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Original article

Knowledge, attitude and practice of general practitioners and pediatricians regarding food allergy in Iran

Connaissances, positionnement et pratique des médecins généralistes et des pédiatres iraniens sur l'allergie alimentaire

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ABSTRACT

Background. – Food allergy is a common disorder affecting up to 8% of children around the world. Normally, general practitioners and pediatricians are the first practitioners to see food-allergic patients. Consequently, these doctors' awareness about the presentation, diagnosis and management of food allergies is vital, as is their knowledge about the best practical methods for the prevention and treatment of systemic near-fatal reactions due to food allergy. We sought to determine the knowledge, attitude and practice (KAP) of general practitioners and pediatricians regarding food allergy in our environment.

Methods and materials. – In this observational KAP study, 105 general practitioners and pediatricians were enrolled and their knowledge, attitude and practice in the food allergy field were determined by means of a questionnaire.

Results. – In the survey, low, medium, and high levels of knowledge were seen in 4.8%, 59%, and 36.2% of the participants, respectively. Physicians' knowledge levels were significantly correlated with their medical specialty. Attitude was appropriate in 86.7% of the participants and practice was positive in 75.2%. Medical specialty had a significant effect on physicians' practice regarding food allergy ($P = 0.007$). Extensive knowledge and positive practice were significantly more frequent in pediatricians in comparison with general practitioners.

Conclusion. – The survey showed the knowledge, attitude and practice of Iranian pediatricians and general practitioners regarding food allergy to be suboptimal. This finding underlines the importance of organized re-education to upgrade the knowledge, attitude and practice of clinical practitioners.

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R É S U M É

But de l'étude. – L'allergie alimentaire est une pathologie fréquente concernant jusqu'à 8% des enfants dans la population mondiale. Habituellement les médecins généralistes et les pédiatres sont les premiers praticiens à examiner les patients victimes d'allergie alimentaire. Par conséquent, l'expertise de ces médecins sur les signes d'appel, le diagnostic et la prise en charge des allergies alimentaires est capitale, ainsi que leurs connaissances sur les meilleures méthodes pratiques de prévention et de traitement des réactions systémiques pré-létales par allergie alimentaire. Nous nous sommes attachés à déterminer les connaissances, le positionnement et la pratique des médecins généralistes et des pédiatres sur l'allergie alimentaire dans notre environnement.

Mots clés :

Connaissances

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Méthodes et matériel. – Dans cette étude observationnelle, 105 généralistes et pédiatres ont été recrutés et leurs connaissances, positionnement et pratique sur l'allergie alimentaire furent appréciés par questionnaire.

Résultats. – Au cours du suivi, des niveaux bas, moyens et élevés des connaissances furent observés chez 4,8 %, 59 % et 36,2 % des participants, respectivement. Le niveau de connaissances des médecins était corrélé à leur spécialisation. Le positionnement était adapté chez 86,7 % des participants et la pratique était validée chez 75,2 % d'entre eux. La spécialité médicale avait un effet significatif sur la pratique médicale pour l'allergie alimentaire ($p=0,007$). Des connaissances étendues et une pratique appropriée étaient significativement plus fréquentes chez les pédiatres en comparaison avec les médecins généralistes.

Conclusion. – L'étude a montré que les connaissances, le positionnement et la pratique des pédiatres et des généralistes iraniens sur l'allergie alimentaire étaient suboptimaux. Ces résultats soulignent l'importance d'une formation médicale continue pour actualiser les connaissances, le positionnement et la pratique des médecins praticiens.

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1. Introduction

Food allergy is defined as a distinct immunologic reaction, either IgE-mediated or not, occurring aberrantly after cutaneous or mucosal exposure to normally innocuous food proteins [1,2].

Food allergy is an increasingly common condition involving up to 8% of children worldwide. A recent study showed that food allergy is seen among 1% to 10% of the general population regardless of age [3–5]. However, there is a substantial difference in figures between self-reported food allergy and what is scientifically documented through oral food challenge, namely 13% vs. 3% [6]. In addition, food allergy is one of the most common causes of anaphylaxis in young adults and 30–50% of instances of anaphylaxis referred to hospitals are due to food allergy [3,7].

