

# Knowledge, attitude and behaviour of family physicians on vaccination of children with a history of food allergies

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A – Study Design, B – Data Collection, C – Statistical Analysis, D – Data Interpretation, E – Manuscript Preparation, F – Literature Search, G – Funds Collection

**Summary Background.** Routine immunisation, one of the most successful public health initiatives, has significantly decreased infectious disease-related mortality and morbidity. Family physicians in Turkey avoid administering vaccines to children who have food allergies and instead refer them to a hospital setting.

**Objectives.** In this study, we aimed to evaluate the approaches of family physicians when applying vaccines to children with diagnosed or suspected food allergies according to the national vaccination schedule.

**Material and methods.** This study was carried out between 01.07.2021 and 31.08.2021 with family physicians in the Ankara province. Using questionnaire, the participants were questioned about their sociodemographic characteristics, their vaccination approaches towards patients with diagnoses or suspicions of food allergies and their personal experiences.

**Results.** A total of 184 family physicians participated in this study, and 82.6% of them stated that they were hesitant about the administrations of vaccines to children with diagnosed or suspected food allergies. Regarding the administration of vaccines, the most concerning food allergies involved eggs (71.7%) and cow's milk (15.8%). The vaccinations they were mainly concerned about were determined as the measles-rubella-mumps (MMR) (83.7%) and measles (46.7%) vaccines in a suspected or diagnosed presence of an egg allergy and/or cow's milk allergy, respectively.

**Conclusions.** This study showed that the surveyed family physicians are hesitant of vaccinating children with diagnoses or suspicions of food allergies and see themselves as intermediately qualified. This can cause referrals of children to higher-level centres for vaccinations, delays in vaccinations and parental vaccine hesitations.

**Key words:** milk hypersensitivity, egg hypersensitivity, family physicians, food hypersensitivity, measles-mumps-rubella vaccine.

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## Background

Immunisations are implemented to protect individuals and populations from diseases and complications of those diseases. Immunisations are the most effective and cost-effective method to prevent diseases and disease-related mortalities worldwide [1, 2]. Global immunisations prevent about 3 million deaths annually, according to the report of the World Health Organization (WHO) [3].

Since allergic reactions from vaccinations are not completely reported, the actual incidence rate is unknown, but serious allergic reactions to vaccines are known to be rare and difficult to predict [4]. The incidence rate of severe allergic reactions after receiving vaccinations is very low. Most vaccine reactions are mild and limited to the injection site [5]. Despite this, the possibility of a reaction after any kind of vaccination should be kept in mind regarding all patients [6]. Patients can experience severe allergic reactions (0.5–1 per hundred thousand doses) or anaphylaxis (0.5–1 per million doses) from receiving vaccinations in certain conditions. These adverse effects are thought to be due to protein components such as those found in gelatine or eggs, and more rarely in latex, rather than from the vaccine antigens [5].

In Turkey, childhood vaccinations are generally administered by family physicians working in family health centres (FHC). Each vaccine should be administered to the children by family physicians when the time comes, within a month from

then at the latest, but vaccinations can be delayed or the child may be referred to a higher-level centre for their vaccinations in the presence of some conditions, such as food allergies. Egg and cow's milk allergies can be given as an example of these conditions. The measles-rubella-mumps (MMR) vaccinations and their administration approach is controversial in children with egg allergies [7]; therefore, many family physicians avoid applying the MMR vaccines and refer children to a higher-level centre if they have or are suspected to have an egg-based food allergy. A similar situation can be experienced during the administration of diphtheria, tetanus and pertussis (DTP) vaccinations with the presence of cow's milk allergies because these vaccines contain very low amounts of cow's milk protein [8]. Referring parents to a higher-level health centre for their children to be vaccinated may cause both anxiety in the family and delays in the applications of the vaccines.

Family physicians have played a major role in the full and correct implementation of the national vaccination schedule. On the other hand, there was no research found in literature that focused on the approaches of family physicians regarding vaccinating children with food allergies, and this research presents the first data to literature. This study aimed to evaluate Turkish FHC physicians' approaches and attitudes towards administering vaccines in the national vaccination schedule to children with diagnosed or suspected food allergies.



