

Eczema Exacerbation and Food Atopy Beyond Infancy: How Should We Advise Chinese Parents About Dietary History, Eczema Severity, and Skin Prick Testing?

Kam-Lun Ellis Hon, FAAP
Ting-Fan Leung, MRCPCH
Man-Ching Adrian Lam, BSc
Kin-Yee Wong, BSc
Chung-Mo Chow, MRCPCH

Department of Pediatrics

Wai-San Fanny Ko, MRCP

Department of Medicine and Therapeutics

Tai-Fai Fok, FRCP, PCNG, FRCP

Department of Pediatrics

The Chinese University of Hong Kong

Prince of Wales Hospital

Shatin, Hong Kong SAR, China

Alexander K. C. Leung, FRCPC, FRCP (UK & Irel), FRCPCH

Department of Pediatrics

The University of Calgary

Alberta Children's Hospital

Calgary, Alberta, Canada

ABSTRACT

Issues related to empirical dietary restriction are important, but they have been inadequately studied among children with atopic dermatitis (AD). To evaluate whether any association exists between food atopy, food avoidance, and AD severity, investigators in the present study reviewed all skin prick tests (SPTs) performed between January 2005 and April 2006 at a pediatric dermatology clinic and correlated findings with history of food avoidance and eczema severity. Only 13% of 114 children with AD had a positive SPT for beef. The most commonly sensitized foods were egg yolk (53%), egg white (42%), shrimp (35%), peanuts (31%), and crab (29%). Disease severity was not associated with prevalence of

sensitization to these foods. The investigators concluded that immediate immunoglobulin E reaction to beef, as suggested by positive SPT findings, is unlikely to occur in most children with AD. SPT information may be useful in reassuring parents about the unlikelihood of a severe and immediate reaction to beef. As for other foods, it is sensible to advise parents about specific avoidance strategies only in more severely affected children with a definite history of eczema exacerbation by specific food allergens.

Keywords: Atopic dermatitis; beef; children; food avoidance; NESS

INTRODUCTION

Atopic dermatitis (AD) is a common chronic relapsing disease that occurs in children in association with allergy. Because no definitive cure has been identified, alternative therapies are practiced extensively by parents.^{1,2} Food has been implicated as a cause,²⁻⁵ and many parents of children with eczema exert a lot of effort in implementing avoidance strategies, specifically, dietary restriction and avoidance. Seafood and beef are the foods most commonly restricted by Chinese parents.² Despite the common practice among the Chinese of avoiding beef, there is little evidence that indicates whether the presumed "poisonous effects" are due to immune (type 1 versus non-type 1) or nonimmune mechanisms. In this study, investigators postulated as a null hypothesis that type 1 immunoglobulin (Ig)E-mediated immediate hypersensitivity to common foods occurred more commonly in patients with more severe AD. Researchers evaluated the extent of beef avoidance, its association with other food avoidance, and skin prick test (SPT) findings in Chinese children with AD.

METHODS

All SPTs performed between January 2005 and April 2006 on patients older than 12 mo of age with AD who were treated in the pediatric dermatology clinic of a university teaching hospital were reviewed; demographic data, AD severity over the preceding 12 mo, and response to SPT were analyzed. AD severity during the preceding 12 mo was determined clinically by a Chinese version of the Nottingham Eczema Severity Score (NESS), which had been previously validated in the study cohort.^{6,7} Dietary habits of avoidance of beef and restriction of various foods were assessed by the principal investigator (K-L.E.H.). Children without AD and atopy who were seen at the clinic for noneczematous skin conditions (eg, acne, various birthmarks, pigmented skin lesions) during the same period were used as controls.

SPTs were performed with the use of diluent (negative control) and histamine solutions (10 mg/mL; positive control), along with standardized food allergen extracts, including beef, egg white, egg yolk, milk, peanuts, crab, shrimp, lobster, and salmon (ALK Abelló, Round Rock, Tex, USA). Reactions were considered positive if the wheal was at least 3 mm larger than that caused by the diluent, and was further classified as 1+ (3–5 mm), 2+ (6–8 mm), or 3+ or more (≥ 9 mm). Patients discontinued all pharmacotherapy (antihistamines and/or steroids) at least 1 wk before these tests were performed.

Patients were excluded if they had been given a diagnosis of nonspecific dermatitis or urticaria. The Clinical Research Ethics Committee of the Chinese University of Hong Kong approved this study. A χ^2 test was used to compare categorical data. Odds ratios and 95% confidence intervals were calculated when indicated. All comparisons were made with 2-tailed tests, and *P* values less than .05 were considered statistically significant.

