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FOOD ALLERGY AND FOOD INTOLERANCE KNOWLEDGE OF FOODSERVICE WORKERS IN HUNGARIAN SCHOOLS

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ABSTRACT

To provide food for children with food allergy or food intolerances represents an increasingly important role in school catering services. The number of children with food intolerances is growing continuously; therefore, it is necessary to improve the knowledge of foodservice workers, who are responsible for food provision in school catering units in relation with food intolerances, food allergies. The main goal of our research is to assess and analyze the knowledge of food service workers and food handlers on food intolerances and to determine those factors, which may influence their knowledge. Our research was conducted by using paper and pencil questionnaires. The mean of test results was 89.16% while deviation was 12.26%. There were no correlations between the test results and respondents' education level, age group and the number of years working in food catering sector, and only partial correlation was detected with the job of the respondents. Based on the answers the food handling techniques of diet foods represented the poorest results. Our findings proved that the knowledge and food handling practice of food handlers regarding food intolerances and the preparation of diet meals should be improved.

Keywords: food hypersensitivity; food allergy; food intolerances; food handler; school catering; knowledge test

INTRODUCTION

Food allergies and food intolerances are among the most frequent reasons of bad or unfavorable reactions on certain food or meals. Food intolerances are those side effects, which are resulted by any ingredients, components or additives of meals or food products, and are not derived from immune system problems, but it is a caused by any other problems when the human body is not able to digest, to absorb or to metabolize certain food or food components. The most frequent food intolerances are lactose and fructose intolerances **(Mahan and Swift, 2017)**.

Food intolerances generally produce undesirable symptoms in the digestive system, such as abdominal distension, pains, diarrhea and vomiting. The symptoms and impacts of food allergies can be more dangerous **(Caballero, 2013)**.

Food allergies are the abnormal reactions of the immune system on specific components of food (mostly proteins) which are recognized by the allergen-specific immune cells, generating specific immune responses which will result specific symptoms **(L'Hocine, Achouri and Pitre, 2018)**. The reactions on a given allergenic substance may be different in different individuals, from the less intensive to the dangerous forms, which may be even life threatening reaction. Some allergenic substances will cause abdominal discomfort, skin rashes, vomiting or diarrhea, but others may cause difficulties in breathing, drowning or anaphylaxis as well **(Bird, Jones and Burks, 2019)**.

In Europe, based on the information from parents, one from 20 children has any type of health problems because of food allergies **(Nwaru et al., 2014)**. In Hungary, in 72% of the schools there is at least one pupil or student who claimed for dietary menus. The most frequent food allergies and intolerances are caused by milk, eggs and gluten. As a consequence, in 2017, the most frequently required dietary meals were lactose-free, milk protein-free, gluten-free and egg-free dietary menus **(Bakacs et al., 2017)**.

The manifested cases of food allergies and food intolerances show an increasing tendency, so it is among the most important health and food safety questions of our time, which will bring more and more challenges for the food industry and catering industry. The only treatment for allergies and intolerances is the absence of the harmful substances, so these substances should be deleted from the everyday life, everyday food of the hypersensitive persons **(NIAID-Sponsored Expert Panel, 2010)**.

The answer for the question of how to avoid these problems, how to avoid these harmful ingredients in order to keep health, will depend not only on the knowledge of

the patients and their families, but also on the knowledge of their environment, such as school, workplace, food industry, governmental bodies and the authorities.

In public catering, special food and meals shall be provided for those children, who confirm their disease with the certification of specialists. The meals for them may be prepared on the spot, or food may be provided by special delivery service, and the prepared meals shall contain all those nutrients and food types which are given for the relevant age group of healthy children as it is given in an official decree **(No. 37/2014 decree of Hungarian Ministry of Human Capabilities)**.

To avoid the contamination with allergenic components and to keep food safety requirements a high level of knowledge is required **(Sicherer and Sampson, 2018)**. In order to meet these strict requirements, and to prepare the appropriate food and meals for hypersensitive consumers, catering services shall comply with three main requirements.

Firstly, the caterer shall know which are those food types or ingredients which shall be avoided by the hypersensitive person in the given diet, and caterers shall provide the relevant information for these customers.

