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Impact of a web-based program to improve food allergy management in schools and restaurants

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32 To the Editor,

33 Food allergy has emerged as a 'second wave' of the allergy epidemic (1), which demands for the
34 education and awareness at different societal levels, particularly in community facilities as schools and
35 catering services. Insufficient knowledge of schools and restaurants' staff can put students or guests at
36 increased risk of anaphylaxis (2). Most of the schools are not conveniently prepared to welcome food-
37 allergic students and restaurants also pose several challenges for food-allergic customers (2). Educational
38 programs are thus necessary; however, it is necessary to overcome participants' budget and time
39 constraints.

40 With this study, we aimed to assess the efficacy of a web-based food allergy learning program on school
41 and restaurants staff's knowledge.

42 The subjects enrolled in this study were professionals of education and catering sector, from
43 Portuguese speaking countries, that voluntarily signed up in the online courses of the Food Allergy
44 Community Program (FAC Program). The online courses were held at the University of Porto eLearning
45 platform – *Academia UP* (www.academia.up.pt) and consisted of nine non-interactive online training
46 modules in video format, each one of approximately five minutes. The scripts were developed based on
47 an extensive literature review and then translated into a video animation format using the specialized
48 program Go Animate® (GoAnimate, Inc. San Mateo, CA, USA).

49 The lecture topics included food allergy definitions; epidemiology; symptoms; prevention, diagnose and
50 treatment; dietary avoidance, cross-contact prevention; emergency procedures and accidental exposure
51 prevention and work-practices in schools and restaurants. The platform also provided complementary
52 readings and an interactive forum.

53 Two different food allergy knowledge survey tools were designed, one for schools and one for
54 restaurants, consisting of 20 multiple-choice questions with single-best-answer (appendix 1 and 2). To
55 determine the increase in knowledge after the learning program, the same survey was applied before and
56 after the intervention and participants were randomly assigned to 3 different groups, regarding the time
57 of survey administration: pre-test group (PreT), post-test group (PostT), and pre-and post-tests group
58 (PrePostT). The participants in the PreT and PrePostT did not have access to the correct responses and
59 personal scores until the end of the intervention.

60 General linear model for repeated measures was performed to access the improvement on the PrePostT
61 participants' knowledge, after the food allergy web-based intervention program and T-test for
62 independent samples was performed to compare knowledge score means between the PrePostT and the
63 PreT in the initial evaluation and PostT in the final evaluation.

64 The study was approved by the Ethics Committee of University of Porto and by the Portuguese National
65 Commission of Data Protection.

66 Concerning the results for schools, a total of 356 participants enrolled the online program and 216
67 concluded the course. The final sample was constituted mainly by dietitians (40.7%), school teachers
68 (20.8%), and health students (14.4%), and most participants (88%) had superior education. For
69 restaurants, a total of 339 participants attended and 212 concluded the course. The final sample was
70 constituted mainly by dietitians (45.8%), food service workers (15.1%), and health/food sciences students
71 (15.1%), and most participants (80.2%) had college education. Tables 3 and 4 show the demographic
72 characteristics of the participants from the two learning programs.

73 In both learning programs, the participants' score in the knowledge test increased significantly after the
74 course. The knowledge score at the initial and final evaluation was, respectively, 12 and 16 points, for
75 schools, and 13 and 16 points, for restaurants (out of 17 possible points) ($p < 0.01$).

76 For all items individually, the percentage of correct answers was higher after the intervention. (tables 1
77 and 2).

78 In both groups of participants, demographic variables such as education, job or locality do not have a
79 significant effect on total food allergy scores over time. In addition, there were no significant differences
80 between the PrePostT, and the PreT in the initial evaluation, neither between the PrePostT and the PostT.