Although every food may potentially be allergen, allergic reactions are reported chiefly in association with a limited number of foods that include milk, eggs, wheat, soy, fish, shellfish, peanuts, tree nuts and seeds [3,7].

Food allergy may present as isolated organ involvement or a combination of cutaneous, gastrointestinal and respiratory manifestations that may potentially be lethal. It is not possible to accurately predict the seriousness of subsequent reactions to any particular food allergen, even based on the severity of previous responses, serum IgE levels or wheal size in skin-prick tests [8,9].

Compared to allergists, general practitioners and pediatricians are more widely accessible everywhere and are normally the first practitioners to see patients. Consequently, these doctors' awareness about how food allergy presents, and how it should be diagnosed and managed is vital, as is their knowledge about the best practical methods for prevention and treatment of potentially fatal systemic reactions due to food allergy. At the very least, they should know about the critical aspects of food allergy manifestations and its management in order to be able to provide appropriate advice and ensure timely referral of patients to an allergist [10].

Given the frequency of food allergy in Iran [11] and the significance of the role primary physicians and pediatricians in early diagnosis and adoption of appropriate measures, assessment of knowledge, attitude and practice (KAP) in these two groups regarding food allergy appears paramount.

Since no comprehensive surveys have been done in Iran concerning the knowledge, attitude and practice of general practitioners and pediatricians regarding food allergies, the present study was designed to evaluate this issue.

2. Methods and materials

This cross-sectional study was conducted during the 2014 annual International Pediatrics Congress in Tehran, Iran, held at the Children's Medical Center affiliated to Tehran University of Medical Sciences.

A questionnaire was designed based on similar studies, available guidelines and discrepancies between Iran and other countries regarding food allergy patterns. This questionnaire included demographic information concerning gender, specialty, length of practice, the primary setting of practices and the number of food-allergic patients seen on average. There were 18 questions on knowledge, 4 questions on attitude and 15 questions on practice. The questionnaire was reviewed separately and approved by several allergists. Pediatricians and general practitioners attending the congress were asked to fill out the questionnaire. Each participant was assigned a code and completed the questionnaire covering these three domains in anonymous fashion.

The respondents' awareness about sources of food allergy, key manifestations, the main age groups affected, diagnosis, management and food-induced anaphylaxis was evaluated in the knowledge assessment section. For assessment of attitudes, respondents answered questions about their competence in treating food-allergic patients and the best way of providing assistance, and about their desire to join an educational session. They were asked about their therapeutic approach to a food-allergic patient in order to evaluate their practice.

Regarding knowledge, correct answers given by each participant were graded. Grades within the range of ± 2 standard deviations from the mean were considered as evidence of a moderate level of knowledge. Higher grades and lower grades were regarded as indicating good (high) and poor (low) knowledge levels, respectively. Regarding attitudes, the average score was calculated, and participants were categorized into two groups of either appropriate and inappropriate attitudes. Furthermore, in the practice domain, scores above the mean were taken to indicate positive practice while scores below the mean were interpreted as negative practice. Data were analyzed using SPSS v.13 software. Means and standard deviations were determined for quantitative variables while frequency and percentages were assessed for quantitative variables. Chi² and *t*-tests, as well as Fisher's exact test, were used to explore the existence of relationships between variables.

Table 1
Participant characteristics.

Variable	Sample population n (%)
<i>Gender</i>	
Male	41 (39)
Female	64 (61)
<i>Medical specialty</i>	
General practitioner	61 (58.1)
Pediatrician	44 (41.9)
<i>Practice type</i>	
Private office	48 (45.7)
Academic hospital	20 (19)
Private hospital	5 (4.8)
Non-academic public hospital	32 (30.5)
<i>Food-allergic population</i>	
High prevalence	8 (7.6)
Moderate prevalence	46 (43.8)
Low prevalence	51 (48.6)

2.1. Ethical consideration

This study was approved by the IRB/Ethics Committee of Tehran University of Medical Sciences. Questionnaires were completed anonymously, and each participant entering the survey was identified solely by means of a code.

