

Food allergy knowledge, attitudes and beliefs of kindergarten teachers in Kuwait: a cross-sectional study

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ABSTRACT

Background Food allergy (FA) affects up to 10% of children globally, with clinical symptoms varying from mild to severe, and in rare instances, it is life-threatening. Approximately one in five children with FA experience a food-induced allergic reaction in school, leaving teachers as the first line of intervention. This study aimed to assess kindergarten teachers' knowledge, attitudes and beliefs regarding FA.

Methods This cross-sectional study enrolled kindergarten teachers in Kuwait using stratified cluster sampling. The Chicago Food Allergy Research Survey for the General Public was used to assess teachers' knowledge, attitudes and beliefs regarding FA. The overall FA knowledge score was calculated for each participant. The χ^2 test was used to assess the differences in the distribution of categorical variables.

Results Responses were obtained from 882 public kindergarten teachers from 63 kindergartens. Most teachers (81.9%) encountered students with FA in their classrooms. Only 13.5% of the teachers reported receiving training in FA. Overall, participants scored an average of 52.2% on the FA knowledge assessment, with participants receiving prior training in FA scoring on average higher than those with no prior training in FA (55.9% vs 51.6%, $p=0.005$). A few teachers (10.7%) were aware that lactose intolerance was not equivalent to milk allergy. In terms of attitudes regarding FA, only 14.9% of the participants acknowledged that children with FA are teased/stigmatised due to their condition, and 33.7% recognised that avoidance of allergenic food is difficult. Moreover, only 9.9% of the teachers self-reported their ability to use an epinephrine autoinjector.

Conclusions Improved knowledge and awareness of FA among public kindergarten teachers in Kuwait are needed to ensure the safety of children with FA in schools. Teachers should be trained to prevent, recognise and manage FA-related allergic reactions.

INTRODUCTION

Food allergy (FA), defined as 'an adverse health effect arising from a specific immune response that occurs reproducibly on exposure to a given food',¹ is an increasing global public health concern that affects children and adults.^{2 3} The prevalence of

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Food allergy affects a considerable proportion of children worldwide, with an increasing trend.
- ⇒ The knowledge of school personnel, specifically teachers, about food allergy has been reported to be inadequate, which hinders proper management of allergic emergencies in classrooms.
- ⇒ There is a need to assess the knowledge, attitudes and beliefs of kindergarten teachers in Kuwait regarding food allergy.

WHAT THIS STUDY ADDS

- ⇒ Kindergarten teachers in our study sample demonstrated insufficient knowledge about food allergy, with participants answering 52.2% of the knowledge-based items correctly.
- ⇒ Receiving prior training on food allergy was associated with increased food allergy knowledge.
- ⇒ Participating teachers underestimated the impact of food allergy on the quality of life and the social and psychological status of affected children.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ The findings of this study highlight the need for policies and protocols to ensure the safety of children with food allergy in schools.
- ⇒ Schoolteachers should be trained in the prevention, recognition and management of food allergy reactions.

FA varies worldwide, with prevalence estimates ranging between 1% and 10% among children.⁴⁻⁶ Clinical symptoms of a food-induced allergic reaction can vary from mild to severe and, in rare instances, can be fatal, with manifestations involving multiple body systems, including the skin, respiratory, mucosal, cardiovascular and gastrointestinal systems.^{3 7} In its most severe form, FA can lead to anaphylaxis, which has been described as a generalised or systemic, rapid onset, hypersensitivity reaction that may cause death.⁸ In addition to its clinical burden, FA has been shown to impact the social and mental health



of affected individuals and, among children with FA, this burden extends to the parents/caregivers.^{9 10} For instance, the health-related quality of life of children with peanut allergy and their caregivers was worse in comparison with healthy individuals.¹⁰ Moreover, higher levels of anxiety have been documented among children with FA as compared with children without FA.¹¹

Children spend a significant amount of time in school daily, with reports showing that 16%–18% of children with FA experience a food-induced allergic reaction in school.^{12 13} Hence, prevention, recognition and management of FA reactions in schools are crucial to the safety of allergic children. Several studies have shown that there is a deficiency in FA knowledge and negative attitudes toward FA among school teachers and nurses.^{14–17} Such limitations in FA knowledge and attitudes were attenuated by FA-related training, with studies showing improvements in teachers' FA knowledge, confidence and attitudes following training.^{18–23} Given that teachers are considered the first line of management in a school setting and child safety is of utmost importance, ongoing assessments and FA training are needed to better prepare teachers. To this end, there is a paucity of studies on kindergarten (preschool/nursery) teachers' FA knowledge and attitudes, especially in the Arabian Gulf region, where FA is not a rare event.^{24 25} A prior study among adolescents in Kuwait estimated the prevalence of FA to be 4.1%.²⁵ Therefore, this cross-sectional study was conducted to evaluate the knowledge, attitudes and beliefs of kindergarten teachers in Kuwait about FA.

METHODS

Study setting, design and participants

Kuwait is geographically divided into six governorates, and the school districts follow a similar geographical division. In the public education system in Kuwait, kindergarten refers to the optional school years before grade 1, which includes kindergarten levels 1 and 2. Kindergarten is also known as preschool, nursery and daycare. In the academic year 2021–2022, the total number of public kindergarten teachers was estimated to be 7086, with all teachers being female. This cross-sectional study enrolled public kindergarten teachers (n=882) throughout Kuwait. A stratified cluster sampling approach was used to select a representative sample of kindergarten teachers. First, Kuwait was stratified according to the six governorates. Second, public kindergartens (clusters) were randomly selected from each governorate (stratum) using a list of kindergartens within each governorate. Since the total number of teachers differed across the six school districts, proportional allocation was used to determine the number of participants (teachers) needed from each school district by estimating weights relative to the total number of teachers in each school district. In total, 63 schools served as recruitment venues, and all the teachers in each selected school were invited to participate. The

recruitment period was 16 October 2022–22 October 2022.