RESULTS

Results of SPTs of 114 patients with AD (57% males) performed during the study period were analyzed. All patients were of Chinese descent. During this same period, SPTs were performed on 13 control patients who had no symptoms of atopy.

In patients with AD, sensitization was prevalent with egg yolk (53%), egg white (42%), shrimp (35%), peanuts (31%), crab (29%), and lobster (27%). Sensitization with beef, milk, and salmon was relatively uncommon (13%). When compared with controls, a significant prevalence of SPT positivity was found with egg white and peanuts (Table 1). Specifically, beef and fish (salmon) were not common allergens, and most patients tested negative with these foods. The frequency of sensitization and the strength of SPT positivity ($\geq 2+$) to common foods were not associated with disease severity (Table 2). Most people tended to avoid certain foods on an empirical basis (Table 3). A definite personal history of AD aggravation with food and positive SPT was uncommon. Significantly, 75% of children had never avoided milk and were SPT negative to milk.

DISCUSSION

Beef allergy has been estimated to occur among children with AD at a rate between 3% and 6.5%; its incidence is about 0.3% in the general population.⁸ Although it was previously documented that a significant proportion of parents would avoid giving beef to their children with moderate to severe AD, beef sensitization (as documented by SPT) was uncommon regardless of AD severity (Table 2). Among 13% of patients with SPT positivity for beef, most were only "1 plus" and without a history of AD aggravation by beef. It is generally believed that SPT carries a high rate of false positivity, a low positive predictive value, and a high rate of negative predictive accuracy.^{5,9-11} A negative SPT may reassure anxious Chinese parents who are avoiding beef that they should attempt to introduce beef to their children. The major beef allergen is the heat-labile bovine serum albumin. As has been suggested by other authors, industrial heat processing is more efficient than domestic cooking in reducing reactivity in beef-sensitive children.¹²⁻¹⁵ The technology of freeze-drying and homogenization may support the introduction of processed beef into the diet of beef-allergic children.¹⁶

Table 1. SPT in Patients With and Without AD

	Without AD (n=13)	With AD (n=114)	P Value by χ^2
Mean (SD) age, y	13.5 (5.0)	10.2 (4.6)	.017
Male sex, n (%)	4 (31)	65 (57)	.085
History of airway hyperactivity, n (%)	0	35 (31)	.019
History of allergic rhinitis, n (%)	0	66 (58)	<.001
Family history of atopy, n (%) [*]	3 (23)	81 (71)	.001 [†]
Skin prick positivity for			
Beef, n (%)			
All SPT positive	0	15 (13)	.362
SPT $\geq 2+$	0	1 (0.9)	1.000
Egg white, n (%)			
All SPT positive	1 (8)	48 (42)	.016 [‡]
SPT $\geq 2+$	0	11 (10)	.602
Egg yolk, n (%)			
All SPT positive	3 (23)	60 (53)	.076
SPT $\geq 2+$	0	8 (7)	1.000
Milk, n (%)			
All SPT positive	0	15 (13)	.362
SPT $\geq 2+$	0	1 (0.9)	1.000
Peanuts, n (%)			
All SPT positive	0	35 (31)	.019
SPT $\geq 2+$	0	5 (4)	1.000
Crab, n (%)			
All SPT positive	3 (23)	33 (29)	.757
SPT $\geq 2+$	0	7 (6)	1.000
Shrimp, n (%)			
All SPT positive	2 (15)	40 (35)	.217
SPT $\geq 2+$	0	12 (11)	.611
Lobster, n (%)			
All SPT positive	1 (8)	31 (27)	.182
SPT $\geq 2+$	0	6 (5)	1.000
Salmon, n (%)			
All SPT positive	1 (8)	15 (13)	1.000
SPT $\geq 2+$	0	1 (0.9)	1.000

^{*}Atopy refers to AD, allergic rhinitis, or asthma.

[†]Odds ratio (OR) (95% confidence interval [CI]) of family history of atopy for AD was 8.18 (1.90–40.34).

[‡]OR (95% CI) of positive egg white SPT for AD was 8.73 (1.11–185.68).

SD=standard deviation.