81 The significant increase in participants' scores in the knowledge survey, as well as the increase in the
82 percentage of correct answers for each item of the questionnaires, shows that the interventions were
83 effective in enhancing professionals' knowledge. Additionally, regarding the learning program for
84 restaurants, the increase of knowledge in dimensions such as cooking, service and cleaning procedures
85 also shows that this type of intervention can also be effective as part of practical training. These results
86 are in line with previous studies focused on food allergy and food safety short-term interventions in both
87 schools (3) and restaurants (4) using computer-based programs, which had already pointed to the
88 feasibility, and effectiveness of computer-based training. Additionally, despite previous studies have
89 shown a high dropout rate in online courses, around 90% (5), in this food allergy online program the
90 participation rate was over 50% which shows that online education in this field may be a viable tool.

91 The present study has some limitations. First, the sample consists of professionals who voluntarily
92 enrolled in the course and who could already have a greater interest in the area, contributing to the good
93 results of participation. Moreover, this study only includes short-term knowledge retention and the
94 evaluation of the long-term knowledge may be important in future work for the validation of the
95 educational program. An additional limitation is the low rate of participation of professionals directly
96 related to the school work and especially to the foodservice, a drawback also noted by other authors (6,

7). Nonetheless, the sample of this study also reflects the professional situation of the participants, considering that many dietitians in Portugal work in the area of food safety in catering services. The high participation of health professionals may also reflect the perceived needs of training in this area (2), considering that they are the first line of assistance and training for the patient with food allergy. We also believe that more educational initiatives should be promoted and that a greater articulation with governmental entities should be attempted, so that food allergy training can be a legal requirement and therefore can be acceptable for professionals to dedicate some of their working time to it. To our knowledge, this is the first study in Portugal that has developed a web-based educational tool for food allergy and addressed its efficacy, as well as gave insight about the food allergy knowledge of professionals from two sectors of the community that are crucial to food-allergic individuals' safety. Thus, we consider that our tool is viable, easily disseminable and has potential to improve professionals' commitment and skills to deal with food allergy.

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Table 1.

Food Allergy Knowledge of participants from Food Allergy Educational Program for Schools.

Question domain		Correct answers (%) Baseline (n=139)	Evaluation	Correct answers (%) Final (n=140)
Food Allergy General Concepts	Q1. Allergy vs. intolerance	84.9		90.0
	Q2. Major Allergens	68.3		87.9
	Q3. Sign and symptoms	97.1		100.0
	Q4. Causes of an allergic reaction	84.9		100.0
	Q5. Diagnose methods	48.9		75.7
	Q6. Treatment	93.5		98.6
Allergen Avoidance	Q7. Cross-contact concept	94.2		100.0
	Q8. Allergens ubiquity	66.2		99.3
	Q9. Emergency procedures	44.6		98.6
	Q10 Precautionary labeling	97.8		100.0
	Q11. Food allergens labeling	65.5		89.3
Good work practices	Q12. Severity of a reaction	48.9		67.1
	Q13. Food allergy and isolation	79.1		92.1
	Q14. Practical scenario: school dining	69.1		90.0
	Q15. Accidental exposure prevention	28.1		50.7
	Q16. Food allergic reaction triggers	83.5		98.6
	Q17. Practical scenario: school trip	59.7		87.9
	Q18. Bullying	43.9		73.6
	Q19. Food allergy and adolescents	22.3		45.7
	Q20. Psychosocial impact	81.3		96.4

Shaded areas correspond to the questions excluded from the analysis of results after IRT meta-analysis.

Table 2.

Food Allergy Knowledge of participants Food Allergy Educational Program for Restaurants.