Study questionnaire and variables

The Chicago Food Allergy Research Survey for the General Public (CFARS-GP) was used to assess teachers' knowledge, attitudes and beliefs about FA.²⁶ Minor modifications were made to the CFARS-GP to make it applicable to our setting (ie, Kuwait) and our target study population (ie, kindergarten teachers). The overall FA knowledge score was calculated for each participant by summing the percentage of knowledge items correctly answered by each respondent. Moreover, the study questionnaire gathered sociodemographic data and teachers' general awareness of the FA emergency plan in the school and their preparedness to manage FA reactions. A variable representing the number of acquaintances with FA a participant knows (ranging from 0 to ≥ 3) was developed by counting whether the participant's parents, siblings, spouse, children and/or someone else they knew had FA.

The questionnaire was then converted into a web-based survey. A direct link (QR code) to the study questionnaire was given to each school's principal or vice principal who was asked to distribute it among all teachers who completed the study questionnaire. A detailed description of the study questionnaire and its variables is provided in online supplemental appendix 1. A description of the changes made to the CFARS-GP is provided in online supplemental appendix 2, and the study questionnaire is available in online supplemental appendix 3.

Statistical analysis

Analyses were conducted using SAS V.9.4 (SAS Institute,). The statistical significance level was set at 5% ($\alpha=0.05$) for all the association analyses. Descriptive analyses were conducted to calculate the frequencies and proportions of categorical variables. The FA knowledge score variable was described by calculating the mean and SD. The χ^2 test was used to assess the associations between categorical variables. To control for false positive results due to multiple testing, we applied the false discovery rate (FDR) method to estimate adjusted p values.²⁷

RESULTS

Description of study sample

The characteristics of the study sample are presented in [table 1](#). A total of 1801 teachers across 63 kindergartens were invited to participate in the study, of whom 882 (49.0%) completed the study questionnaire. Respondents represented all six governorates proportionally, according to the teachers' geographical distribution ([table 1](#)). Most enrolled teachers were in the age ranges of 30–34 years (33.7%) and 35–39 years (25.4%). Of the total participants, 16.8% ever had FA, 66.2% had at least one acquaintance with FA and 81.9% had a student with FA in their classroom ([table 1](#)). Moreover, only 13.5% had received training in FA.

Table 1 Characteristics of the study sample (N=882)

| Variable | % (n) |
|--|------------|
| Age group (years) | |
| 21–24 | 2.4 (21) |
| 25–29 | 13.6 (120) |
| 30–34 | 33.7 (297) |
| 35–39 | 25.4 (224) |
| 40–44 | 15.0 (132) |
| 45–49 | 8.6 (76) |
| ≥50 | 1.4 (12) |
| Education level (degree) | |
| Diploma (2 years post high school) | 0.7 (6) |
| Bachelor | 95.0 (838) |
| Graduate | 4.3 (38) |
| School's governorate | |
| Hawalli | 10.0 (88) |
| Asima | 13.2 (116) |
| Jahra | 12.5 (110) |
| Farwaniya | 23.7 (209) |
| Mubarak Al-kabeer | 16.1 (142) |
| Ahmadi | 24.6 (217) |
| Years working as a kindergarten teacher | |
| ≤6 | 17.5 (155) |
| 7–12 | 37.4 (330) |
| 13–18 | 27.6 (243) |
| ≥19 | 17.5 (154) |
| Marital status | |
| Married | 82.2 (725) |
| Single | 10.0 (88) |
| Divorced/widowed | 7.8 (69) |
| Have children | |
| Yes | 84.9 (749) |
| Ever had food allergy | |
| Yes | 16.8 (148) |
| Acquaintances with FA* | |
| None | 33.8 (298) |
| 1 | 35.1 (310) |
| 2 | 18.7 (165) |
| ≥3 | 12.4 (109) |
| Ever had students with food allergy | |
| Yes | 81.9 (722) |
| Experience or training with food allergy | |
| Yes | 13.5 (119) |

*Refers to the number of acquaintances of the participants with FA: parents, siblings, spouse, children and/or someone else. FA, food allergy.

Knowledge of FA

Table 2 shows the items used to assess FA knowledge. The overall mean FA knowledge score was estimated to be 52.2% (range 8.3%–87.5%), which represents the

average proportion of correct answers to the total items assessing FA knowledge. Only 10.7% of the participants were aware that lactose intolerance was not the same as milk allergy. Most participants (81.7%) were aware that hives was a common symptom of FA. Peanuts were identified as the most common (83.2%) childhood FA trigger. Very few participants (18.4%) indicated that there was no cure for FA. However, the majority (73.0%) of the participants correctly acknowledged that avoidance was the only way to prevent an FA reaction.

In an additional analysis (online supplemental table 1), we assessed whether FA knowledge scores differed according to whether the participants had received prior training in FA. Participants who received prior training in FA had higher overall mean FA knowledge scores than those who did not receive FA training (55.9% vs 51.6%, $p=0.005$, FDR-adjusted $p=0.042$; online supplemental table 1).