3. Results

3.1. Participant characteristics

Of the 105 participants, 44 (41.9%) were pediatricians and other 61 subjects were general practitioners (58.1%). Sixty-four participants (61%) were male. The average length of practice $\pm$ standard deviation was 11.3 ± 8.8 years. Only 20 (19%) participants were affiliated with academic centers (19%) and 46 participants (43.8%) reported that they were involved with moderate prevalence food-allergic populations (Table 1).

3.2. Knowledge of food allergy

Analysis revealed a high knowledge level in 38 participants (36.2%). Moderate and low levels of food allergy knowledge were identified in 62 (59%) and 5 (4.8%) participants, respectively. Medical specialty had a significant impact on knowledge levels; none of the pediatricians had a low level of knowledge while 5 (8.2%) of general practitioners were in the low knowledge group. Although 26 pediatricians (59.1%) had high levels of knowledge about food allergy, the corresponding figure in the general practitioners' group was 12 (19.7%). No gender difference was detected concerning knowledge of food allergy. Further, level of knowledge was unaffected by type of practice or the food-allergic population under a physician's coverage. Table 2 and Table 5 provide detailed information. In addition, Table 4 provides greater detail regarding knowledge scores.

3.3. Attitude towards food allergy

An appropriate attitude was found in 91 participants (86.7%) while 14 participants (13.3%) did not show a favorable attitude. Tables 3 and 5 illustrate the absence of any significant correlation between general attitude to food allergy and various parameters other than type of practice ($P = 0.036$). Individual results concerning participants' attitudes are given in Table 4.

3.4. Practice regarding food allergy

More than 75% of participants ($n = 79$) exhibited positive practice regarding food allergy management while 26 participants (24.8%) revealed negative practice. Medical specialty had a significant effect on physicians' practice in food allergy ($P = 0.007$). No notable difference was seen between the groups regarding the other parameters. The details are set out in Tables 4 and 5.

4. Discussion

Since general practitioners and pediatricians are typically the first-line care providers in the field of food allergy, an inappropriate approach by them can lead to substandard management, which is detrimental to the quality of life of patients and their families. Moreover, inadequate awareness and lack of positive practice may be fatal for patients predisposed to food-induced anaphylaxis [6,10]. Consequently, evaluating knowledge, attitude and practice among this group of doctor is of considerable practical importance. The present study to assess practitioners' KAP toward food allergy was carried out during the annual International Pediatrics Congress organized by Tehran University of Medical Sciences.

The most striking finding of this survey was the fact that knowledge among over half (59%) of the responders was moderate with only 36% being sufficiently knowledgeable. Furthermore, the extent of knowledge was significantly higher among pediatricians compared to general practitioners ($P < 0.05$). Although there was no significant difference in attitude between pediatricians and general practitioners, practice was considerably more positive among pediatricians ($P < 0.05$). There was no gender difference in participants' knowledge, attitude or practice. Regarding the association of each domain with variables that included duration of work experience, type of practice and number of food allergy patients seen, the only appreciable finding was the relationship between practitioners' attitudes and employment in a private hospital ($P < 0.05$).

Guidelines recommend intramuscular epinephrine as the first-line drug therapy for acute anaphylaxis, and an epinephrine auto-injector should thus be prescribed for all patients with a history of food-induced anaphylaxis [2,8]. Nonetheless, we found that 21% of the responders did not believe in using epinephrine in the treatment of anaphylaxis, with 71.4% of them reporting that they preferred subcutaneous administration, while 73.3% had never prescribed an epinephrine auto-injector for any patients with food-induced anaphylaxis. These findings highlight the need for regular programs to re-educate health workers, especially general practitioners, to keep them abreast of current developments in the prevention, management and follow-up of food-allergic patients, with particular attention to revised guidelines, especially those concerning life-threatening conditions.

A problem-solving survey concerning pediatricians' awareness about anaphylaxis diagnosis and management was conducted by Krugman et al. in 2006. Most of the study group (486 pediatricians) correctly diagnosed anaphylaxis. However, their approach to management, including the duration of patient observation post anaphylaxis, was suboptimal. Prior experience in managing patients with food allergy positively influenced physicians' awareness. Conversely, taking an educational update course showed no positive impact on their knowledge [12]. Gupta et al. conducted a KAP study in which they enrolled 407 primary practitioners, including 339 pediatricians and 68 family physicians. They concluded that while the knowledge level of general practitioners

Table 2

Knowledge of food allergy in relation to gender, medical specialty, practice type, food-allergic population, and practice years.