Secondly, the caterers shall provide information for the consumers about the dietary food or meals **(Hattersley and King, 2014)** as well as the nutritional point of view in order to allow consumers to make healthy food choices **(Šedík et al., 2018)**. Each catering services (school kitchens, fast food or street food caterers, restaurants) shall give the appropriate information for the consumer about the food itself, the meals displayed at the menu card, the ingredients, the appearance of different allergenic components, the food preparing technology and storage matters, as not only the absence of allergenic components is necessary, but also the storage and the avoidance of cross contamination **(Abbot, Byrd-Bredbenner and Grasso, 2007)**.

This procedure is highlighted by the **decree of the European Parliament and Commission (1169/2011/EU)** which outlines the compulsory information, which shall be given by the caterers at each stages of the food supply chain. The minimum requirement is to indicate the 14 main allergenic materials, namely cereals containing gluten, crustaceans, eggs, fish, peanuts, soybeans, milk, nuts, celery, mustard, sesame seed, sulphur dioxide and sulphites, lupin and molluscs. Ingredients containing these allergens shall be indicated on menu cards and food labels.

Thirdly – and this requirement has a critically high importance – caterers shall provide appropriate training and education for the kitchen staff, to inform them about the importance of allergies and food intolerances. Information shall also be given about the special steps of food handling in the preparation of dietary food and meals. The knowledge of the food handlers is one of the most important influencing factors in the course of health protection of hypersensitive consumers (i.e. patients with food allergies or food intolerances).

The main objective of our research is to evaluate the knowledge of the kitchen workers in relation with food allergies or food intolerances.

Scientific hypothesis

Based on the previous research results and own experiences two scientific hypotheses were formulated.

Hypothesis H1: We assume that the knowledge level of the food handlers in school catering services in relation with food intolerances is rather low, as these workers do not have such education or training.

Hypothesis H2: We assume that the job type, the age, the time spent in catering sector (work experiences) and the education level are correlated with the knowledge about food intolerances.

MATERIAL AND METHODOLOGY

Structure of the questionnaire

The goal of the survey was to evaluate the general knowledge of food handlers on food allergies and food intolerances, by conducting a questionnaire survey. The questionnaire was prepared by the help of food experts, and the suggestions of literature sources dealing with this topic were also taken into consideration. **(Ajala et al., 2010; Dzwolak, 2017; Lee and Sozen, 2018)**. The first version of the questionnaire was filled in after preliminary discussions by 24 kitchen workers, and based on the experiences and suggestions, some modifications were conducted. The final version of the questionnaire contained 12 questions, from which the 4^{th} question included 9 sub-questions. Three questions were related to the knowledge of food and meals which may cause food intolerances, 5 questions were related to the main characteristics of food intolerances and 4 questions were related to the appropriate preparation and handling techniques of dietary meals.

Besides the questions related to the knowledge of food handlers, additional demographic questions were also given to help in the deeper analysis of the results, namely age, job/profile, work experiences in the catering sector, educational level and skills. Each proper answer represented one point and in case of question 4, partial points were also given. The maximum result was 12 points. The results are shown in the percentage of the maximum points.

Study samples

The survey was conducted in June of 2018. The questionnaires were filled in during special training days organized for the food handlers, it means that workers should not work in their shifts at that day. All food workers were employees of different school catering units (kindergartens, primary and secondary schools), some of them worked at cooking kitchens and the other part worked in institutions with serving kitchens. 215 workers filled in the questionnaire, 180 of them worked as kitchen maid, 24 as cook and 11 workers as storage manager.

The kitchen workers of the sample previously took part regularly at compulsory trainings in food hygiene topics, but they did not have specific knowledge about food allergies and food intolerances before filling in the questionnaire. They could rely on only their general knowledge and experiences while responding the questions.

Statistical analysis

Data processing and statistical analyses were performed by using the IBM SPSS Statistics 22.0 for Windows. On one hand, in order to compare means between two groups, we used the independent two-sample t tests. On the other hand, when comparing more than two groups, we used one-way variance analysis (one-way ANOVA). The equality of group variances was tested by Levene-test. Significant differences were detected by using the Duncan's multiple range test in the case of equal variances; while in case of different variances, we used the Tamhane-test.