## Material and methods

This study, which was carried out within the framework of the Helsinki Declaration protocol, was conducted between 01.07.2021 and 31.08.2021. The ethics committee's permission and other necessary permissions were obtained from Dr Sami Ulus, Maternity Child Health and Diseases Training and Research Hospital, and the Ankara Governorship Provincial Health Directorate, respectively.

### Selection of the participants

The universe of this descriptive cross-sectional study consists of family physicians working in FHCs in Ankara. The size of the sample needed for a 95% confidence interval and a 0.05 sampling error was calculated as 233 people. Among the 233 people who were reached via e-mail and smartphone by a random sampling method, 184 participants agreed to participate in the study. After the participants were informed about the study, their consent was obtained, and a questionnaire was given. Physicians who were actively practicing family medicine in FHCs were included in the study. Those not currently actively serving in FHCs were excluded from the study.

### Study design

A questionnaire was prepared after a literary review, and the necessary arrangements were made after applying it to the pilot group of 30 people. An online survey technique was used to obtain the data. The questionnaire form was sent to the participants via e-mail or smartphones. In the first and second parts of the survey, the participants were asked questions about their sociodemographic data, food allergies and vaccinations in the presence of food allergies, respectively. The vaccines included in Turkey's National Immunisation Programme were included within the scope of the study. Turkey's national vaccination schedule as of 2021 is given in Table 1.

Age	Vaccine
Birth	HepB
1 month	HepB
2 months	BCG, DTaP-IPV-Hib, PCV13
4 months	DTaP-IPV-Hib, PCV13
6 months	HepB, DTaP-IPV-Hib, OPV
9 months	MMR*
12 months	PCV13 (booster), MMR, VAR
18 months	DTaP-IPV-Hib (booster), OPV, HepA
24 months	HAV
48 months	MMR, DTaP-IPV (booster)
13 years	Td (booster)

HepB – Hepatitis B; BCG – Bacillus Calmette-Guérin; PCV13 – Pneumococcal conjugate; DTaP-IPV-Hib – Diphtheria, tetanus, pertussis, polio, Haemophilus influenzae Type b; OPV – Oral polio vaccine; MMR – Measles, mumps, rubella; HepA – Hepatitis A; VAR – Varicella; Td – Tetanus and diphtheria toxoids vaccine; \* In high-risk areas.

### Statistical analysis

The data was transferred to the computer environment after compiling it according to the aim of the study, which was then analysed with the SPSS (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0; IBM Corp, Armonk, NY) program. The data obtained within the scope of the research was analysed with descriptive statistics such as frequen-

cy and percentage distribution. A test of the significance for the two means (Student's *t*-Test) was used to test whether there was a difference between two independent groups of data or not. On the other hand, the Kruskal-Wallis variance analysis was used for the comparison of the difference between more than two groups when the parametric test assumptions were not met. If there was a statistically significant difference because of the analysis of variance, the post-hoc Bonferroni corrected Mann-Whitney U-test was used to determine from which group or groups the difference originated.

## Results

A total number of 184 family physicians actively working in FHCs participated in the study. 61.4% of the participants were male. 84.2% of family physicians stated that they were hesitant to vaccinate a child with a diagnosed or suspected food allergy. The working experience periods of the participants as family physicians were as follows: 11–15 years for 79 participants (42.9%), 6–10 years for 70 (38%), 0–5 years for 22 (12%), and 16–20 years for 13 (7.1%). There was a difference between the professional experience groups in terms of hesitancy concerning administering vaccinations ( $p < 0.05$ ). Accordingly, it was observed that family physicians with less professional experience felt this reservation more. It was observed that the rate of family physicians who had a history of any reaction after vaccinating a child with a diagnosed or suspected food allergy was 27.7%. The most common reaction was swelling, redness and/or pain at the injection site (47%). It was stated that reactions most frequently occurred within the first 4–24 hours (55.1%), followed by after 24 hours (16.3%), right after the vaccination (10.2%) and within the first 0–4 hours (18.3%).