	High <i>n</i> (%) or mean $\pm$ SD	Intermediate <i>n</i> (%) or mean $\pm$ SD	Low <i>n</i> (%) or mean $\pm$ SD
<i>Gender</i>			
Male	13 (31.7)	26 (63.4)	2 (4.9)
Female	25 (39.1)	36 (56.3)	3 (4.7)
<i>Medical specialty</i>			
General practitioner	12 (19.7)	44 (72.1)	5 (8.2)
Pediatrician	26 (59.1)	18 (40.9)	–
<i>Type of practice</i>			
Private office	15 (31.3)	29 (60.4)	4 (8.3)
Academic hospital	8 (40)	12 (60)	–
Private hospital	3 (60)	2 (40)	–
Non-academic public hospital	12 (37.5)	19 (59.4)	1 (3.1)
<i>Food-allergic population</i>			
High prevalence	5 (62.5)	3 (37.5)	–
Moderate prevalence	17 (37)	28 (60.9)	1 (2.2)
Low prevalence	16 (31.4)	31 (60.8)	4 (7.8)
<i>Length of practice</i>	12.5 $\pm$ 9.1	10.5 $\pm$ 8.6	11.7 $\pm$ 9.7

Table 3

Attitude toward food allergy in relation to gender, medical specialty, practice type, food-allergic population, and practice years.

	Appropriate <i>n</i> (%) or mean $\pm$ SD	Inappropriate <i>n</i> (%) or mean $\pm$ SD
<i>Gender</i>		
Male	35 (85.4)	6 (14.6)
Female	56 (87.5)	8 (12.5)
<i>Medical specialty</i>		
General practitioner	52 (85.2)	9 (14.8)
Pediatrician	39 (88.6)	5 (11.4)
<i>Practice type</i>		
Private office	41 (85.4)	7 (14.6)
Academic hospital	14 (70)	6 (30)
Private hospital	5 (100)	–
Non-academic public hospital	31 (96.9)	1 (3.1)
<i>Food-allergic population</i>		
High prevalence	45 (88.2)	6 (11.8)
Moderate prevalence	40 (87)	6 (13)
Low prevalence	2 (25)	6 (75)
<i>Practice years</i>	11.1 $\pm$ 8.9	12.6 $\pm$ 8.4

about food allergy was quite good, knowledge-promotion programs should be undertaken to raise their awareness on the issue. In their study, 61% of knowledge-directed questions were accurately answered by the study group. Nonetheless, only 12% displayed adequate knowledge about the relationship between food allergy and chronic nasal symptoms. Likewise, a mere 23% believed that consumption of yoghurt and cheese is not safe in subjects with milk allergy [10]. In contrast, we found that nearly all pediatricians and over 90% of general practitioners had a high level of knowledge about food allergies. This discrepancy could be explained by the difference in sample size (407 vs. 105). On the other hand, the study sampling method could also account for this difference; the fact that all our participants were attending a congress militates in favor of sampling bias, since such subjects are likely to be more interested in scientific practice and thus cannot be considered representative of practitioners in general.

Erkoçoğlu et al. carried out a survey in Turkey in 2012 and reported that general practitioners' knowledge about food allergy and allergic reactions was unsatisfactory. This survey included 297 primary care physicians active for an average of 17 years. The authors found that although most participants (>60%) knew about the risk of life-threatening events due to food allergy, only a few of

Table 4

Practice regarding food allergy in relation to gender, medical specialty, practice type, food-allergic population, and practice years.

	Positive	Negative
<i>Gender</i>		
Male	30 (73.2)	11 (26.8)
Female	49 (76.6)	15 (23.4)
<i>Medical specialty</i>		
General practitioner	40 (65.6)	21 (34.4)
Pediatrician	39 (88.6)	5 (11.4)
<i>Practice type</i>		
Private office	38 (79.2)	10 (20.8)
Academic hospital	14 (70)	6 (30)
Private hospital	5 (100)	–
Non-academic public hospital	22 (68.7)	10 (31.3)
<i>Food-allergic population</i>		
High prevalence	37 (72.5)	14 (27.5)
Moderate prevalence	35 (76.1)	11 (23.9)
Low prevalence	7 (87.5)	1 (12.5)
<i>Practice years</i>	11.7 $\pm$ 8.5	10.1 $\pm$ 9.8

them made accurate judgments about food avoidance in patients with milk allergy or about the correct dose of epinephrine needed to treat acute anaphylaxis [13]. In our study meanwhile, 19.7% (12 of 61) of general practitioners had a high level of knowledge,

Table 5
Percentage and frequency of answers of the participants to each question of the questioner.

