



## CATERING OF CHILDREN WITH SPECIAL DIETARY NEEDS IN SCHOOL CANTEENS

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### ABSTRACT

The occurrence of diagnosed food intolerances and food allergies shows an increasing trend worldwide and the most affected age group is schoolchildren. School catering services are not always prepared for fulfilling the strict requirements of special diets. The main goal of the paper is to summarize the main food intolerances, allergies and diets and to show the situation of dietary food based on an empirical research representing 44 secondary schools in Hungary, where the existence of special diets, the number of consumers with special dietary needs and the appropriateness of conditions were analyzed. 4.3% of children of the sample required for special diets, but in 20% of all cases, diets were requested without appropriate documents. Only 3 kitchens complied fully the conditions of special dietary needs, an important problem was non-appropriate labelling of meals and cross-contamination. The increasing need for special diets generates additional tasks and responsibilities for school kitchens and food providers by providing special technologies, processes and conditions required for preparing dietary meals, and present research findings call attention for these requirements. In the future stage of the research the role of technical background and the knowledge of employees related to the special diets are to be explored.

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## 1. Introduction

Food allergies and food intolerances are well known and frequently diagnosed diseases of our times. In many countries labelling of food allergens are determined by official regulations and acts. In the European Union EC Regulation No. 1169/2011 (EC, 2011) while in the United States the Food Allergen Labeling and Consumer Protection Act of 2004 (FDA, 2004) describes the regulations related to the main allergens. The major allergens are the following: cereals containing gluten, crustaceans, eggs, fish, peanuts, soybeans, milk (including

lactose), tree nuts, celery, mustard, sesame seeds, sulphur dioxide and sulphites, lupin and molluscs (EC, 2011). According to the summary of FARRP (Food Allergy Research and Resource Program of Institute of Agriculture and Natural Resources at the University of Nebraska-Lincoln), these main allergens are labelled all across the world. FARRP analyses different countries in North and South America, Europe (EU countries, Iceland, Liechtenstein, Norway, Switzerland, Ukraine), Turkey and Arab States of the Gulf, Australia and New

Zealand, China, Japan, Korea, India, Malaysia, Thailand, and South Africa. Gluten/wheat, crustaceans, egg, milk, peanut, tree nuts are labelled in all these countries, soybean, fish is not labelled in Japan, sulphur dioxide/sulphites is not labelled in China, Japan and South Africa. EU and other European countries, Arab States of the Gulf, Canada, Australia, New Zealand and Korea are those countries which label the most allergens in food (FARRP, 2019).

In the past few years, the number of food product withdrawals due to missing or incorrect labelling was higher than the withdrawal of food products due to the existence of pathogens (Spotz, 2018). Food intolerances are frequent in childhood, so providing appropriate food for children with special dietary needs represent an important task for school catering services.

To provide appropriate food for schoolchildren at school is an important task, as students spend most of their days at school and they need the required nutrients in order to maintain their good health status, wellbeing and proper school performance (Kiss *et al.*, 2019). In many countries of the European Union, the measures for improving the school catering services are outlined by school food programs. In some countries, these programs are compulsory, but other countries the proposed measures are only suggestions. It should be noted that only seven national school food programs (Northern Ireland, Wales, Hungary, Ireland, Spain, Sweden, Germany, Belgium) consider the special needs of children with food allergies and intolerances (EU JRC, 2015). According to Hungarian regulations, for children with special dietary needs at least one meal should be served in the daytime at educational institutions. The need for the special diets shall be justified by an official certification issued by specialist, but only those certifications may be accepted which are issued by doctors specialized in endocrinology, gastroenterology, diabetes or allergology/clinical immunology.

