

ORIGINAL RESEARCH

Beef, Pork, and Milk Allergy (Cross Reactivity With Each Other and Pet Allergies)

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OBJECTIVE: The purposes of this study were to examine milk allergic patients to determine concomitant reactivity between milk, beef, pork and cat and dog dander and other common inhalant allergens.

METHODS: 19 patients were selected according to their Immuno-CAP results, which had increased Ig-E levels against milk, pork or beef. Patients were also tested against Johnson grass, short ragweed, cat/dog dander and d. farina.

RESULTS: Pearson's test revealed strong correlation between beef and pork, beef and milk, pork and milk Ig-E counts (consecutively $r_2 = 0.89$, $r_2 = 0.81$, $r_2 = 0.60$ and $p < 0.01$). All cat allergic patients also appeared to be allergic to either beef/pork meat or milk. The correlation between pork and dog dander Ig-E counts was also significant ($r_2 = 0.38$, $p < 0.01$). No correlation detected between milk-meat-pet and grass-weed-dust allergies.

DISCUSSION AND CONCLUSION: Patients who are known to have pet allergies may need to be screened for meat and milk allergy. Milk allergic patients may also need to avoid cows and pork meat.

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Milk has been recognized for many years as one of the leading causes of food allergies. Epidemiological data indicate that the prevalence of cow's milk allergy is approximately 1% to 2%. On the other hand, no definite data are available for beef or pork meat allergy.^{1,2}

Inhalant allergy may help clinicians identify some food allergies because cross-reactivity is known to exist between airborne and food allergens. Proteins that share common epitopes with the major birch pollen allergen occur in pollens of several tree species: apples, stone fruits, celery, carrot, nuts, chicory, and soybeans. Approximately 70% of patients who are allergic to birch pollen may experience symptoms after consumption of foods from these groups.^{3,4}

Likewise, IgE cross-reactivity has been identified be-

tween house dust mites and snails.⁵ The so-called latex-fruit syndrome also is a well-documented phenomenon in cross-reactive allergies. The presence of IgE cross-reactivity between kiwi fruit and grass pollen allergens and between ragweed and gourds (watermelon, cantaloupe, honeydew melon, zucchini, and cucumber) has been reported.^{6–8}

Studies on pork-meat allergy have revealed a high frequency of concomitant allergy to cat epithelium.⁹ Further investigations showed that serum albumin is the common allergen and that the frequency of sensitization among cat-allergic patients was 14%–23% for cat serum albumin and 3%–10% for pig serum albumin.¹⁰ The high degree of structural similarity between albumins of different animals suggests that patients sensitized by one species are likely to react to several different animal meats and epithelia.

MATERIAL AND METHODS

Patients were recruited from the author's otolaryngology practice located in northeast Arkansas. All patients were randomly selected from those known or strongly suspected to have allergies to milk and milk products according to their history, clinical examination, or in vitro allergy test results. Allergy tests were performed according to the patient's allergy history and clinical findings. None of the patients underwent any additional allergy testing specifically for this study. Only test results available in their office charts were reviewed and included for this retrospective analytic study. Institutional review board approval was not required because the author gathered the information only from his private patients. No other author or research assistant was involved in this study, and none of the patients' identities were released at any time to any parties, whether during data gathering, analysis, or presentation of the re-

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Table 1

ImmunoCap-specific IgE results are expressed as a percentage of response of the patient specimen compared with the 0.35-KU/L calibrator

Patient number	Age (yr)	F2	F26	F27	E1	E5	D2	G8	W1
1	71	31	29	29	60	41	NA	93	1195
2	66	49	62	81	NA	48	37	42	37
3	75	61	84	154	122	35	25	27	31
4	74	72	86	136	NA	NA	NA	NA	NA
5	28	75	106	122	NA	88	NA	48	43
6	73	75	137	178	NA	35	87	102	30
7	36	86	154	282	225	123	65	172	1619
8	12	114	66	81	96	58	44	50	56
9	53	140	57	80	40	72	40	49	47
10	48	140	1409	934	3806	4989	27	28	28
11	13	144	57	57	NA	131	5184	39	30
12	22	151	318	427	466	177	47	57	54
13	2	191	31	40	NA	NA	NA	NA	NA
14	14	298	419	580	700	198	42	36	39
15	18	300	1019	1106	NA	399	52	51	47
16	71	311	90	151	147	95	30	57	70
17	54	427	914	1384	NA	482	38	44	39
18	55	601	1543	1969	NA	982	NA	58	128
19	75	1033	1632	2404	2902	945	39	31	319
Median		140	106	154	186	123	41	49	47