	Correct/yes n (%)	False/No n (%)
<i>Knowledge</i>		
Asthma is an important risk factor for food anaphylaxis (T)	36 (34.3)	69 (65.7)
Children with cow's milk allergy are allowed to use yogurt or cheese (T)	73 (69.5)	32 (30.5)
There is a risk of death due to milk allergy (T)	54 (51.4)	51 (48.6)
Age group most likely to have food allergy (0–5 y) (T)	66 (62.8)	39 (37.2)
Food allergens can pass through maternal diet into breast milk (T)	90 (85.7)	15 (14.3)
Daily anti-histamine can prevent food allergy reactions (F)	29 (27.6)	76 (72.4)
Moderate to severe atopic dermatitis is related to food allergy (T)	90 (85.7)	15 (14.3)
In case of anaphylaxis, my choice of treatment is epinephrine (T)	83 (79)	22 (21)
The appropriate location for epinephrine injection (lateral thigh)	36 (34.2)	69 (65.7)
Appropriate dose of epinephrine (Epipen/Twinject, 0.3 mg epinephrine)	24 (22.8)	81 (77.1)
The best method of epinephrine administration (intramuscular)	30 (28.6)	75 (71.4)
The most common manifestations of food allergy		
Skin symptoms	63 (60)	
Gastrointestinal symptoms	37 (35.2)	
Respiratory symptoms	5 (4.8)	
Serologic test is sufficient for food allergy diagnosis (F)	93 (88.6)	12 (11.4)
Skin-prick test is sufficient for food allergy diagnosis (F)	84 (80)	21 (20)
<i>Attitude</i>		
How often do you refer suspicious cases of food allergy to an allergy specialist?		
Often	43 (40.9)	
Sometimes	57 (54.3)	
Rarely	5 (4.8)	
Are you confident in your ability to treat patients with food allergy?	17 (16.2)	88 (83.7)
What's the best way to help patients with food allergy?		
Raising general awareness on food allergy	56 (53.3)	
Determining the cause of food allergy and avoid the allergen	48 (45.8)	
Finding definite cure for food allergy	1 (0.9)	
Are you interested in participating in educational courses on food allergy?	99 (94.3)	6 (5.7)
<i>Practice</i>		
Do you request serologic diagnostic tests for food allergy diagnosis?	32 (30.5)	73 (69.5)
Do you request diagnostic skin tests for food allergy diagnosis?	34 (32.4)	71 (67.6)
Do you advise a regimen for infant?	37 (35.2)	68 (64.8)
Do you perform a challenge test for definite diagnosis?	32 (30.5)	73 (69.5)
Do you prescribe prophylactic anti-histamine for infants with food allergy?	28 (26.7)	77 (73.3)
Do you stop breast milk in case of allergy suspicion?	80 (76.2)	25 (23.8)
Do you use books and pamphlets to guide your patients?	23 (21.9)	82 (78.1)
In case of prescribing a regimen, do you use predefined list or cards?	21 (20)	84 (80)
Do you prescribe calcium supplement for mothers under dietary-free regimen?	35 (33.3)	70 (66.7)
Do you prescribe autoinject epinephrine for a child with history of food anaphylaxis?	30 (28.6)	75 (71.4)
Have you ever prescribed epinephrine for your patients?	28 (26.7)	77 (73.3)
Which method do you choose in treatment of cow's milk allergy?		
Breast milk plus a regimen for mother	79 (75.2)	
Discontinuing breast milk and initiating formula	26 (24.8)	
In case of formula prescription, which one do you advise?		
Continuing lactose-free formula	2 (7.6)	
Soy based formula	2 (7.6)	
Hypo-allergen formula	17 (65.3)	
Amino acid based formula (Neocate)	2 (7.6)	
Extensively hydrolyzed formula (Aptamil pepti)	3 (11.5)	
Do you have enough time to instruct mothers of children with food allergy?	81 (77.1)	24 (22.9)