FA attitudes and beliefs

Table 3 shows participants' perceptions, attitudes and beliefs about FA. Few teachers (14.9%) believed that children with FA are teased/stigmatised at school, 33.7% indicated that avoiding allergenic foods is difficult and 47.7% agreed that having injectable epinephrine (EpiPen or Twinject; also called epinephrine autoinjectors) is important for children with severe FA. Most respondents (62.9%) agreed that schools should have plans to keep children with FA safe. However, only 34.9% of participants agreed that schools should ban all products with nuts.

In further analysis (online supplemental table 2), FA perceptions, attitudes and beliefs were stratified according to whether the participant had any acquaintances with FA. This analysis showed that, overall, participants who knew people with food allergies were more engaged in this health issue and were motivated to witness change. For example, those with at least one acquaintance with FA compared with those with none were more likely to agree that it is difficult for people with FA to safely eat at restaurants (51.5% vs 45.0%, $p=0.008$, FDR-adjusted $p=0.010$; online supplemental table 2).

General knowledge of emergency interventions

Online supplemental table 3 presents data on general knowledge of emergency interventions. Of all participants, only 25.2% were aware that their respective schools had an FA emergency action plan. The majority (82.7%) correctly identified the most frequent symptoms of FA (ie, urticaria, stomachache, wheezing), and approximately half (50.1%) correctly identified the most frequent symptoms of anaphylaxis (ie, urticaria, itching, stomachache, wheezing, throat tightness, collapse). Additionally, only 3.1% of the participants knew that intramuscular epinephrine was the best medication for anaphylaxis and severe FA reactions. Lastly, only 9.9% (online supplemental table 3) of the teachers self-reported their ability to use an epinephrine pen (EpiPen).

**Table 2** Overall and itemised knowledge of food allergy among kindergarten teachers in the total study sample (N=882)

| Item | Correct answer, % (n) |
|--|-----------------------|
| Overall mean knowledge score (SD) | 52.2 (15.2)* |
| Definition and diagnosis | |
| Allergic reaction when body considers food harmful (T) | 29.1 (257) |
| Lactose intolerance same as milk allergy (F) | 10.7 (94) |
| Symptoms and severity | |
| Food allergy reaction can be fatal (T) | 56.6 (499) |
| Hives a common symptom of food allergy (T) | 81.7 (721) |
| Signs of milk allergy reaction | |
| Hyperactivity (F) | 68.3 (602) |
| Hives (T) | 81.2 (716) |
| Tongue swelling/trouble breathing (T) | 65.2 (575) |
| Stuffy nose (F) | 58 (512) |
| Triggers and environmental risk | |
| Allergic reaction from touching allergenic food (T) | 45.6 (402) |
| Milk-allergic person: safely drink low-fat milk (F) | 42 (370) |
| Mother can pass food to child through breast milk (T) | 59.1 (521) |
| Acidic food: common cause of food allergy (F) | 22.9 (202) |
| 3 Most common childhood food allergies | |
| Egg | 71 (626) |
| Milk | 70.4 (621) |
| Peanut | 83.2 (734) |
| Most common adult food allergy: shellfish | 57 (503) |
| Perceptions of susceptibility and prevalence | |
| Allergic diseases run in families (T) | 54.1 (477) |
| Food allergy can go away with age (T) | 39.5 (348) |
| Food allergy more common in children (T) | 63.8 (563) |
| Food allergy increasing in Kuwaiti children (T) | 61.6 (543) |
| Treatment and use of healthcare | |
| There is a cure for food allergy (F) | 18.4 (162) |
| Avoidance is the only way to prevent food allergy reaction (T) | 73.0 (644) |
| Daily medicine can prevent food allergy reaction (F) | 32.8 (289) |
| Policy issue | |
| Law in Kuwait requires foods to be labelled (F) | 7.0 (62) |

Correct answers are indicated in parentheses as T=true and F=false
*This figure represents mean knowledge score (SD).

DISCUSSION

This study evaluated kindergarten teachers' knowledge, attitudes and beliefs regarding FA in Kuwait. Our findings demonstrate that FA knowledge varied across the assessed FA knowledge domains, with most teachers correctly identifying peanuts as the leading food allergen in children. However, very few participants were able to indicate that lactose intolerance is different from milk allergy. Moreover, FA knowledge was higher among participants who had received prior training than among those who had not. Regarding participants' attitudes and beliefs towards FA, very few participants agreed that children with FA were stigmatised. More than half of the participants agreed that schools should have plans to keep children with FA safe. Overall, our study showed

that FA knowledge among kindergarten teachers is insufficient in some domains.

Our study estimated an overall mean FA knowledge score of 52.2%. This overall FA knowledge score is lower than the estimated FA knowledge score (64.9%) among the general public in the USA,²⁸ and lower than FA knowledge score estimates among teachers in the United States reported by Canon *et al* (70.8%)¹⁹ and Kanter *et al* (69.7%).¹¹ Our study and the aforementioned studies have used the same CFARS-GP instrument to assess FA knowledge. Hence, these comparisons show that kindergarten teachers in Kuwait lack sufficient FA knowledge compared with teachers in the USA.