The most common food allergies which conflicted with the administration of vaccines involved eggs (71.7%) and cow's milk (15.8%). The vaccines of greatest concern in the case of a suspected or diagnosed egg allergy were the MMR (80.4%) and hepatitis A (8.7%) types. Besides these, a few participants also had reactions after the application of the DTaP-IPV (1.6%), DTaP-IPV-Hib (1.6%) and pneumococcal conjugate vaccines (1.6%). The vaccines of greatest concern in the presence of cow-milk allergy suspicions or diagnoses were for measles (46.2%), and the ones for DTaP-IPV-Hib (29.9%), oral polio (7.6%), DTaP-IPV (4.9%), MMR (6%) and pneumococcal conjugate vaccines (5.4%) also triggered responses at lower rates. The data on the attitudes of the family physicians towards administering routine childhood vaccines in the presence of diagnosed or suspected food allergies is given in Table 2.

Table 2. Data on the attitudes of family physicians towards routine childhood vaccinations in the diagnosis or suspicion of food allergy

	n (%)
<b>Food allergy of most concern in vaccine administration</b>	
Egg	132 (71.7%)
Cow's milk	29 (15.8%)
Latex	6 (3.3%)
Nuts	9 (4.9%)
Yeast	5 (2.7%)
Others	3 (1.6%)
<b>The vaccine of most concern in the suspicion or diagnosis of egg allergy</b>	
MMR	148 (80.4%)
Hepatitis A	16 (8.7%)
Measles	11 (6%)
DTaP-IPV-Hib	3 (1.6%)

**Table 2. Data on the attitudes of family physicians towards routine childhood vaccinations in the diagnosis or suspicion of food allergy**

	n (%)
DTaP-IPV	3 (1.6%)
Pneumococcal conjugate	3 (1.6%)
<b>The vaccine of most concern in the suspicion or diagnosis of cow's milk allergy</b>	
Measles	85 (46.2%)
DTaP-IPV-Hib	55 (29.9%)
Oral polio vaccine	14 (7.6%)
DTaP-IPV	9 (4.9%)
MMR	11 (6%)
Pneumococcal conjugate	10 (5.4%)
<b>Type of vaccine to which allergic reactions occur most frequently</b>	
MMR	35 (68.6%)
Varicella	4 (7.8%)
DTaP-IPV-Hib	3 (5.8%)
DTaP-IPV	2 (3.9%)
Measles	3 (5.8%)
Tetanus and diphtheria toxoids	2 (3.9%)
Others	2 (1.8%)
<b>Type of food to which allergic reactions occur most frequently during vaccination</b>	
Egg	36 (70.5%)
Cow's milk	10 (19.6%)
Latex	2 (3.9%)
Soybean	2 (3.9%)
Others	1 (2.1%)

It was observed that allergic reactions most commonly occurred after the application of MMR (68.6%), varicella (7.8%) and DTaP-IPV-Hib (5.8%) vaccines. The foods that caused the most allergic reactions were eggs (70.5%) and cow's milk (19.6%).

In MMR or measles vaccines, 77% ( $n$ : 142) of family physicians stated that they were primarily concerned about egg allergies, while 20% ( $n$ : 38) stated that they were primarily concerned about cow's milk allergies.

The family physicians were asked to define to what extent they consider themselves to be sufficient in terms of their knowledge and experience in vaccinating children with food allergies, and they were asked to score themselves from inadequate (1) to fully adequate (10). The average score was determined as 5.08.

Only 5 participants (2.7%) answered yes to the following question: "Did you encounter anaphylaxis while vaccinating a child with a diagnosis or suspicion of a food allergy?". The answer given by the participants at the highest rate (90.2%) to the question "How would you approach a child with a suspected or diagnosed food allergy who had an allergic reaction in a previous vaccine for the second dose of the same vaccine?" was "I will refer the patient to the higher-level centre".

It was observed that the ratio of family physicians who had any problems with a patient who was not vaccinated and referred to a higher-level centre with the suspicion or diagnosis of a food allergy was 13%.

Factors causing anxiety in family physicians about the vaccination of children with a history of food allergy were evaluated with logistic regression analysis. It was found that the feeling of incompetency increases the anxiety of family physicians by 20.35 times, and the risk of encountering an early reaction (within 0–4 hours) after vaccination increases by 14.48 times (Table 3).