and intermediate knowledge levels were seen in 72.1%. General practitioners in these adjacent countries thus possess acceptable levels of knowledge. However, more practical education is really required to improve their attitude and practice. Another study by Gupta et al. in 2007 showed that patients' parents had acceptable knowledge about food allergies but were concerned about the knowledge, attitude and practice of general practitioners in the food allergy field. While they found the knowledge level of family physicians and pediatricians to be satisfactory, they felt that their approach to management and the introduction of

solid foods in food-allergic patients were in need of improvement [14].

Based on the results of two subsequent studies in 2007 and 2008, the approach of allergy specialists regarding the diagnosis, treatment and prevention of food allergy differed from that of other physicians, thus prompting a need to consider more extensive educational programs for physicians [15,16]. Our study findings are consistent with these surveys, especially concerning attitudes and practice approaches among general practitioners.

In 2010 Gupta et al. conducted a survey in 2945 parents, 94% of whom were women. They reported that 19–100% (mean: 75%) of American mothers answered the questions in the knowledge domain correctly. Parents of a child with multiple food allergies were better informed than the parents of children with a single food allergy [17]. Bailey et al. showed that 90% of restaurant workers in England have adequate awareness of food allergy, and 81% of the study group showed good perceptions leading to a good attitude in 38% of them [18].

In a study in 2015, 20% of students in South Korea had appropriate knowledge about food allergy but this did not correlate with their attitude [19]. By contrast, a significant relationship between attitude and knowledge was noted in our study.

Greiwe et al. reported that 64% of American pediatric nurses had appropriate knowledge concerning food allergies, 71% had appropriate attitudes and 66% expressed a desire for more information [20]. The figures were similar to those in our own study, which revealed 86.7% of appropriate attitudes and 75.2% of positive practice, although the study populations were different.

Ribeiro et al. conducted a study similar to our own, with data being collected during scientific conferences. Their study showed that regarding knowledge and practice, the approach of practitioners showed some degree of mismatch with the most recent scientific recommendations about the prevention of food allergy. Their study emphasizes the need for regular re-qualification of practitioners [21]. A prospective study was done by Pouessel et al. concerning the individual healthcare plan (IHP) introduced in France to improve the approach to allergic reactions occurring in schools. School doctors ($n=67$) and head teachers ($n=2372$) answered the questions in the specially designed questionnaire. General practitioners were significantly more likely to advise specific allergen avoidance and emergency kits lacking an epinephrine auto-injector compared to other doctors. The survey showed that accessibility to emergency kits and epinephrine auto-injectors was suboptimal. Moreover, the authors concluded that there is inadequate skill regarding the management of anaphylactic reactions, thus highlighting the need for training of personnel [22].

5. Conclusion

Our survey shows the knowledge, attitude and practice of Iranian pediatricians and general practitioners regarding food allergy to be suboptimal, thereby underlining the importance of organized re-education to upgrade these factors. The survey was conducted during a scientific annual congress, and the likelihood that respondents attending such a meeting have above-average motivation to remain fully apprised doubtless constitutes a source of sampling bias, making results unrepresentative. Further well-designed surveys with greater numbers of participants and meticulous selection criteria are thus needed in the future.

Disclosure of interest

The authors declare that they have no competing interest.