Question domain		Correct answers (%) Baseline (n=146)	Evaluation	Correct answers (%) Final (n=144)	Evaluation
Food Allergy General Concepts	Q1. Allergy vs. intolerance	74.0		84.7	
	Q2. Major Allergens	57.5		88.2	
	Q3. Sign and symptoms	82.2		95.8	
	Q4. Causes of an allergic reaction	74.7		97.2	
	Q5. Diagnose methods	39.0		68.8	
	Q6. Treatment	80.1		98.6	
Allergen Avoidance	Q7. Cross-contact concept	84.2		100.0	
	Q8. Allergens ubiquity	59.6		97.9	
	Q9. Emergency procedures	40.4		93.8	
	Q10 Precautionary labeling	87.7		100.0	
	Q11. Food allergens labeling	59.6		93.8	
Good work practices	Q12. Communication between co-workers	65.8		100.0	
	Q13. Food allergens declaration	74.0		93.1	
	Q14. Cross contact prevention	74.0		100.0	
	Q15. Cooking procedures	58.3		100.0	
	Q16. Preparation procedures	82.2		100.0	
	Q17. Service procedures	26.0		77.1	
	Q18. Cleaning procedures	61.6		100.0	
	Q19. Cross-contact fonts	41.8		92.4	
	Q20. Recipes and technical datasheets	81.5		100.0	

Shaded areas correspond to the questions excluded from the analysis of results after IRT meta-analysis.

Table 3.

Demographic characteristics of participants from Food Allergy Educational Program for Schools (total scores and by study group).

		Total (n=216)		Study groups (n)		
Demographic characteristics		n	%	Pre-test	Pre- and posttest	Posttest
Gender	Male	17	7.9	7	6	4
	Female	199	92.1	70	70	59
Education level	Doctorate	4	1.9	2	1	1
	Master	52	24.1	18	19	15
	Bachelor	134	62.0	46	48	40
	High School	25	11.6	11	8	6
	Secondary Education	1	0.5	0	0	1
Job/Occupation	Registered dietitians	88	40.7	32	33	28
	School teacher	45	20.8	16	17	13
	Health Student	31	14.4	12	10	9
	Foodservice worker	15	7.0	4	5	6
	Health Professional (doctor, nurse, psychologist)	13	6.0	4	2	4
	School worker	12	5.6	3	4	2
	Other	12	5.6	6	5	3
Locality (accordingly to Portugal NUTS-II)	North Region	121	56.0	45	40	36
	Centre Region	32	14.8	13	11	8
	Lisbon Metropolitan Area	20	9.3	5	8	7
	Algarve	10	4.6	3	4	3
	Madeira	6	2.8	2	2	2
	Azores	4	1.8	1	2	1
	Alentejo	3	1.4	1	1	1

Table 4.

Demographic characteristics of participants from Food Allergy Educational Program for Restaurants (total scores and by study group)

		Total (n=212)		Study groups (n)		
Demographic characteristics		n	%	Pre-test	Pre- and posttest	Posttest
Gender	Male	21	10.0	7	8	6
	Female	191	90.0	59	59	73
Education level	Master	47	22.2	14	16	17
	Bachelor	124	58.5	39	40	45
	High School	40	18.9	12	11	16
	Secondary Education	1	0.4	0	0	1
Job/Occupation	Registered dietitians	97	45.8	353	31	33
	Foodservice worker	32	15.1	9	10	13
	Health Student	32	15.1	10	11	11
	Food safety and quality technician	22	10.4	6	7	9
	School worker	8	3.8	2	2	3
	Food Engineer	5	2.4	1	1	3
	Health Professional (veterinary, pharmacists)	5	2.4	1	1	1
	Other	11	5.2	4	4	6
Locality (accordingly to Portugal NUTS-II)	North Region	127	59.9	39	40	46
	Lisbon Metropolitan Area	27	12.7	7	8	11
	Centre Region	26	12.3	8	11	10
	Algarve	9	4.2	4	3	3
	Alentejo	8	3.8	2	1	5
	Madeira	7	3.3	3	2	2
	Azores	3	1.4	1	1	1

Food Allergy Community Program

School Survey

Knowledge survey

- 1. Lactose intolerance is a food allergy to milk protein.**
 - A. True
 - B. False
 - C. Do not know

