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PII: S2213-2198(21)01108-9

DOI: <https://doi.org/10.1016/j.jaip.2021.09.041>

Reference: JAIP 3878

To appear in: *The Journal of Allergy and Clinical Immunology: In Practice*

Received Date: 12 May 2021

Revised Date: 23 September 2021

Accepted Date: 24 September 2021

Please cite this article as: Zhang S, Sicherer SH, Bakhl K, Wang K, Stoffels G, Oriel RC, Restaurant Takeout Practices of Food Allergic Individuals and Associated Allergic Reactions in the COVID era, *The Journal of Allergy and Clinical Immunology: In Practice* (2021), doi: <https://doi.org/10.1016/j.jaip.2021.09.041>.

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Restaurant Takeout Practices of Food Allergic Individuals and Associated Allergic Reactions in the COVID era

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Sources of Funding: None

Conflicts of Interests:

Shouling Zhang - Nothing to disclose

Scott H. Sicherer - Reports royalty payments from UpToDate and Johns Hopkins University Press; grants to his institution from the National Institute of Allergy and Infectious Diseases, Food Allergy Research and Education; and personal fees from the American Academy of Allergy, Asthma and Immunology as Deputy Editor of the Journal of Allergy and Clinical Immunology: In Practice, outside of the submitted work.

Katrina Bakhl - Nothing to disclose

Kelly Wang, MPH - Nothing to disclose

Guillaume Stoffels, MA - Nothing to disclose

Roxanne C. Oriel - Nothing to disclose

Clinical Implications: Allergic reactions from restaurant takeout food were reported by 16.8% of survey respondents and about 25% avoided takeout altogether, with no differences pre-/during COVID.

Allergists should counsel patients on obtaining safe restaurant takeout.

Individuals with food allergies face challenges when ingesting food prepared in restaurants. Allergic reactions can be severe or even fatal. In a US national registry study, 19% of food-associated fatalities occurred in restaurants.(1, 2) While restaurant staff may feel comfortable with providing allergen-safe meals, deficits in staff training and knowledge of food allergies exist.(3, 4) Recent analysis of national survey data showed one's home accounting for 51% of food allergic reactions in children.(5) Some of these reactions could be due to restaurant takeout, but takeout was not specifically assessed. Dining out accounted for 13% of reactions.(5) Allergic reactions to restaurant takeout has never been previously evaluated.

With social distancing implemented during the COVID-19 pandemic, takeout has become more common. We sought to characterize takeout preferences among US families with a food allergic child pre- and during the COVID-19 pandemic. As a secondary objective, we characterized any associated allergic reactions. We created a survey of parents ordering takeout with pre-pandemic data, during pandemic data, allergic reactions, and demographics. The study was approved by the Institutional Review Board (IRB). From 11/2020-12/2020, a REDCap online survey was distributed via the Mount Sinai Jaffe Food Allergy Institute listserv and social media. Listserv subscribers include food allergic individuals, their parents, and individuals interested in food allergy. Individuals 18 years or older with at least one child with a physician-diagnosed food allergy were sent the survey after informed consent was obtained. De-identified, parental-reported data were collected. Descriptive statistics, McNemar's, Wilcoxon Signed Rank Sum, Chi-square, Fisher's exact, and Cochran-Armitage trend tests were used for analyses, all performed using SAS version 9.4 (SAS Institute, Cary, NC). Statistical significance was set at $p < 0.05$.

A total of 206 individuals participated. The children with food allergy were mostly male (56.3%), White (87.9%), non-Hispanic (83.5%), and from the northeast (New York 60.7%, New Jersey 21.4%, Connecticut 6.8%). Table E1 summarizes demographics (online repository). Pre-pandemic, defined as

before 3/2020, most (77.7%) families reported ordering takeout in varying frequencies (Table E2). Table E2 summarizes takeout preferences and practices. Overall, there were no differences in takeout practices among food allergic individuals pre- and during the COVID-19 pandemic.

Figure 1 shows pre-COVID precautions taken by food allergic individuals who order takeout and reasons why respondents avoided takeout. Other mitigation efforts (11.2%) included only ordering from restaurants previously visited or that do not cook with avoided ingredients. There were no differences in these responses pre-/during COVID; however, during COVID-19, 11.2% indicated that the pandemic was a reason to avoid takeout.

Allergic reactions from restaurant takeout were reported by 16.8% (n=29) of 173 respondents. Thirty-three participants did not answer. Most children who had an allergic reaction were school-aged children or adolescents: 6-12 years (37.9%), 13-17 years (37.9%), ≥ 18 years (13.8%). The number of allergic reactions were 1 (44.8%), 2 (34.5%), and ≥ 3 (20.7%). One allergic reaction was excluded from analyses due to delayed symptom onset; all other reported reactions occurred within 2 hours. Symptoms typically occurred within 30 minutes (69.0%) or 31 minutes to 2 hours (27.6%), with 28.6% reporting emergency room evaluation. Treatment included oral antihistamines (86.2%), epinephrine auto-injector use (27.6%), steroids (20.7%), bronchodilators (6.9%), none (6.9%), and antacids (3.4%). Allergic reaction source was often unknown. When identified, milk (24.1%), peanut (20.7%), and wheat (6.9%) were most common. Restaurant cuisines most often implicated in allergic reactions included Chinese (25.0%), American (14.3%), and Indian/Korean/Thai/Italian/Vegan/hotel restaurants (each 7.1%). There were no significant differences in takeout precautions or methods of ordering among those who had reactions. A statistically higher risk of reaction was noted for those ordering Chinese, "Asian," and Mexican cuisines (Table 1).