The organization of dietary catering processes brings many challenges for the school caterers and kitchen staff. These challenges are mostly related to organizing activities (food

handling, control, training of kitchen staff etc.) which represent additional costs and requires for additional financial sources (Tóth *et al.*, 2017). Special diets of different food allergies are prepared by the total exclusion of particular ingredients, while in case of food intolerances, some ingredients may appear in the prepared meals at a limited amount. An important deficiency of regulations related to labelling (Regulation EC 1169/2011) (EC, 2011) is that it does not deal with the problem of cross-contamination that may appear during the preparation or packaging process and the final product accidentally will be contaminated by harmful ingredients (Popping and Diaz-Amigo, 2018).

For catering services avoiding cross-contamination problems means the most important task of allergen management. According to the Hungarian regulations, the preparation of dietary food and meals shall be performed or supervised by certified experts such as dietary cooks or dietitians. Based on the abovementioned circumstances, the official limits of dietary or 'free from' meals were indicated by literature sources and were implemented into practice. The most important work of this field was conducted by the Australian Allergen Bureau (called Voluntary Incidental Trace Allergen Labelling - VITAL scheme), which limiting factors are spread and widely used in the catering industry (Taylor *et al.*, 2014).

In school catering system, dietary food may be served in two ways. In case of cooking kitchens with appropriate equipment and circumstances, the dietary meals are prepared under the supervision of dietary cooks or dietitians. If this process cannot be managed, then dietary food shall be ordered from an external food provider. Due to the relatively small number of consumers and the wide variety of diets, the dietary meals are packaged individually for the children on special diet.

A key factor of the proper management of special dietary meals is the knowledge and experience of food handlers in the field of different diets and food intolerances, which was

already discussed by different researches [Ajala *et al.*, 2010; Lee and Sozen, 2008; Soon, 2018; Dunay *et al.*, 2019).

The objective of our research was to explore and evaluate the main features of special diets, i.e. the number of students with special dietary needs, the conditions for preparing dietary meals and the compliance with the special requirements.

## 2. Materials and methods

### 2.1. Materials

Our research was performed in 44 secondary schools, where 4800 students eat their meals at a daily average. In 5 schools cooking kitchens are working (i.e. the meals are prepared at the institution), the rest of the schools have only serving kitchens, which means that food is prepared at other institutions, only serving of the portions is done at the schools.

### 2.2. Methods

We assessed how many students required for special food, what type of diets they followed and by which documents they justified their dietary requirements. In case of medical documents, we also checked their appropriateness, i.e. the required professional certificates of doctors. In case of religious diets, the statements by the parents were also checked. In the next step, the school kitchens were checked through a food safety checklist with 10 questions, in order to assess the appropriateness of their structure and equipment to meet the requirements of preparing food for special diets. (The questions of the checklist are summarized later, in Table 2.) In this step, we focused on the traceability of dietary meals and the presence and use of equipment and utensils by which cross-contamination may be avoided.

Data processing and statistical analyses were performed by using the IBM SPSS Statistics 22.0 for Windows. Independent two-sample t tests were used to compare means between two groups. Significant differences were considered at  $p > 0.05$ . The equality of group variances was tested by Levene-test.

## 3. Results and discussions

### 3.1. Number of students requiring special diets

From the total 4800 students 208 students required dietary food, which represent 4,3% of the total number of schoolchildren in the sample. There were no claims for special dietary food in ten schools from the 44.

From human health aspects, the special diet categories should be differentiated: diets for children with diabetes mellitus and/or obesity require different preparation and handling methods than food for children with food intolerances or allergies, as in the latter case, cross-contamination represent an additional challenge. The most frequent special diets in the examined sample are summarized by Table 1.

**Table 1.** Types of special diets, number of students with dietary needs and number of affected schools in the surveyed sample

Allergens, diets	Students with allergies or special diets		Affected schools	
	Number	%	Number	%
Gluten	62	1,29	37	84
Milk	53	1,10	34	77
Lactose	44	0,92	30	68
Low energy	34	0,71	23	52
Diabetes	24	0,50	17	39
Egg	12	0,25	12	27
Soybeans	6	0,13	6	14
Nuts	6	0,13	6	14
Pork	7	0,15	6	14
Other	18	0,38	15	34

From these data it is seen that the most of the required diets are caused by food intolerances and allergies (gluten, lactose, milk, egg, soybeans and nuts), but the number of diets related to diabetes or obesity (low energy diet) is also significant. Diets due to religious requirements or other issues (e.g. vegetarian) were less significant in the sample. For 39 children, two or more diet types were prescribed,

the most frequent compositions were milk and gluten-free diets (10 children) and milk and egg free diets (15 children).