## Discussion

Our results showed that only 2.7% of the family physicians experienced a child undergoing anaphylaxis from a food allergy diagnosis or suspicion while vaccinating them. Despite this, most of these family physicians (84.2%) refrained from administering their vaccinations. Another finding is that the family physicians stated that they had moderate knowledge and experience in vaccinating these children. In this study, it has been shown that the food allergy and the vaccine combination that they were most concerned about were eggs and the MMR shot in the case of vaccinating children with diagnoses or suspicions of food allergy.

Childhood vaccinations in Turkey are generally administered by family physicians working in FHCs. The knowledge, attitude and behaviour of a family physician becomes very important especially when the parents are hesitant about their children receiving vaccinations. Recently, the attitudes of family physicians towards parents gained importance because of the increased trend of vaccine rejections and hesitations [9]. In a study conducted in 2015 to determine the vaccine hesitancy rate among healthcare workers in Europe, it was shown that healthcare professionals are the most reliable source of vaccine information, but some physicians behave timidly about vaccines, which may cause vaccine hesitations for patients and parents [10]. Referring a child with a diagnosed or suspected food allergy to a higher-level health institution for a vaccine that can be safely administered in an FHC can both cause delays in receiving vaccinations and cause/increase families' concerns about vaccinations and vaccination hesitations.

It should be correctly determined whether a reaction after a vaccination is an allergic reaction or not. It is very important to distinguish allergic reactions from post-vaccine vasovagal syncope, local injection reactions and/or an ocular respiratory syndrome. The ratio of family physicians who witnessed any reaction after a vaccination was determined as 27.7%. It was stated that 47.7% of experienced reactions were local reactions at the injection site, such as swelling, redness and/or pain. These are common reactions that occur after the administration of many vaccines. As expressed by the participants, it should be known that these reactions are considered to be local injection reactions rather than dominant allergic reactions [11].

Measles, MMR, influenza and yellow fever vaccines should be used carefully in patients with egg allergies [11]. As influ-

**Table 3. Factors causing anxiety among family physicians about vaccination of children with a history of food allergies (logistic regression analysis results)**

Factors*	Univariate analysis			Multivariate analysis		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
Feeling of incompetency	10.37	4.3–25.02	< 0.001	20.35	6.3–65.65	< 0.001
Risk of early-phase reaction (0–4 hours)	6.24	1.42–27.3	0.015	14.48	2.92–71.71	0.001
Possibility of argument/trouble with parents	10.63	4.09–27.63	< 0.001			
Short professional experience (< 5 years)	8.87	3.51–22.41	< 0.001			

\*  $p$  < 0.05 values in the table were obtained according to the results of the univariate analysis; OR – odds ratio; CI – confidence interval.

enza and yellow fever are not present in the national vaccination schedule of our country [12], these vaccines were excluded from this study. In a study by Cronin et al. [13], MMR vaccination referrals with the suspicion of egg allergies (84.2%) also constituted most of the referrals due to allergies. These studies are in line with the results of our study. It was also shown in our study that in children who are suspected to have or are diagnosed with a food allergy, the most worrying food is egg, and the most worrying vaccines target MMR. Some MMR/Measles vaccines may also cause reactions in children with a cow's milk protein allergy due to the alpha-lactalbumin content. Sipahi et al. [14] reported that anaphylaxis developed after a measles vaccine (M-VAC®) administered to a patient with cow's milk protein allergy. The contents of the vaccines produced by different companies may vary, and there may be different nutritional proteins, and physicians should be aware of this issue. Egg and cow's milk allergies are of the most concern when administering MMR or measles vaccines. In MMR or measles vaccines, 77% ( $n: 142$ ) of family physicians stated that they were primarily concerned about egg allergy, while 20% ( $n: 38$ ) stated that they were primarily concerned about cow's milk allergy. MMR and measles vaccines of different companies are used in our country, and it was thought that family physicians were more concerned about eggs because they used the MMR vaccine containing egg protein more intensively during the study period.

