column %)	139 (46.6%)	32 (27.6%)	< .001†
Child sensitized to at least 1 inhalant allergen, n (column %)	79 (27.2%)	18 (16.8%)	.033†
Doctor concluded the child had eczema/AD at the clinic visit, n (column %)	108 (27.7%)	19 (11.9%)	< .001†

*Student's t-test.

†Chi-square test.

‡Wilcoxon rank sum test.

§due to low blood volume there are some missing IgE values.

||GM = geometric mean.