Table 2. Prevalence of Food Atopy and AD Severity

	Group B₁ Mild AD (n=19)	Group B₂ Moderate AD (n=29)	Group B₃ Severe AD (n=66)	P Value for Trend
Mean (SD) age, y	9.8 (4.9)	10.8 (4.4)	10.1 (4.6)	.718
Male sex, n (%)	13 (68)	18 (59)	34 (51)	.346
History of airway hyperactivity, n (%)	6 (32)	7 (24)	22 (33)	.667
History of allergic rhinitis, n (%)	9 (47)	19 (66)	38 (58)	.274
Family history of atopy, n (%)*	14 (74)	21 (72)	46 (70)	.949
Skin prick positivity for				
Beef, n (%)				
All SPT positive	2 (11)	2 (7)	11 (17)	.540
SPT $\geq 2+$	0	0	1 (2)	.693
Egg white, n (%)				
All SPT positive	9 (47)	12 (41)	27 (41)	.878
SPT $\geq 2+$	0	3 (10)	8 (12)	.285
Egg yolk, n (%)				
All SPT positive	11 (58)	18 (62)	31 (47)	.351
SPT $\geq 2+$	0	2 (7)	6 (9)	.393
Milk, n (%)				
All SPT positive	0	3 (10)	12 (18)	.103
SPT $\geq 2+$	0	0	1 (2)	.693
Peanuts, n (%)				
All SPT positive	5 (26)	8 (28)	22 (33)	.771
SPT $\geq 2+$	1 (5)	1 (3)	3 (5)	.951
Crab, n (%)				
All SPT positive	6 (32)	6 (21)	21 (32)	.525
SPT $\geq 2+$	2 (11)	0	5 (8)	.251
Shrimp, n (%)				
All SPT positive	8 (42)	8 (28)	24 (36)	.556
SPT $\geq 2+$	2 (11)	2 (7)	8 (12)	.747
Lobster, n (%)				
All SPT positive	6 (32)	8 (28)	17 (26)	.880
SPT $\geq 2+$	2 (11)	1 (3)	3 (5)	.518
Salmon, n (%)				
All SPT positive	3 (16)	1 (3)	11 (17)	.200
SPT $\geq 2+$	0	0	1 (2)	.693

*Atopy refers to AD, allergic rhinitis, or asthma.

Table 3. Skin Prick Results and Pattern of Food Avoidance Among 114 Children With AD

	SPT Positivity	SPT Negativity	P Value for Trend
Avoid beef empirically	8	36	.428
AD aggravated by beef, therefore avoid	2	14	
No beef avoidance ever	5	49	
Avoid crab empirically	12	34	.208
AD aggravated by crab, therefore avoid	7	7	
No crab avoidance ever	15	39	
Avoid shrimp empirically	13	34	.228
AD aggravated by shrimp, therefore avoid	9	9	
No shrimp avoidance ever	18	31	
Avoid egg (white) empirically	12	15	.661
AD aggravated by egg, therefore avoid	5	4	
No egg avoidance ever	31	46	
Avoid peanuts empirically	2	4	.826
AD aggravated by peanuts, therefore avoid	1	1	
No peanut avoidance ever	32	74	
Avoid milk empirically	5	9	.006
AD aggravated by milk, therefore avoid	2	4	
No milk avoidance ever	8	86	

Note: One parent reported eczema aggravation caused by egg but continued to give egg to the patient.

The most commonly sensitized foods were egg, shrimp, peanuts, and crab. The findings reported here are in agreement with those provided in other reports.^{3,9} Nearly one-third of patients had avoided shrimp, crab, or beef empirically despite a negative history of AD aggravation, and, subsequently, they were found to have no sensitization to these foods. Although there was a higher prevalence of sensitization to shrimp/crab than to beef, a similar pattern of avoidance practices and lack of association with eczema severity was observed among these seafood items. Furthermore, multiple food avoidance was a common practice, and more than 60% of parents who avoided beef had also avoided shrimp or crab. Pediatricians generally discourage the practice of empirical food avoidance, especially in children with mild AD and no specific history of disease aggravation with common foods. Additional studies are needed to confirm or refute many of the popular myths and practices that are based on disciplines in traditional Chinese medicine.

Dietary practices have usually been empirical, and advice was not generally sought from a doctor or a Chinese medicine practitioner.² Findings in Chinese patients were different from those reported in the UK study of mixed ethnicity, which stated that 75% of parents had tried some form of dietary exclusion, and that foods most commonly omitted were dairy products (48%), eggs (27%), and cow's

milk (25%), instead of seafood and beef.⁴ It is interesting to note that milk sensitization, empirical milk avoidance, and eczema aggravation were all relatively uncommon among the Chinese beyond infancy. Only 51% of parents of the UK patients had consulted a doctor or dietitian before altering children's diets, but 39% believed that their child's skin had improved as a result of this dietary manipulation.⁴

Nonatopic controls were used in the present study, and only Chinese patients were studied. The patient number was small because most patients had some personal or family history of atopy and were therefore excluded. Investigators in this study performed a cross-sectional analysis, and patterns of dietary change were not evaluated. SPT results and grading of severity of AD were considered in the analysis, however. It is important to note that disease severity was apparently not related to the prevalence of sensitization to these foods. Unlike previous investigators who used the SCORAD (SCORing Atopic Dermatitis scale developed by the European Task Force on Atopic Dermatitis) to evaluate eczema severity and symptoms over 3 days,¹¹ the investigators in the present study used the NESS score, which better reflected the chronic relapsing nature of AD.