We observed variability among the items assessing knowledge of FA. For instance, only 10.7% of the

Table 3 Perception, attitudes, beliefs and policy consideration of food allergy

| Item | Total study sample (N=882), % (n) | | |
|---|-----------------------------------|------------|------------|
| | Disagree | Neutral | Agree |
| Stigma and acceptability | | | |
| Food allergy serious problem in Kuwait | 14.2 (125) | 41.4 (365) | 44.4 (392) |
| People with food allergies treated differently | 13.9 (123) | 26.4 (233) | 59.6 (526) |
| Parents of food-allergic child overprotective | 31.5 (278) | 40.8 (360) | 27.7 (244) |
| Food-allergic children teased at school | 51.8 (457) | 33.3 (294) | 14.9 (131) |
| Would worry over student with food allergy | 31.1 (274) | 22.7 (200) | 46.3 (408) |
| Perceptions of quality of life | | | |
| Avoiding allergenic food is difficult | 30.0 (265) | 36.3 (320) | 33.7 (297) |
| People worry a lot about their food allergy | 20.0 (176) | 25.7 (227) | 54.3 (479) |
| Hard to eat out safely with food allergy | 23.9 (211) | 26.8 (236) | 49.3 (435) |
| Treatment and use of healthcare | | | |
| Having injectable epinephrine (EpiPen) important for child with severe food allergy | 19.7 (174) | 32.5 (287) | 47.7 (421) |
| Policy issues | | | |
| Schools should have plans to keep food-allergic children safe | 21.7 (191) | 15.4 (136) | 62.9 (555) |
| Schools should ban all products with nuts | 29.4 (259) | 35.7 (315) | 34.9 (308) |
| Schools should have special table for food-allergic child | 29.4 (259) | 25.2 (222) | 45.5 (401) |
| Unfair if a student cannot have peanut butter sandwich | 27.0 (238) | 32.4 (286) | 40.6 (358) |

participants in our study correctly indicated that lactose intolerance was not the same as milk allergy. This result is much less than what was reported by Kanter *et al* (63%).¹¹ In contrast, participants scored highest in items pertaining to knowledge about symptoms and severity, with the majority identifying hives as a common sign of an allergic reaction to food. In both our study and the study by Gupta *et al*,²⁸ peanuts, as compared with eggs and milk, were the most commonly reported FA triggers among children. In a study conducted in Italy to measure FA knowledge among schoolteachers and principals, similar findings were found, with the highest score achieved in questions about symptoms of FA, anaphylaxis and the most common FA triggers.¹⁵ In addition, there was an evident weakness in knowledge regarding FA treatment, where only 32.8% of respondents correctly indicated that daily medicine intake cannot prevent the occurrence of an FA reaction, and only 18.4% of participants correctly stated that there is no cure for FA. In contrast, 65% of teachers in the USA were aware that daily use of medicine cannot prevent FA reactions and 69% were aware that FA cannot be cured.¹¹ Nonetheless, the majority of respondents (73%) knew that avoiding allergens was the only way to prevent an FA reaction.

We observed higher overall knowledge scores among teachers with prior training in FA than among teachers without previous training (online supplemental table 1). This was also demonstrated in an interventional study conducted among teachers in the USA, which showed that FA knowledge scores increased by 19% in the group that received FA training compared with the control

group.¹⁹ Another study has shown that teachers who received an educational session improved their understanding of causal foods, signs of anaphylaxis, and proper treatment of local and systemic FA reactions compared with the control group.²⁰ Overall, these findings suggest that proper education and training increase knowledge of FA. Hence, to ensure children's health and safety in schools, training teachers in FA is essential to reduce accidental exposure and adequately manage FA-related emergencies.

The results of this study showed that teachers underestimated the impact of FA on quality of life and mental health, with only 33.7% indicating that avoiding allergenic foods is difficult, and 14.9% agreeing that children with FA are teased/stigmatised at school. A prior study in Italy reported similar findings, with a minority of school personnel acknowledging the emotional consequences (37.2%) and social difficulties (10.2%) of children with FA.¹⁵ Moreover, FA-related bullying is not uncommon, with studies reporting that as many as 40% of children with FA have been bullied for their FA.^{29–32} Such bullying experiences might have long-term consequences on a child's development and well-being. Among children with FA (aged 7–14 years), 100% indicated, 'I want other kids in my class to know not to tease or bully someone with food allergy'.³³ Therefore, to protect children with FA from such hardships, it is essential to make schoolteachers aware of the possible psychosocial impact of FA.

Our study is in agreement with previous studies showing deficiencies in establishing and implementing emergency management plans for relieving allergic reactions

in schools.^{16 18 34} Only a quarter of our study participants (25.2%) reported that an emergency plan exists in their school for managing allergic reactions. Additionally, only 3.1% knew that intramuscular epinephrine was the best medication for anaphylaxis and severe FA reactions, and only 9.9% of the teachers self-reported the ability to use an epinephrine pen. These results raise serious concerns about the lack of preparedness of kindergarten teachers and schools in Kuwait to manage in-school FA reactions. Since it has been reported that, in most cases, the first adult to become aware of an allergic reaction in school is the teacher, it would be beneficial to train them to recognise and manage signs of anaphylaxis, especially considering that delays in treating anaphylaxis are associated with poor outcomes.^{35 36}

The results of this study can only be generalised to public kindergarten teachers. Additionally, the response rate (approximately 49%) was low, which may have resulted in nonresponse bias. We would imagine that non-response (self-selection) bias, if any, will lead to an overestimation of the FA knowledge score, as people interested in the topic would be more motivated to participate. Nonetheless, our study covered a large proportion of the target population: 63 out of 200 schools were included in the study, and data were collected from 12.5% (n=882) of the total target population (kindergarten teachers; n=7086). To increase the representativeness of our study, we used proportional allocation sampling. Furthermore, data were collected anonymously to reduce social desirability bias.