Here we report the first study evaluating restaurant takeout practices among food allergic individuals and any associated allergic reactions. Allergic reactions to takeout food occur despite

precautions taken by the food allergic individual, 16.8% in this survey. Severe allergic reactions mostly occurred to food from Asian restaurants, results consistent with research citing Asian restaurants as high-risk for food-allergic reactions (up to 19%), suggesting that risk may vary by cuisine which should be considered by restaurant patrons.(6) Our study is the first to highlight specific precautions taken by food allergic individuals ordering takeout (Figure 1). While there was no difference in the types of precautions exercised between individuals who reacted and did not react, future studies understanding the efficacy of individual precautionary strategies are suggested to identify best practices. Most individuals that had an allergic reaction took steps to prevent one from occurring. Interestingly, only one individual experienced an allergic reaction when no precaution was taken. We hypothesize that miscommunication of allergy status from families to restaurants may help explain why individuals experienced allergic reactions even when taking precautionary steps. Moreover, certain precautionary strategies may have different levels of effectiveness compared to others. We would not encourage depending upon visual inspection of food (and there was a trend toward risk with this strategy). A restaurant's lack of knowledge is also likely.(3) There was a high percentage of restaurants without any menu allergen labeling (35.8%), and a borderline difference in this category between those who did and did not react ($p=.06$), suggesting that this could be a focus area and may reflect increased allergen awareness and protocols in those establishments (i.e., better communication and knowledge). Identifying potential barriers that may exist for restaurants in menu allergen labeling is recommended, so that widespread menu labeling can occur as a collaboration with restaurants. Families made no major changes to takeout routines during the COVID-19 pandemic, and allergic reactions occurred in patterns seen pre-pandemic. Data presented here support the need for improved communication between restaurant workers and patrons, and the expansion of food allergy knowledge among restaurant staff.

While allergic reactions from takeout was high, this should be interpreted with caution due to study limitations, including the survey-based nature of this study, potentially biased by respondent

experience and recall. Recall bias may exist with pre-pandemic data, as this study was conducted more than 6 months after the start of the COVID-19 pandemic. The nature of the survey did not allow us to determine if persons with specific allergies (e.g., milk versus peanut) had increased risks of reactions, nor could we determine if restaurants that did not usually provide take-out pre-pandemic were riskier than those that did. The study was based on a convenience sample, and thus geographically limited. Additional analysis excluding the ~11% of survey participants outside of NY, NJ, CT, however, did not yield any meaningful differences in study conclusions.

Future studies examining effective ways of preventing allergic reactions from takeout food are needed to advance advocacy efforts. Allergists should carefully discuss risks with patients, promoting clear communication, asking/educating about cross-contact and hidden ingredients.(7, 8) Mandating declaration of allergenic ingredients on menus, encouraging free text options for food allergies to be declared by individuals ordering takeout, and regular and effective restaurant staff training may be helpful at reducing risk.(8) Prior studies from the hospitality industry also indicate interest from restaurants in obtaining additional food allergy training.(9) Together, these efforts may help improve takeout experiences among food-allergic individuals, so food can be enjoyed safely.

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Figure Legends:

Figure 1. Precautions taken when ordering and reasons cited for avoiding takeout in food-allergic individuals

Online Repository:**Table E1:** Characteristics of Food-Allergic Children

Characteristics of Food-Allergic Children		All (n=206) n (%)
Sex		
	Male	116 (56.3)
	Female	90 (43.7)
Race		
	White	181 (87.9)
	Asian	26 (12.6)
	Black or African American	7 (3.4)
	Prefer not to answer	5 (2.4)
	Not listed	4 (1.9)
	American Indian or Alaska Native	1 (0.5)
	Native Hawaiian or Pacific Islander	0 (0)
Ethnicity		
	Not Hispanic or Latino	172 (83.5)
	Not listed	17 (8.3)
	Hispanic or Latino	9 (4.4)
	Prefer not to answer	8 (3.9)
Avoided Foods		
	Peanut	146 (70.9)
	Tree nuts	124 (60.2)
	Sesame	82 (39.8)
	Egg	57 (27.7)
	Milk	56 (27.2)
	Shellfish	36 (17.5)
	Fish	26 (12.6)
	Wheat	16 (7.8)
	Soy	10 (4.9)
	Other (legumes, seeds, grains, avocado)	42 (20.4)