The findings reported here can be used to clarify the nature of dietary avoidance in local children. It is generally believed that food allergy affects only a minority of patients with AD beyond infancy.¹⁷ Dietary practices are cultural and may vary from country to country.⁹ Instead of giving nonspecific dietary advice or adopting guidelines from another culture, clinicians must tailor instructions to individuals for optimal compliance. It is important to evaluate whether some of these food items are genuinely allergenic or harmful for patients with AD. Management is suboptimal if children with food allergy and severe disease continue to consume the culprit food.¹⁸ On the other hand, avoidance of common foods in children without food allergy could result in food faddism or malnutrition.

REFERENCES

1. Hon KL, Ma KC, Wong Y, et al. A survey of traditional Chinese medicine use in children with atopic dermatitis attending a paediatric dermatology clinic. *J Dermatol Treat*. 2005;16:154-157.
2. Hon KL, Leung TF, Kam WY, et al. Dietary restriction and supplementation in children with atopic eczema. *Clin Exp Dermatol*. 2006;31:187-191.
3. Eigenmann PA, Sicherer SH, Borkowski TA, et al. Prevalence of IgE-mediated food allergy among children with atopic dermatitis. *Pediatrics*. 1998;101:e8.
4. Johnston G, Bilbao R, Graham-Brown R, et al. The use of dietary manipulation by parents of children with atopic dermatitis. *Br J Dermatol*. 2004;150:1186-1189.
5. Sampson HA. Food allergy—accurately identifying clinical reactivity. *Allergy*. 2005;(suppl 79):19-24.
6. Emerson RM, Charman CR, Williams HC. The Nottingham Eczema Severity Score: preliminary refinement of the Rajka and Langeland grading. *Br J Dermatol*. 2000;142:288-297.
7. Hon KL, Ma KC, Wong E, et al. Validation of a self-administered questionnaire in Chinese in the assessment of eczema severity. *Pediatr Dermatol*. 2003;20:465-469.
8. Fiocchi A, Restani P, Riva E. Beef allergy in children. *Nutrition*. 2000;16:454-457.
9. Hill DJ, Hosking CS, Heine RG. Clinical spectrum of food allergy in children in Australia and South-East Asia: identification and targets for treatment. *Ann Med*. 1999;31:272-281.
10. Hill DJ, Heine RG, Hosking CS. The diagnostic value of skin prick testing in children with food allergy. *Pediatr Allergy Immunol*. 2004;15:435-441.

11. Verstege A, Mehl A, Rolinck-Werninghaus C, et al. The predictive value of the skin prick test weal size for the outcome of oral food challenges. *Clin Exp Allergy*. 2005;35:1220-1226.
12. Werfel SJ, Cooke SK, Sampson HA. Clinical reactivity to beef in children allergic to cow's milk. *J Allergy Clin Immunol*. 1997;99:293-300.
13. Fiocchi A, Restani P, Riva E, et al. Meat allergy: I—Specific IgE to BSA and OSA in atopic, beef sensitive children. *J Am Coll Nutr*. 1995;14:239-244.
14. Fiocchi A, Restani P, Riva E, et al. Meat allergy: II—Effects of food processing and enzymatic digestion on the allergenicity of bovine and ovine meats. *J Am Coll Nutr*. 1995;14:245-250.
15. Fiocchi A, Restani P, Riva E, et al. Heat treatment modifies the allergenicity of beef and bovine serum albumin. *Allergy*. 1998;53:798-802.
16. Restani P, Ballabio C, Cattaneo A, et al. Characterization of bovine serum albumin epitopes and their role in allergic reactions. *Allergy*. 2004;(suppl 78):21-24.
17. Halbert AR, Weston WL, Morelli JG. Atopic dermatitis: is it an allergic disease? *J Am Acad Dermatol*. 1995;33:1008-1018.
18. Leung AK. Food allergy: a clinical approach. *Adv Pediatr*. 1998;45:145-177.