RESULTS AND DISCUSSION

Sample

The average age of the respondents at the time of the survey was 49 years, the youngest food worker was 22 years old, and the oldest was 75 years old. 35% of the respondents were in the age group of older than 55 years, 48% of the respondents were between 40 – 54 years old and 15% was younger than 39 years old. Five respondents did not indicate their age group, so their answers were not taken into consideration in calculations related to age. The majority (92%) of the respondents was female. The general distribution of educational level showed a relatively balanced image: 28% of respondents indicated that their highest educational level is elementary school, 36% of them finished basic professional level of education (semi-skilled) and 34% of them had secondary or higher education level. Three respondents did not answer for the question related to the educational level. 118 kitchen maids worked at serving kitchens, the others worked at cooking kitchens, from this 62 worked as kitchen maids. Nearly half of the respondents (102 food handlers) indicated that they have more than 10 years of experience in the catering sector (Table 1).

Test results

The average result of the tests was 89.16%, standard deviation was 12.26%. The worst result was 22.92%, the best result was 100%.

According to the job (position), there were significant differences between kitchen maids and cooks. Although the average result the storage managers was better than the results of kitchen maids, significant differences were not detected (Table 1). According to the statistical analyses, there were no correlations between the educational levels, age of respondents, work experience, and there were no differences in the knowledge level of kitchen staff working in cooking and serving kitchens (Table 1).

Results on questionnaire questions

The distribution of the answers of the 215 respondents is shown in Table 2. The questions were separated into three groups:

- food knowledge related to meals which may have impact on hypersensitive individuals (i.e. allergenic food) were represented by questions No. 1., 2. and 4.,
- knowledge on the symptoms of food allergies and intolerances (i.e. allergenic reactions) were represented by questions No. 3., 5., 6., 7. and 8.,
- knowledge of the special handling techniques of the dietary foods and meals (diet food handling) were represented by questions No. 9., 10., 11 and 12.

Food knowledge

The knowledge of the respondents about those food components and meals, which may cause problems for hypersensitive individuals was answered successfully with 91% ±13% result, there were no differences according to the age and job of the food handlers.

Nevertheless, the result of workers with professional education showed significantly better results, compared to workers with elementary education. Other correlations were detected according to the working experience and the knowledge of food that may cause harmful reactions for hypersensitive consumers. Those workers, who had less than one year of working experience, reached worse results than those who had more than 5 years of working experience. The workers of cooking kitchens also reached better results in total, but in case of kitchen maids, their group did not show such differences according to their kitchen type (i.e. cooking or serving kitchens).

Table 1 Descriptive data of food handlers' knowledge scores.

		N	% ±StDev
Total		215	89.16 ±12.27
Position	Kitchen maid	180	87.87 ±12.74[a]
	Storage manager	11	94.88 ±7.02[a,b]
	Cook	24	97.73 ±4.11[b]
Educational level	Elementary	60	87.33 ±15.69[a]
	Semi-skilled	78	90.09 ±8.9[a]
	Skilled	74	89.84 ±11.98[a]
Age	Age range: 55 and above	74	88.82 ±12.47[a]
	Age range: 40 – 54	101	89.6 ±12.86[a]
	Age range: below 39	35	87.38 ±10.5[a]
Work experience	less than 1 year	35	86.61 ±13.59[a]
	1 – 4.99 years	43	87.84 ±13.25[a]
	5 – 9.99 years	35	87.8 ±11.6[a]
	10+ years	102	91.05 ±11.44[a]
Cooking/serving kitchen*	Cooking	62	90.29 ±11.54[a]
	Serving	118	86.6 ±13.19[a]

Note: *Kitchen maids only. [a, b] Results indicated by different letters are statistically different (p <0.05 Student's t-test and ANOVA with Duncan's multiple range test).

Table 2 Food intolerance questionnaire and correct answers in %.