The World Allergy Organization (WAO) recommends the usual administration of the vaccine without special precautions in the presence of egg allergies [11]. On the other hand, the American Academy of Pediatrics (AAP) stated that the MMR vaccines do not contain enough egg protein to trigger an allergic reaction, and the MMR vaccinations can be performed in general vaccine centres to all children with egg allergies, even if they had anaphylaxis in response to eggs [6]. It is quite remarkable that in our country, due to food allergies, the most concerning food is egg, and the most concerning vaccine is MMR, despite the recommendations of both the WAO and AAP. Despite these guidelines, the concerns of the surveyed family physicians about egg allergies might cause the referral of their young patients to higher centres for vaccinations.

In this study, the foods that most often caused allergic reactions while family physicians were vaccinating children with a diagnosed or suspected food allergy were determined as eggs (70.5%) and cow's milk (19.6%). This situation is associated with the fact that the two most common food allergies in our country involve eggs and cow's milk. The vaccines with the most common allergic reaction-triggering vaccines were determined as the MMR (68.6%), varicella (7.8%) and DaBT-IPV-HIB (5.8%) types. The fact that the MMR vaccines are the type with the most common allergic reaction may be related to the fact that the most common food allergy in our country involves eggs. Defining the chickenpox, DaBT-IPV-HIB, diphtheria toxoid, pneumococcal conjugate, oral polio and hepatitis A vaccines as being among the vaccines which potentially trigger allergic reactions suggests that there may be reactions to other substances in the vaccines rather than the patients' histories of food allergies. It was thought that the reactions to these vaccines might be due to microbial antigens, stabilisers, preservatives, adjuvants and residual contaminants in the vaccines rather than food allergies.

Anaphylaxis after an administration of a vaccine is a rare occurrence with a reported ratio of 0.5–1 per million doses of

vaccine, and deaths due to vaccinations are much less common [5]. Reactions that occur more frequently in response to the administrations of vaccines include a vasovagal reaction, panic attack and vocal cord dysfunction, which can all be mistaken for anaphylaxis [11]. A detailed history should be taken; the presence of an additional infection such as an upper respiratory tract infection concurrent with the vaccine and the intake of another drug simultaneously should be asked about for a differential diagnosis. A laboratory analysis, such as tryptase, provided that it is sent at the appropriate time, is extremely important in a differential diagnosis [15]. In this study, the rate of family physicians who stated that they witnessed anaphylaxis after administering vaccinations was 2.7%. All diagnoses of anaphylaxis may not be correct, since the diagnoses of anaphylaxis of the patients in our study were not confirmed by laboratory parameters, and the clinical prognoses after anaphylaxis were unknown.

In this study, we show that the main factors that cause anxiety in family physicians when vaccinating children with a history of food allergy are the feeling of incompetency in vaccinating these children and the risk of encountering a reaction in the early (0–4 hours) period after vaccination. It was found that the early-phase reactions that may be encountered following vaccination of children with a history of food allergy cause anxiety in family physicians, and those who have previously experienced such reactions are more reluctant to vaccinate these children. This may be mainly associated with concerns about severe allergic reactions, such as anaphylaxis in the early post-vaccine period. However, it should be kept in mind that many non-allergic post-vaccination findings, such as fever, can also manifest in the early period. This study demonstrates the importance of physicians' participation in training programmes on the vaccination of individuals with food allergies, both during their medical education and after graduation.

### Limitations of the study

Our study has some limitations, as our results could not be compared with other studies since there were no other similar studies found that focused on the vaccination approaches of family physicians in the presence of a food allergy. Along with this, the study's data was based on declarations, and it was not possible to observe the participants at the administration time of related practices. This in turn may have caused a bias during the collection of information.

### Conclusions

This study showed that family physicians were hesitant when vaccinating children with a diagnosed or suspected food allergy and found themselves moderately competent for this issue. This may lead to the referrals of children to higher-level health institutions for vaccinations, delays in vaccinations and the occurrence of a vaccination hesitancy in parents. If family physicians choose to vaccinate children with diagnosed or suspected food allergies, they can prevent vaccination hesitations and delays, but studies with a higher participation rate are needed in different cities across the country. Continuing education after graduation may be beneficial in increasing the awareness and competence of family physicians on the issue.

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