In conclusion, the knowledge and awareness of FA among public kindergarten teachers in Kuwait are insufficient. As the prevalence of FA in children of preschool age is high, teachers, as first-line responders to classroom emergencies, must be trained to prevent, recognise and manage FA-related reactions. In addition, injectable epinephrine must be made available on school campuses and teachers must be trained to administer epinephrine in emergencies promptly to ensure the safety of children. Collectively, policies and protocols that ensure the safety of children with FA are needed and should be enforced.

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Online Appendix 1. Study questionnaire and variables

The Chicago Food Allergy Research Survey for the General Public (CFARS-GP) was used to assess teachers' knowledge, attitudes, and beliefs of food allergy (FA).¹ Minor modifications were made to the CFARS-GP to make it applicable to our setting (i.e., Kuwait) and our target study population (i.e., kindergarten teachers). The CFARS-GP contains 35 items, of which 19 items assessed FA knowledge (16 true/false and 3 multiple choice questions) and 16 items evaluate FA attitudes and beliefs (13 Likert scale and 3 multiple choice questions). The instrument covered the following domains: (1) definition and diagnosis, (2) symptoms and severity, (3) triggers and environmental risk, (4) perceptions of susceptibility and prevalence, (5) stigma and acceptability, (6) perceptions of quality of life, (7) treatment and use of health care, and (8) policy issues.¹ An overall FA knowledge score was calculated for each participant by summing the percentage of knowledge items that each respondent answered correctly.

Moreover, the study questionnaire gathered information on socio-demographic data. In addition, it collected data on whether teachers were aware of any school emergency action plans in the event of an allergic reaction, if teachers have received information about FA and anaphylaxis, if teachers received training in FA, and asked teachers to identify the most common symptoms of FA. The study questionnaire also asked for their knowledge of the best medication that relieves a severe FA reaction and food-induced anaphylaxis. A variable resembling the number of acquaintances with FA a participant knows (ranging from 0 to ≥ 3) was developed by counting if the participant's parents, siblings, spouse, children, and/or someone else they know has FA.

The CFARS-GP was translated to the Arabic language by two of the study investigators who are Arabic native speakers and proficient in the English language. The Arabic-translated version of the CFARS-GP was checked by the other investigators to ensure resemblance to the original survey. Subsequently, pilot testing of the Arabic version of the CFARS-GP was conducted. The respondents in the pilot testing were asked to explain their understanding of the questions to confirm content validity. The comprehensibility and coherence were also reviewed, and the required modifications were done before finalizing the questionnaire. Only the Arabic translated version of the CFARS-GP was used, as it is the population's preferred language. The study questionnaire was converted into a web-based survey. A direct link (QR code) to the study questionnaire was given to each school's principal or vice principal, and she was asked to distribute it among all the teachers who self-completed the study questionnaire.

Online supplemental references

1. Gupta RS, Kim JS, Springston EE, et al. Development of the Chicago Food Allergy Research Surveys: assessing knowledge, attitudes, and beliefs of parents, physicians, and the general public. *BMC Health Serv Res* 2009;9:142.

Online Appendix 2. Description of changes made to the Chicago Food Allergy Research Survey for the General Public (CFARS-GP) Questionnaire.

Following is a description of the changes we made to the CFARS-GP questionnaire (our study questionnaire is provided in the Online Appendix 3):

FA Knowledge section (i.e., Q1 to Q19 in the original CFARS-GP questionnaire; Q13 to Q31 in our study questionnaire):

- The “United States” in Q12 and Q16 in the CFARS-GP questionnaire was changed to “Kuwait” (Q24 and Q28 in our study questionnaire).

Note: The changes we made to the FA knowledge section did not affect the scoring of system of FA knowledge used in the original CFARS-GP questionnaire.

FA Attitudes/Beliefs section (i.e., Q20 to Q35 in the original CFARS-GP questionnaire; Q32 to Q44 in our study questionnaire):

- The “United States” in Q20 in the CFARS-GP questionnaire was changed to “Kuwait” (Q32 in our study questionnaire).
- In the original CFARS-GP questionnaire, Q31 to Q34 were directed to parents with school-aged children. In our questionnaire, we asked all teachers these questions while making the following changes to the questions:

- Q31 in the CFARS-GP questionnaire: “Schools should ban all products with nuts.”
We did not make any changes to this question (Q41 in our study questionnaire) as it is applicable to teachers.
- Q32 in the CFARS-GP questionnaire: “Schools should have special tables where children with food allergies can safely eat lunch.” We did not make any changes to this question (Q42 in our study questionnaire) as it is applicable to teachers.
- Q33 in the CFARS-GP questionnaire: “It would be unfair if my child could not have a peanut butter sandwich because of another student’s peanut allergy.” To make this question applicable to teachers with and without children, the following modified question was asked (Q43 in our study questionnaire): “It would be unfair if a student could not have a peanut butter sandwich because of another student’s peanut allergy.”
- Q34 in the CFARS-GP questionnaire: “I would worry about having a child with food allergy play at my house.” To make this question applicable to all teachers, the following modified question was asked (Q44 in our study questionnaire): “I would worry about having a student with food allergy at my classroom.”
- Questions 29, 30, and 35 in the original CFARS-GP questionnaire were not included in our study questionnaire. These questions asked about the best way to help people with food allergy, the best way to learn about food allergy, and the best way to teach parents how to protect children with food allergy. The decision of not including these questions was to reduce the length of the study questionnaire.

Note: We have provided the questionnaire that we have used as a supplemental material (see Online Appendix 3).