Table E2: Takeout Preferences

	<u>Pre-COVID</u> n (%)	<u>During COVID</u> n (%)	p-value [□]
Ordered Takeout			0.3035
Yes	160 (77.7)	154 (74.8)	
No	46 (22.3)	52 (25.2)	
Takeout Frequency*			0.2550
Less than once per month	26 (16.4)	27 (17.7)	

1-3 times per month	62 (39.0)	61 (39.9)	
Once per week	43 (27.0)	39 (25.5)	
1-3 times per week	27 (17.0)	23 (15.0)	
4 or more times per week	1 (0.6)	3 (2.0)	
Takeout Mode			
Online application	66 (32.0)	73 (35.4)	0.1779
Restaurant website	63 (30.6)	73 (35.4)	0.0588
Telephone order	130 (63.1)	116 (56.3)	0.0196
Menu Allergies Declared*			
			0.3764
Yes, all of the time	16 (10.1)	14 (9.2)	
Yes, most of the time	21 (13.2)	23 (15.1)	
Yes, half of the time	6 (3.8)	4 (2.6)	
Yes, some of the time	59 (37.1)	55 (36.2)	
No	57 (35.8)	56 (36.8)	
Restaurants Ordered From			
American	99 (48.1)	86 (41.8)	0.0526
Deli	39 (18.9)	29 (14.1)	0.0330
Asian	31 (15.1)	25 (12.1)	0.2008
Chinese	49 (23.8)	33 (16.0)	0.0002
Japanese	49 (23.8)	41 (19.9)	0.0455
Italian	82 (39.8)	69 (33.5)	0.0124
Mediterranean	33 (16.0)	28 (13.6)	0.2253
Mexican	65 (31.6)	51 (24.8)	0.0082
Fast food	60 (29.1)	48 (23.3)	0.029
Pizza	116 (56.3)	103 (50.0)	0.024
Other**	<10%	<10%	-

* Missing 47 responses pre-COVID. Missing 53 responses for takeout frequency, and 54 responses for menu allergies declared, during COVID.

** Other (<10%) includes bakery, bar, Cambodian, Indian, Korean, Taiwanese, Thai, Vietnamese, African, Caribbean, French, German, Polish, Spanish, fine dining, ice cream parlor, seafood, smoothie/juice, steakhouse, vegan, vegetarian, and other food establishments (hotel restaurants) which were each individually less than 10%.

□ McNemar's and Wilcoxon Signed Rank Sum tests were used to determine if there was an association between time of delivery (pre or during COVID) and the following factors presented in Table E2.

Table(s)**Table 1:** Pre-Pandemic Characteristics of Allergic Reactions from Takeout Food

	Reacted (n=28) n (%)	No Reaction (n=144) n (%)	p-value[□]
Ordered Takeout	27 (96.4)	131 (91.0)	0.47
Takeout Precautions			
Write child's food allergy in online order	11 (39.3)	66 (45.8)	0.52
Call restaurant to discuss allergy	23 (82.1)	94 (65.3)	0.08
Visually inspect dish	12 (42.9)	49 (34.0)	0.37
Other	3 (10.7)	20 (13.9)	1.00
None	1 (3.6)	7 (4.9)	1.00
Takeout Mode			
Online application	7 (25.0)	59 (41.0)	0.11
Restaurant website	7 (25.0)	56 (38.9)	0.16
Telephone order	24 (85.7)	105 (72.9)	0.15
Menu Allergies Declared*			0.06
Yes, all of the time	1 (3.7)	15 (11.5)	
Yes, most of the time	3 (11.1)	18 (13.7)	
Yes, half of the time	1 (3.7)	5 (3.8)	
Yes, some of the time	7 (25.9)	51 (38.9)	
No	15 (55.6)	42 (32.1)	
Restaurants Ordered From			
American	17 (60.7)	82 (56.9)	0.7119
Bakery	1 (3.7)	10 (6.9)	1.0000
Deli	8 (28.6)	31 (21.5)	0.42
Asian	10 (35.7)	21 (14.6)	0.008
Chinese	15 (53.6)	33 (22.9)	0.0009
Indian	4 (14.3)	14 (9.7)	0.50
Japanese	9 (32.1)	40 (27.8)	0.64
Thai	2 (7.1)	13 (9.0)	1.0000
Italian	16 (57.1)	66 (45.8)	0.27
Mediterranean	8 (28.6)	25 (17.4)	0.17
Mexican	17 (60.7)	48 (33.3)	0.006
Spanish	4 (14.3)	11 (7.6)	0.27
Fine dining	2 (7.1)	11 (7.6)	1.0000
Fast food	12 (42.9)	48 (33.3)	0.33
Ice cream parlor	2 (7.1)	14 (9.7)	1.0000
Pizza	18 (64.3)	98 (68.1)	0.83
Steakhouse	0 (0)	15 (10.4)	--
* Missing 47 responses			

☐ Chi-square test for association and Cochran Armitage Trend Tests were used to determine if there was an association between individuals who had a reaction compared to individuals who did not pre-pandemic among the factors presented in Table 1.

Figures:**Figure 1:**