F2, milk; F26, pork; F27, beef; E1, cat; E5, dog; D2, *Dermatophagoides farinae*; G8, June grass; W1, short ragweed; NA, not available.

Patient response scores above 71 were accepted as positive for allergy. All patients except 1 were allergic to 1 of the 3 food antigens (milk, pork, and beef) used in this study; 1 patient was allergic to grass and weed only.

sults. Patients' symptoms varied from mild to moderate nasal congestion, to sneezing that was clinically diagnosed as perennial allergic rhinitis, to severe persistent asthma. Patients initially were screened for allergies to common indoor and outdoor allergens. This screen panel consists of June grass (g8), ragweed (w1), *Dermatophagoides farinae* (d2), *Alternaria*, milk (f2), cat epithelium and dander (e1) or dog dander (e2), and total IgE levels. The screen test was modified according to the patient's allergy history and clinical findings; different allergens were added or deleted according to the clinical indications. Patient who showed positive results to milk or who showed elevated IgE levels or strong food allergy history also were tested for the complete food panel, which includes soy, egg yolk, wheat, rice, chicken, beef (f27), and pork (f26). The same reference laboratory performed all in vitro allergy tests by using ImmunoCAP method (Quest Diagnostics Inc., St. Louis, Mo.). The allergy results to milk (f2), cat epithelium and dander (e1), dog dander (e5), pork (f26), beef (f27), *Dermatophagoides farinae* (d2), June grass (g8), and short ragweed (w1) were used. Results were reported as a percentage response of the patient's serum compared with the 0.35-kU/L calibrator. Pearson's correlation test, which was available from the Vassarstats Web site for statistical computation (<http://departments.vassar.edu/~lowry/VassarStats.html>), was used for the statistical analysis, and the scatter graphs were created by using a spreadsheet program.

RESULTS

All of the patients except 1 were allergic to at least 1 food antigen (milk, pork, or beef) according to their in vitro allergy test results. One patient's serum reacted only to June grass and short ragweed. Patients ranged from 2 years to 75 years (mean age, 45 ± 25 years). The cutoff point of positive results of a percentage response of the patient's serum compared with the 0.35-kU/L calibrator was 71% (Table 1). Sixteen patients were allergic to milk; 14 of these also were allergic to pork and beef antigens, according to their immunoCAP results. Sixteen patients were allergic to beef, and 13 of these beef-allergic patients also were allergic to pork antigens (Fig 1). High levels of

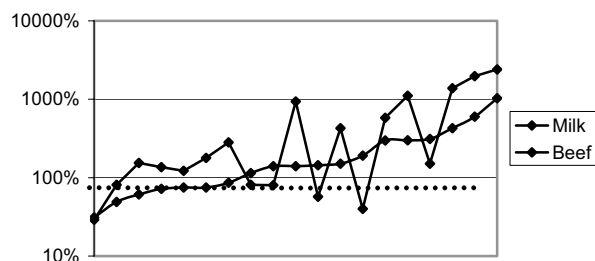


Figure 1 Correlation between beef and milk allergy, expressed as a percentage of response of the patients' specimen compared with the 0.35-KU/L calibrator. Dashed line represents the cut point at 71%; all scores above this indicated a positive result for milk or beef allergy.

specific IgE counts could be seen even in advanced age, as seen in patient 19, though no correlation could be detected between age and the specific IgE counts. The correlations between milk and beef, pork and beef, and also pork and cat were very strong and significant ($r^2 = 0.81, 0.89$, and 0.93 respectively) and were even stronger than the correlations between cat and dog ($r^2 = 0.75$) or ragweed and grass ($r^2 = 0.67$) allergy (Table 2). Additionally, milk and pork and also beef and cat allergies revealed good correlation, but not as strong as that of the others ($r^2 = 0.60$ and 0.61 , respectively). The correlation between pork and dog was weak (Fig 2) but was statistically significant ($r^2 = 0.38, P < 0.01$). None of the other correlation tests were significant.