Online Appendix 3. Study Questionnaire**Section 1: Sociodemographic Information:**

1. How old are you (years)?

- | | | | |
|---------------------------------------|------------|---------------------------------------|---------|
| <input type="checkbox"/> ¹ | 21 – 24 | <input type="checkbox"/> ² | 25 – 29 |
| <input type="checkbox"/> ³ | 30 – 34 | <input type="checkbox"/> ⁴ | 35 – 39 |
| <input type="checkbox"/> ⁵ | 40 – 44 | <input type="checkbox"/> ⁶ | 45 – 49 |
| <input type="checkbox"/> ⁷ | 50 or more | | |

2. What is your nationality?

- | | | | |
|---------------------------------------|---------|---------------------------------------|-------------|
| <input type="checkbox"/> ¹ | Kuwaiti | <input type="checkbox"/> ² | Non-Kuwaiti |
|---------------------------------------|---------|---------------------------------------|-------------|

3. What is the highest education level you have completed?

- | | |
|---------------------------------------|---------------------------------------|
| <input type="checkbox"/> ¹ | Less than high school |
| <input type="checkbox"/> ² | High school |
| <input type="checkbox"/> ³ | Diploma (two years post high school) |
| <input type="checkbox"/> ⁴ | Bachelor's degree (university degree) |
| <input type="checkbox"/> ⁵ | Graduate degree (Master, Doctorate) |

4. Which of the following categories best represents the combined income for all family members in your household per month?

- | | |
|---------------------------------------|----------------|
| <input type="checkbox"/> ¹ | <1000 KD |
| <input type="checkbox"/> ² | 1000 – 1499 KD |
| <input type="checkbox"/> ³ | 1500 – 1999 KD |
| <input type="checkbox"/> ⁴ | 2000 – 2499 KD |
| <input type="checkbox"/> ⁵ | 2500 – 2999 KD |
| <input type="checkbox"/> ⁶ | ≥3000 KD |
| <input type="checkbox"/> ⁷ | I do not know |

5. In which governorate do you work?

- | | |
|---------------------------------------|-------------------|
| <input type="checkbox"/> ¹ | Hawally |
| <input type="checkbox"/> ² | Assima |
| <input type="checkbox"/> ³ | Jahra |
| <input type="checkbox"/> ⁴ | Farwaniya |
| <input type="checkbox"/> ⁵ | Mubarak Al-Kabeer |
| <input type="checkbox"/> ⁶ | Ahmadi |

6. What is your marital status?

- | | |
|---------------------------------------|------------------|
| <input type="checkbox"/> ¹ | Married |
| <input type="checkbox"/> ² | Single |
| <input type="checkbox"/> ³ | Divorced/widowed |

7. Do you have children?

- ⁰ No
¹ Yes

8. For how many **years** have you been working as a kindergarten teacher?

- | | |
|---|---|
| <input type="checkbox"/> ¹ This is my first year | <input type="checkbox"/> ² 1 – 2 |
| <input type="checkbox"/> ³ 3 – 4 | <input type="checkbox"/> ⁴ 5 – 6 |
| <input type="checkbox"/> ⁵ 7 – 8 | <input type="checkbox"/> ⁶ 9 – 10 |
| <input type="checkbox"/> ⁷ 11 – 12 | <input type="checkbox"/> ⁸ 13 – 14 |
| <input type="checkbox"/> ⁹ 15 – 16 | <input type="checkbox"/> ¹⁰ 17 – 18 |
| <input type="checkbox"/> ¹¹ 19 – 20 | <input type="checkbox"/> ¹² 21 or more |

9. Have you ever suffered from food allergy?

- ⁰ No
¹ Yes

10. Do you currently have or had students with food allergy in your classroom?

- ⁰ No
¹ Yes
² I do not know

11. Have you had any experience or training with food allergy through your job?

- ⁰ No
¹ Yes

12. Do you know if any of the following people suffer from food allergy?

| | Yes | No | I do not know | Not applicable to me |
|---|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Does any of your parents suffer from food allergy? | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ | <input type="checkbox"/> ⁴ |
| Does any of your siblings suffer from food allergy? | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ | <input type="checkbox"/> ⁴ |
| Does your spouse suffer from food allergy? | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ | <input type="checkbox"/> ⁴ |
| Does any of your children suffer from food allergy? | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ | <input type="checkbox"/> ⁴ |
| Do you know someone else who suffer from food allergy? | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ | <input type="checkbox"/> ⁴ |

Section 2: Please mark one box for each statement below:

| | True | False | I don't know |
|---|---------------------------------------|---------------------------------------|---------------------------------------|
| 13. An allergic reaction can happen when the body considers a food to be harmful. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 14. Lactose intolerance (trouble digesting dairy products) is the same as having a milk allergy. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 15. A person can die from having a food allergy | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 16. Hives (red bumps or blotches on the skin that can be itchy) are a <u>common</u> symptom of a food allergy reaction. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 17. People with food allergies can have an allergic reaction after touching a food. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 18. A person with milk allergy can still drink low-fat milk without having an allergic reaction. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 19. Foods eaten by a mother can be passed to her child through her breast milk. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 20. Acidic foods (like lemons, oranges, and tomatoes) <u>commonly</u> cause food allergy | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 21. Allergic diseases run in families. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 22. Food allergies can go away as a person gets older. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 23. Food allergy is more common in children than adults. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 24. The number of children in Kuwait who have a food allergy has been increasing over the past ten years. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 25. There is a cure for food allergy. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 26. The <u>only</u> way to prevent an allergic reaction is to stay away from the food that causes the allergy | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 27. A person can take a medicine everyday to prevent having food allergy reactions. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 28. There is a law in the Kuwait that requires all foods to be labeled with allergy information. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |

29. Which of the following are the **three** most common food allergies in **children**? [Mark **three** answers with “Yes” that you think are the most common causes of food allergy in children]

| | Yes, common cause of food allergy in children | No, not a common cause of food allergy in children |
|---|---|--|
| Eggs | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Shellfish (shrimp, lobster, crab) | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Peanut | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Milk | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Wheat | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Tree nuts (almonds, walnuts, pecans, cashews) | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |

30. Which of the following is the **most** common food allergy in **adults**? [Mark **one** answer with “Yes” that you think is the most common cause of food allergy in adults]

| | Yes, common cause of food allergy in adults | No, not a common cause of food allergy in adults |
|---|---|--|
| Eggs | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Shellfish (shrimp, lobster, crab) | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Peanut | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Milk | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Wheat | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Tree nuts (almonds, walnuts, pecans, cashews) | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |

31. A boy with a milk allergy accidentally drank some milk. Please mark which of the following could be a sign of food allergy reaction. [Mark **All** that apply]

| | Yes, a sign of food allergy reaction | No, not a sign of food allergy reaction |
|---|---------------------------------------|---|
| After two days he gets hyperactive and cranky and has headaches | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| After 15 minutes he gets hives on his face and chest | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| Immediately his tongue swells and he has trouble breathing | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |
| He has a stuffy nose that won't go away for weeks | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² |

Section 3: Please mark one box for each statement below:

| | Disagree | Neutral | Agree |
|---|---------------------------------------|---------------------------------------|---------------------------------------|
| 32. Food allergy is a serious health problem in Kuwait. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 33. People with food allergies are treated differently because of their food allergy. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 34. Children with food allergy have overprotective parents. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 35. Children with food allergy are teased at school. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 36. For someone who has a food allergy, staying away from the food that he or she is allergic to is difficult. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 37. People with food allergies worry a lot about their allergy. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 38. It is difficult for people with food allergies to safely eat at restaurants | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 39. Having an EpiPen or Twinject (injectable epinephrine) is important for most children with severe food allergies. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 40. Schools should have plans for keeping children with food allergies safe at school. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 41. Schools should ban all products with nuts. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 42. Schools should have special tables where children with food allergies can safely eat lunch. | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 43. It would be unfair if a student could not have a peanut butter sandwich because of another student's peanut allergy | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |
| 44. I would worry about having a student with food allergy at my classroom | <input type="checkbox"/> ¹ | <input type="checkbox"/> ² | <input type="checkbox"/> ³ |

45. Does the school where you work have an emergency action plan in the case of a child having an allergic reaction in the school?

- ¹ No
² Yes
³ I do not know

46. Did you ever receive information about food allergy and anaphylaxis?

- ¹ No
² Yes

47. What are the most frequent symptoms of food allergy?

- ¹ Urticaria, stomachache, wheezing
- ² Headache, fever, tremors
- ³ Constipation, headache, nausea
- ⁴ Conjunctivitis, tonsillitis

48. What are the most frequent symptoms of anaphylaxis?

- ¹ Asthma, dermatitis
- ² Conjunctivitis, rhinitis, headache
- ³ Urticaria, itch, stomachache, wheezing, throat tightness, collapse
- ⁴ Tonsillitis, cough, temperature

49. Which is the best medication for anaphylaxis and severe food allergy reaction?

- ¹ Orally antihistamine
- ² Cortisone
- ³ Intramuscular adrenaline
- ⁴ Intramuscular antihistamine
- ⁵ I do not know

50. Do you know how to use an adrenaline pen (an EpiPen is shown in the picture below)?

- ¹ No
- ² Yes
- ³ I do not know what an EpiPen is.



Supplementary Table 1. Overall and itemized knowledge of food allergy among kindergarten teachers stratified by previous training in food allergy

| Item | Previous training in FA, % (n) | | P-value* | FDR- adjusted P-value [#] |
|--|-----------------------------------|--------------------------|--------------------|--|
| | Yes (n = 119), Correct | No (n = 763), Correct | | |
| Overall mean score | 55.9 | 51.6 | 0.005 [†] | 0.042 |
| Definition and diagnosis | | | | |
| Allergic reaction when body considers food harmful (T) | 36.1 (43) | 28 (214) | 0.071 | 0.225 |
| Lactose intolerance same as milk allergy (F) | 15.1 (18) | 10 (76) | 0.089 | 0.239 |
| Symptoms and severity | | | | |
| Food allergy reaction can be fatal (T) | 61.3 (73) | 55.8 (426) | 0.259 | 0.463 |
| Hives a common symptom of food allergy (T) | 81.5 (97) | 81.8 (624) | 0.944 | 0.944 |
| Signs of milk allergy reaction | | | | |
| Hyperactivity (F) | 59.7 (71) | 69.6 (531) | 0.030 | 0.150 |
| Hives (T) | 84 (100) | 80.7 (616) | 0.392 | 0.516 |
| Tongue swelling/trouble breathing (T) | 74.8 (89) | 63.7 (486) | 0.018 | 0.113 |
| Stuffy nose (F) | 52.9 (63) | 58.8 (449) | 0.225 | 0.433 |
| Triggers and environmental risk | | | | |
| Allergic reaction from touching allergenic food (T) | 58.8 (70) | 43.5 (332) | 0.002 | 0.025 |
| Milk-allergic person: safely drink low-fat milk (F) | 44.5 (53) | 41.5 (317) | 0.539 | 0.642 |
| Mother can pass food to child through breast milk (T) | 72.3 (86) | 57 (435) | 0.002 | 0.025 |
| Acidic food: common cause of food allergy (F) | 26.1 (31) | 22.4 (171) | 0.380 | 0.516 |
| 3 Most common childhood food allergies | | | | |
| Egg | 69.7 (83) | 71.2 (543) | 0.751 | 0.816 |
| Milk | 73.9 (88) | 69.9 (533) | 0.363 | 0.516 |
| Peanut | 80.7 (96) | 83.6 (638) | 0.424 | 0.530 |
| Most common adult food allergy: shellfish | 61.3 (73) | 56.4 (430) | 0.307 | 0.484 |
| Perceptions of susceptibility and prevalence | | | | |
| Allergic diseases run in families (T) | 56.3 (67) | 53.7 (410) | 0.601 | 0.683 |
| Food allergy can go away with age (T) | 46.2 (55) | 38.4 (293) | 0.105 | 0.239 |
| Food allergy more common in children (T) | 70.6 (84) | 62.8 (479) | 0.099 | 0.239 |
| Food allergy increasing in Kuwaiti children (T) | 68.1 (81) | 60.6 (462) | 0.117 | 0.244 |
| Treatment and use of health care | | | | |
| There is a cure for food allergy (F) | 24.4 (29) | 17.4 (133) | 0.069 | 0.225 |
| Avoidance is the only way to prevent food allergy reaction (T) | 79.8 (95) | 72 (549) | 0.072 | 0.225 |
| Daily medicine can prevent food allergy reaction (F) | 33.6 (40) | 32.6 (249) | 0.832 | 0.867 |
| Policy issue | | | | |
| Law in Kuwait requires foods to be labeled | 9.2 (11) | 6.7 (51) | 0.310 | 0.484 |