Question	Question type	Kitchen maid (n = 180)	Cook (n = 24)	Storage manager (n = 11)	Total (n = 215)
1. Which of the following items contains gluten? (Apple, Pork stew, **Spaghetti,** Potato with parsley)	Allergenic food	92	100	100	93
2. Which of the following items are risky for guests who have food allergies? (**Pasta with walnut**, Fresh salad, Cooked rice, Fried leg of chicken)	Allergenic food	97	100	100	98
3. What is lactose intolerance? (Intolerance against cereals, **Intolerance against sugar of milk**, Intolerance against nuts, Intolerance against egg)	Allergic reactions	96	100	100	96
4. Check the food items that are considered as major food allergen [b,c]	Allergenic food				
a) **Milk**		91	88	100	91
b) Chocolate		63	42	27	59
c) **Egg**		79	83	91	80
d) **Peanut**		88	92	100	89
e) Strawberry		51	50	55	51
f) Carrot		97	100	100	97
g) Tomato		94	100	82	94
h) Orange		94	100	100	95
i) **Almond**		73	75	73	73
5. Individuals with food allergies can safely consume the foods that cause the allergies if only a small amount is consumed. (True, **False**)[a]	Allergic reactions	86	100	91	87
6. Can high temperature (deep-frying, cooking) destroy food allergens? (Yes, **No**)[a,c]	Allergic reactions	89	100	100	91
7. If someone has an allergic reaction, is it correct to offer water in order to ‘‘dilute” the allergen and stop the reaction. (True, **False**)[a]	Allergic reactions	97	100	100	98
8. If you remove allergenic food items (such as walnuts) from a finished dish, will it prevent the client from having an allergic reaction? (Yes, **No**)[a,c]	Allergic reactions	91	92	100	92
9. Gluten-free meal can be handled together with regular utensils. (True, **False**)	Diet food handling	80	88	100	82
10. The utensils used for handling gluten-free food can be stored with other utensils. (True, **False**)	Diet food handling	71	92	100	75
11. Gluten-free meal can be transported only in airtight container. (**True**, False)	Diet food handling	85	96	91	87
12. Gluten free meal must be handled separately. (**True**, False)	Diet food handling	87	88	100	88

Note: [a] These questions are from **Ajala et al. (2010)**; [b] Similar question has been published by **Ajala et al. (2010)**; [c] Similar question has been published by **Lee and Sozen (2018)**. Correct answers are indicated by **bold** letters.

Knowledge of food allergies and intolerances

The respondents of the survey reached the best results in these field, the average result and deviation was 92% ±15%. There were no differences according to job, age and working experience, moreover the type of kitchen also did not influence the results. The results of respondents with elementary educational level were worse than the responses of skilled and semi-skilled kitchen workers.

Handling of dietary food and meals

This part of the survey brought the worst results, the average result and deviation was 83% ±22%. The storage managers reached better results than the kitchen maids, but the cooks did not differ from the other groups. The results of kitchen maids working in cooking kitchens were better than of those who worked in serving kitchens. This part of the results was not influenced by the age, educational level and working experience.

Discussion

Nowadays, the importance of the existence of food intolerances is increasing in the school catering sector, and one of the most important players of this process is the group of food handlers, who works at the end of the food chain. Food handlers serve the consumers directly, i.e. food handlers will make the final decision about the food (meal): is it safe or not? In this situation, the responsibility of the food handlers is very high, and the knowledge of these workers will determine the final objective, i.e. to serve the appropriate meal for each customers. As the number of children with food allergies and intolerances showed a growing tendency in the past decades, so it is necessary to improve the knowledge level of food workers in this specific topic. The primary goal of our research was to explore and evaluate the knowledge of kitchen workers of the school catering sector in relation with this topic, and to determine those factors, which may influence the knowledge on food hypersensitivity issues.

Our survey was conducted by a paper-and-pencil questionnaire, which was elaborated based on the findings of different literature sources. Based on the feedbacks, we could detect some problems. For example, the 4th question of our questionnaire was not appropriate for measuring the knowledge properly. In this question, chocolate and strawberry was indicated by almost 50% of the respondents as major allergens. Of course, chocolate and strawberry allergy is existing, but they are not so frequent and dangerous, so the term “major allergen” is not clear in this aspect. This problem was also highlighted by previous researchers as well, such type of questions cannot be understood clearly, so the answers might be very diverse **(Ajala et al., 2010**; **Lee and Sozen, 2018)**.