DISCUSSION

Diagnosing food allergies is challenging for clinicians. These allergies can be seen in all age groups. Cooking or other processing methods do not necessarily eliminate the allergenic epitopes from milk and meat products.^{11,12} The double-blind, placebo-controlled food challenge is believed to be the gold standard for the absolute diagnosis of food allergy in a clinic hospital setting¹³; however, it has to be performed cautiously because it may cause anaphylaxis and cardiovascular collapse.

According to the results of this study, a milk-allergic patient usually also is allergic to beef. Additionally, beef allergen usually cross-reacts with pork allergens. Incidence and prevalence of beef and pork allergies is not known but probably is very close to milk allergy. In the literature, between 13% and 92% of children with beef allergy also have cow's milk allergy.¹⁴ The statistical analysis in this study showed a strong and significant correlation between milk and meat allergies. This finding supports the previously published studies and shows that similar correlation continues in adult life also. Patients with known milk aller-

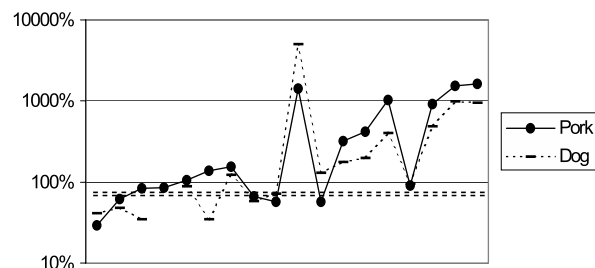


Figure 2 Correlation between pork and dog dander allergy. Dashed line represents the cutoff point at 71%; all scores above this indicated a positive result for pork or dog allergy.

gies may need to be informed about this correlation, and additional testing is suggested for beef and pork products when clinically indicated.

In this study, patients with cat allergies appear also to be allergic to pork or beef. So-called cat-pork syndrome has been reported elsewhere.^{9,10} However, no published study revealing pork and dog dander allergy is found in current medical literature. Additionally, there is a statistically significant correlation between cat dander and beef allergy according to the specific IgE counts analysis, but one not as strong as the ones already specified.

CONCLUSION

Current results obtained from this study are significant and can be clinically beneficial to the milk and animal-dander allergy patients. The correlation between milk and beef, and also to a lesser degree between milk and pork meat, is very strong and significant according to this study result. Patients who are allergic to milk may need to be tested for allergies for beef and maybe pork meat also. Moreover, allergy to pork meat is significantly related to cat and dog dander allergy, and beef allergy, to dog dander. Therefore, allergies to beef and pork antigens might be more common than previously thought and may be present in up to 2% of the population as with milk allergy. This study was performed on a small population of allergic patients, so a repeat of this study on a larger group of patients with a food challenge testing is recommended.

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Table 2
Pearson coefficient of determination

	Milk	Pork	Beef	Cat	Dog	D.F.	Grass
Pork	0.60						
Beef	0.81	0.89					
Cat	NC	0.93	0.61				
Dog	NC	0.38	NC	0.75			
D.F.	NC	NC	NC	NC	NC		
Grass	NC	NC	NC	NC	NC	NC	
Weed	NC	NC	NC	NC	NC	NC	0.67

D.F., *Dermatophagoides farinae*; NC, no correlation. For all coefficients given, $P < 0.01$. Many of the milk-allergic patients also reacted to beef and pork antigens. Patients' cat allergy correlated with dog allergy, and grass allergies correlated with ragweed allergy. Pork-allergic patients usually have cat or dog allergies; the correlations were significant. Beef allergy appeared to correlate with cat allergy.

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