- 2. Which of the following foods is not included in the group of food allergens responsible for about 90% of all allergic reactions?**
 - A. Milk
 - B. Fish
 - C. Strawberry
 - D. Wheat
 - E. All above are included

- 3. Hives, redness of the skin and abdominal pain are the only symptoms of an allergic reaction to a food.**
 - A. True
 - B. False
 - C. Do not know

- 4. To trigger an allergic reaction, a person must consume the food to which he/she is allergic.**
 - A. True
 - B. False
 - C. Do not know

- 5. Of the following, which one is not clinically relevant for the diagnosis of food allergy?**
 - A. Oral food challenge
 - B. Food intolerance test
 - C. Medical history
 - D. skin prick tests
 - E. All above are clinically relevant.

- 6. Food allergy can be cured through allergy medicines.**
 - A. True
 - B. False

C. Do not know

7. A nut-allergic individual can eat a birthday cake with nuts topping as long as the nuts are removed from the cake before serving.

A. True

B. False

C. Do not know

8. What products should a food allergic individual have attention to?

A. Food

B. Hygiene and cosmetic products

C. Non-prescription medicines

D. All above can trigger a food-allergic reaction

E. A + C

9. What are the procedures to take in case of an anaphylactic reaction?

A. Call the emergency number and then address what might have caused the reaction

B. Give the patient an epinephrine injection and then call the emergency number

C. Give the patient an antihistamine and, if it does not work, then give an epinephrine injection.

D. Give the patient an antihistamine and then call the emergency number

E. Give the patient an antihistamine and then address what might have caused the reaction.

10. When a food label says "may contain traces of ..." the amount of the allergen is too small that food allergic individuals can safely consume that food.

A. True

B. False

C. Do not know

11. Only pre-packaged food is legally obliged to have food allergens information

A. True

B. False

C. Do not know

12. The severity of an allergic reaction can be predictable by the severity of the previous one.

A. True

B. False

C. Do not know

13. Food-allergic children with food allergies should be isolated at meal time to avoid the risk of contamination.

A. True

B. False

C. Do not know

14. Today's menu in the school cafeteria is stewed fish. During lunchtime, you hear a fish-allergic student, who is eating the lunch he/she brought from home, complaining to his friends that he is not feeling well and that maybe flu. He says he feels dizzy and complains of stomach pain and burning in his throat. Can this be an anaphylactic reaction?

- A. Yes
- B. No
- C. Do not know

15. Concerning accidental exposure prevention on school setting, identify the wrong statement.

- A. To reduce the risk of cross-contamination through food waste in children's hands, it is recommended to use hand sanitizers.
- B. Some materials for painting and crafts can be sources of food allergens.
- C. Children's emergency medication must be stored in a locked locker.
- D. None of the statements is wrong
- E. B + C

16. A kiss can trigger an allergic reaction.

- A. True
- B. False
- C. Do not know

17. Your school organized a study visit to a museum, and on the day of the visit, you question your milk-allergic student about her emergency medication. The student says that she doesn't bring it because it would not be necessary since her parents prepared her lunch and she knows that she also cannot eat anything offered by colleagues. Can the student make the trip safely?

- A. Yes
- B. No
- C. Do not know

18. Concerning food allergy bullying, identify the wrong statement.

- A. Bullying to children with food allergies is more frequent than to non-allergic peers
- B. Bullying to children with food allergies can have serious physical consequences.
- C. Bullying often results from the lack of food allergy information and awareness.
- D. None of the statements is wrong
- E. A + B

19. Children are at a greater risk of accidental exposure than adolescents.

- A. True
- B. False
- C. Do not know

20. Take risks and consume foods to which they are allergic can be a consequence of social isolation in food-allergic adolescents.