The respondents of the survey have not passed previously any specific training in the topic of food hypersensitivity; they have finished only general training courses in food hygiene topics. Thus, according to our first hypothesis, they do not have high level of knowledge, or they have different knowledge levels related to topics in food allergy and food intolerances. In our research, the average score of 215 food handlers was 89.16% with a deviation of 12.27%, which was higher than the preliminary expectations. The scores on the different questions showed a wide range between 75 – 98%, excluding the results of question 4, which was not considered in the final evaluation. The findings of other literature sources showed lower scores for such questions: according to the findings of **Lee and Sozen (2018)**, the results of the food handlers were between 41.5 – 89.5%, and the results of **Ayala et al. (2010)** were between 69 – 84%.

Based on the abovementioned facts, we rejected our first hypotheses (H1), because the knowledge level of Hungarian food handlers, who did not have previous specific knowledge on food hypersensitivity, cannot be considered as low, even in international comparison.

According to our results, there were some correlations between the knowledge of the food handlers and their job (position). For the position of kitchen maid, no educational requirements are needed, therefore, it was assumed, that their knowledge will be lower than the knowledge of the skilled worker cooks and storage managers. This assumption was verified only in case of the comparison with cooks. The results of other previous researches on the knowledge of food hygiene issues **(Illés et al., 2018)** also showed that there is no correlation between the knowledge and working position of the food workers working in positions like kitchen maids, cooks and storage managers. There were no correlations at all between the test results and the educational level, working experiences and age, in addition, the type of the working place (i.e. cooking or serving kitchens) have not shown any correlations with the knowledge of food handlers. As cooks and storage managers work only in cooking kitchens, an additional analysis was conducted only for the evaluation of kitchen maids, who work in both kitchen types (Table 1).

Based on the abovementioned results, H2 hypotheses was rejected, because the age, the working experience in the catering sector and the educational level did not show correlations with the knowledge level, while the job profile (position) was just partly influenced by the knowledge on food hypersensitivity.

During the analysis of the different fields, it was an alarming observation that the worst results were achieved in the questions related to handling of dietary food. These questions were connected to the everyday working processes and practices of food handlers. Based on these results it is clearly concluded that there is need for specific education and trainings in this topic. Another important observation was related to the knowledge of allergens. Respondents, who have only elementary education level, reached lower scores in general knowledge on the reasons of food intolerances and allergies. To provide safe dietary food for the consumers at cooking or serving kitchens is the responsibility of the food catering service. Therefore, food caterers and food services shall ensure the traceability of allergenic components, which shall be built into their monitoring system based on the principles of HACCS and GHP, and this traceability process is to be monitored by the authorities **(Fontcuberta-Famadas et al., 2018)**. In the course of preparing dietary meals, the general principle is that preparation of dietary food should be separated in time and place. The cleanness of the devices and utensils should be ensured, because the surfaces of the equipment may be a primary source of cross-contaminations **(Ortiz et al., 2018)**. The production and supply of allergen-free food may have several hidden dangers, for which the food

producer or food provider shall take the responsibility. Besides other previous researches **(Ahuja and Sicherer, 2007)**, our survey results also highlighted that the sources of such dangers frequently arise from the non-appropriate knowledge of food handlers.

CONCLUSION

A contemporary challenge of food providers, particularly for school catering services is to prepare and serve food for children with food intolerances or food allergies. In managing this process, and in the prevention of diseases, harmful reactions and diet mistakes, the food handlers – as players who work at the end of the food chain – play an important and active role.

Our research findings highlighted that the general principles of preparing dietary food and meals are not clear enough for the food handlers. In order to manage the process properly, and to prepare and serve healthy food for hypersensitive consumers in a safe and appropriate way, the knowledge of the kitchen workers shall be improved not only in general, but also this special field.

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