FA: food allergy. The correct answer is indicated in parentheses as: T = true and F = false; FDR: false discovery rate.

* Calculated using chi-squared (χ^2) test.

[†] Calculated using the Wilcoxon rank sum test.

[#] P-values were adjusted for multiple testing using the FDR method.

Supplementary Table 2. Perception, attitudes, beliefs, and policy consideration of food allergy according to having acquaintances with food allergy

| Item | Have any acquaintances with FA, Agree % (n) | | P-value* | FDR-adjusted P-value [#] |
|---|---|--------------|----------|-----------------------------------|
| | Yes (n = 584) | No (n = 298) | | |
| Stigma and acceptability | | | | |
| Food allergy serious problem in Kuwait | 49.0 (286) | 36.0 (106) | <0.001 | <0.001 |
| People with food allergies treated differently | 63.2 (365) | 52.7 (157) | <0.001 | <0.001 |
| Parents of food-allergic child overprotective | 28.1 (164) | 26.9 (80) | 0.084 | 0.091 |
| Food-allergic children teased at school | 15.9 (93) | 12.8 (38) | 0.095 | 0.097 |
| Would worry over student with food allergy | 49.0 (286) | 40.9 (122) | 0.003 | 0.005 |
| Perceptions of quality of life | | | | |
| Avoiding allergenic food is difficult | 35.5 (207) | 30.2 (90) | 0.013 | 0.015 |
| People worry a lot about their food allergy | 59.1 (345) | 45.0 (134) | <0.001 | <0.001 |
| Hard to eat out safely with food allergy | 51.5 (301) | 45.0 (134) | 0.008 | 0.010 |
| Treatment and use of health care | | | | |
| Having injectable epinephrine (EpiPen) important for child with severe food allergy | 51.7 (302) | 39.9 (119) | <0.001 | <0.001 |
| Policy issues | | | | |
| Schools should have plans to keep food-allergic children safe | 67.6 (395) | 53.7 (160) | <0.001 | <0.001 |
| Schools should ban all products with nuts | 36.6 (214) | 31.5 (94) | <0.001 | <0.001 |
| Schools should have special table for food-allergic child | 48.3 (282) | 39.9 (119) | 0.005 | 0.007 |
| Unfair if a student cannot have peanut butter sandwich | 43.7 (255) | 34.6 (103) | 0.001 | 0.002 |

FA: food allergy; FDR: false discovery rate.

* Calculated using chi-squared (χ^2) test.[#] P-values were adjusted for multiple testing using the FDR method.

Supplementary Table 3. Frequency of general knowledge of food allergy emergency interventions

| Variable | % |
|---|----------|
| Does the school where you work have an emergency action plan in the case of a child having an allergic reaction in the school? | |
| Yes | 25.2 |
| What are the most frequent symptoms of food allergy? | |
| Urticaria, stomachache, wheezing (T) | 82.7 |
| Headache, fever, tremors | 4.5 |
| Constipation, headache, nausea | 7.5 |
| Conjunctivitis, tonsillitis | 5.3 |
| What are the most frequent symptoms of anaphylaxis? | |
| Asthma, dermatitis | 34.6 |
| Conjunctivitis, rhinitis, headache | 6.0 |
| Urticaria, itch, stomachache, wheezing, throat tightness, collapse (T) | 50.1 |
| Tonsillitis, cough, temperature | 9.3 |
| Which is the best medication for anaphylaxis and severe food allergy reaction? | |
| Orally antihistamine | 9.9 |
| Cortisone | 19.8 |
| Intramuscular adrenaline (T) | 3.1 |
| Intramuscular antihistamine | 9.7 |
| I do not know | 57.5 |
| Do you know how to use an adrenaline pen (an EpiPen is shown in the picture below)? | |
| Yes | 9.9 |

The correct answer is indicated in parentheses as: T = true and F = false.