- A. True
- B. False
- C. Do not know

Food Allergy Community Program

Restaurant Survey

Knowledge Survey

- 1. Lactose intolerance is a food allergy to milk protein.**
 - A. True
 - B. False
 - C. Do not know

- 2. Which of the following foods is not included in the group of food allergens responsible for about 90% of all allergic reactions?**
 - A. Milk
 - B. Fish
 - C. Strawberry
 - D. Wheat
 - E. All above are included

- 3. Hives, redness of the skin and abdominal pain are the only symptoms of an allergic reaction to a food.**
 - A. True
 - B. False
 - C. Do not know

- 4. To trigger an allergic reaction, a person must consume the food to which he/she is allergic.**
 - A. True
 - B. False
 - C. Do not know

- 5. Of the following, which one is not clinically relevant for the diagnosis of food allergy?**
 - A. Oral food challenge
 - B. Food intolerance test
 - C. Medical history
 - D. skin prick tests
 - E. All above are clinically relevant.

- 6. Food allergy can be cured through allergy medicines.**
 - A. True
 - B. False

C. Do not know

7. A nut-allergic individual can eat a birthday cake with nuts topping as long as the nuts are removed from the cake before serving.

- A. True
- B. False
- C. Do not know

8. What products should a food allergic individual have attention to?

- A. Food
- B. Hygiene and cosmetic products
- C. Non-prescription medicines
- D. All above can trigger a food-allergic reaction
- E. A + C

9. What are the procedures to take in case of an anaphylactic reaction?

- A. Call the emergency number and then address what might have caused the reaction
- B. Give the patient an epinephrine injection and then call the emergency number
- C. Give the patient an antihistamine and, if it does not work, then give an epinephrine injection.
- D. Give the patient an antihistamine and then call the emergency number
- E. Give the patient an antihistamine and then address what might have caused the reaction.

10. When a food label says "may contain traces of ..." the amount of the allergen is too small that food allergic individuals can safely consume that food.

- A. True
- B. False
- C. Do not know

11. Only pre-packaged food is legally obliged to have food allergens information.

- A. True
- B. False
- C. Do not know

12. If a recipe needs a small change due to lack of ingredients, the alteration does not need to be communicated to the server.

- A. True
- B. False
- C. Do not know

13. Considering Portuguese legal dispositions and Regulation EU 1169/2011, the information on food allergens may be provided only upon consumer's request.

- A. True

- B. False
- C. Do not know

14. To grate carrot for a person with food allergy to milk, it can be used the cheese grater as long as it is passed through water and the visible pieces of cheese are removed.

- A. True
- B. False
- C. Do not know

15. A fish-allergic individual can eat fish only if it is cooked under high temperatures for a long time.

- A. True
- B. False
- C. Do not know

16. To prepare fish and shellfish in a catering establishment, the same tongs may be used, but the food should be served on separate plates.

- A. True
- B. False
- C. Do not know

17. Concerning the food service for a food-allergic client, state the wrong statement.

- A. Even if a meal is conveniently prepared in the kitchen, cross-contact may occur during table service
- B. When the allergen-free meal is prepared first, it should wait in the kitchen to be served with the others in order to not stigmatize the food allergic client.
- C. The table indicated to the customer with food allergy should preferably not be near the kitchen
- D. B + C
- E. There are no wrong statements

18. Cutlery and plates are the only utensils to keep in mind concerning the prevention of cross-contact.

- A. True
- B. False
- C. Do not know

19. From the following utensils, which can be a source of cross-contact?

- A. Home appliances like toasters.
- B. Cans and containers opened in the refrigerator
- C. Dishwashing sponge
- D. All of the above
- E. A + B

20. The recipes 'technical sheets allow a higher standardization of recipes and are therefore an important tool in the management of food allergy.

- A. True
- B. False
- C. Do not know

Please find some of the videos that were part of the FAC educational program at the following address of the University of Porto (peer review only):

<https://uporto.cloud.panopto.eu/Panopto/Pages/Viewer.aspx?id=1d8df170-a7ec-4ef0-8027-a8ff010f3d8d>