References

- [1] Bangash SA, Bahna SL. Pediatric food allergy update. *Curr Allergy Asthma Rep* 2005;5(6):437–44.
- [2] Gupta RS, Dyer AA, Jain N, Greenhawt MJ. Childhood food allergies: current diagnosis, treatment, and management strategies. *Mayo Clin Proc* 2013;88(5):512–26.
- [3] Sampson HA. Update on food allergy. *J Allergy Clin Immunol* 2004;113(5):805–19.
- [4] Branum AM, Lukacs SL. Food allergy among children in the United States. *Pediatrics* 2009;124(6):1549–59.
- [5] Gupta RS, Springston EE, Warrier MR, Smith B, Kumar R, Pongracic J, et al. The prevalence, severity, and distribution of childhood food allergy in the United States. *Pediatrics* 2011;128(1):e9–17 [Peds. 2011-0204].
- [6] Sampson HA, Aceves S, Bock SA, James J, Jones S, Lang D, et al. Food allergy: a practice parameter update – 2014. *J Allergy Clin Immunol* 2014;134(5):1016.e43–1025.e43.
- [7] Lin RY, Anderson AS, Shah SN, Nurruzzaman F. Increasing anaphylaxis hospitalizations in the first 2 decades of life: New York State 1990–2006. *Ann Allergy Asthma Immunol* 2008;101(4):387–93.
- [8] Boyce JA, Assa'ad A, Burks AW, Jones SM, Sampson HA, Wood RA, et al. Guidelines for the diagnosis and management of food allergy in the United States: summary of the NIAID-sponsored expert panel report. *J Am Acad Dermatol* 2011;64(1):175–92.
- [9] Bock SA, Muñoz-Furlong A, Sampson HA. Further fatalities caused by anaphylactic reactions to food 2001–2006. *J Allergy Clin Immunol* 2007;119(4):1016–8.
- [10] Gupta RS, Springston EE, Kim JS, Smith B, Pongracic JA, Wang X, et al. Food allergy knowledge, attitudes, and beliefs of primary care physicians. *Pediatrics* 2010;125(1):126–32.
- [11] Boye JL. Food allergies in developing and emerging economies: need for comprehensive data on prevalence rates. *Clin Transl Allergy* 2012;2(1):25.
- [12] Krugman SD, Chiamonte DR, Matsui EC. Diagnosis and management of food-induced anaphylaxis: a national survey of pediatricians. *Pediatrics* 2006;118(3):e554–60.
- [13] Erkoçoğlu M, Civelek E, Azkur D, Özcan C, Öztürk K, Kaya A, et al. Knowledge and attitudes of primary care physicians regarding food allergy and anaphylaxis in Turkey. *Allergol Immunopathol* 2013;41(5):292–7.
- [14] Gupta RS, Kim JS, Barnathan JA, Amsden LB, Tummala LS, Holl JL. Food allergy knowledge, attitudes and beliefs: focus groups of parents, physicians and the general public. *BMC Pediatr* 2008;8(1):36.
- [15] Cruz NV, Wilson BG, Fiocchi A, Bahna SL. Survey of physicians' approach to food allergy, part 1: prevalence and manifestations. *Ann Allergy Asthma Immunol* 2007;99(4):325–33.
- [16] Wilson BG, Cruz NV, Fiocchi A, Bahna SL. Survey of physicians' approach to food allergy, part 2: allergens, diagnosis, treatment, and prevention. *Ann Allergy Asthma Immunol* 2008;100(3):250–5.
- [17] Gupta RS, Springston EE, Smith B, Kim JS, Pongracic JA, Wang X, et al. Food allergy knowledge, attitudes, and beliefs of parents with food allergic children in the United States. *Pediatr Allergy Immunol* 2010;21(6):927–34.
- [18] Bailey S, Albardi R, Frew AJ, Smith H. Restaurant staff's knowledge of anaphylaxis and dietary care of people with allergies. *Clin Exp Allergy* 2011;41(5):713–7.
- [19] Choi Y, Ju S, Chang H. Food allergy knowledge, perception of food allergy labeling, and level of dietary practice: a comparison between children with and without food allergy experience. *Nutr Res Pract* 2015;9(1):92–8.
- [20] Greiwe JC, Pazheri F, Schroer B, Nannies' knowledge, attitude, and management of food allergies of children: an online survey. *J Allergy Clin Immunol* 2015;3(1):63–7.
- [21] Ribeiro CC, Speridião PdGL, de Moraes MB. Knowledge and practice of physicians and nutritionists regarding the prevention of food allergy. *Clin Nutr* 2013;32(4):624–9.
- [22] Pouessel G, Lejeune S, Dupond MP, Renard A, Fallot C, Deschildre A. Individual healthcare plan for allergic children at school: lessons from a 2015 2016 school year survey. *Pediatr Allergy Immunol* 2017;28(7):655–60.