The medical certificates issued by specialists were also checked in the research, we checked that the documents are in accordance with the legal regulations and are they in harmony with the required diets. It was stated, that in 136 cases the certificates were correct, while in 44 cases were not appropriate. In additional 28 cases, the appropriateness of the certificates could not be assessed. It means that in 20% of all cases the claims for special diets were prepared incorrectly, not in accordance with the existing rules.

### 3.2. Requirements of the preparation of special dietary food/menus

#### 3.2.1. Labelling

As most kitchens in the examined sample work as serving kitchens (i.e. food is delivered by the food providers from an external location,

and only serving is done by the kitchen staff) labelling plays a critical role in the process as the criteria of traceability.

The information flow by labelling was correct in 14 serving kitchens and in 1 cooking kitchen, but there were 3 kitchens (two serving kitchens and one cooking kitchen), where the criteria of labelling were not in compliance with the requirements.

In the checklist, five questions were related to proper information about the given meals (Questions 3-8 in Table 2). Statistical differences were found between serving and cooking kitchens in relation with the information about the name of food, the name of consumer and the time of preparation. In all three cases, the performance of serving kitchens was more correct. This difference is probably because in cooking kitchens there is an opportunity of oral information flow, therefore the risks arising from missing or not correct labelling is lower.

**Table 2.** Checklist questions related to special food and the number of ‘yes’ answers in the examined 44 schools (in numbers and in %)

Questions		All kitchens (n=44)		Serving kitchens (n=39)		Cooking kitchens (n=5)	
		Number	%	Number	%	Number	%
1	Does the food arrive at the kitchen at cold temperature?	29	66	29	74	0	0
2	Does the food arrive at the kitchen in portions?	41	93	37	95	4	80
3	Is the name of food indicated?*	32	73	31	79	1	20
4	Is the type of the diet indicated?	36	82	33	85	3	60
5	Is the name of the consumer indicated?*	37	84	35	90	2	40
6	Are the circumstances of food storing methods indicated?	18	41	17	44	1	20
7	Is the time of preparation indicated?*	32	73	31	79	1	20
8	Are the suggestions for handling and serving of food indicated?	15	34	14	36	1	20
9	Are there isolated devices available for handling dietary food?	33	75	28	72	5	100
10	Are there appropriate circumstances to store dietary food in a separated way?*	7	16	2	5	5	100

\* Differences between cooking and serving kitchens are statistically significant

The methods and requirements of storing and handling of food (Questions 6 and 8) were mentioned in relatively few cases, and these requirements were not appropriate in more than the half of the examined kitchens. Surprisingly, in more than 25% of the kitchens trivial information, like the name of the food was not given (Question 3).

### 3.2.2. Cross-contamination

Cross-contamination is caused most frequently by inappropriate cleaning of the different utensils which are used for both dietary and non-dietary food (Do *et al.*, 2018). According to the strict requirements, the conventional and dietary food and even the meals of different diet types shall be handled separately in time and space during the stages of preparation, storage, delivery and serving. When there is no opportunity for spatial separation, then the separation in time shall have higher attention.

In the checklist, illustrated by Table 2, two questions (Question 9 and 10) were related to cross-contamination. Seven kitchens from the examined sample get 'yes' answers for both questions, including all the 5 cooking kitchens. The result for Question 9 (about isolated devices for handling) were acceptable (above 70%) but the results of Question 10 (circumstances for separated storage of dietary food) were much weaker due to the performance of serving kitchens ('yes' answers represented only 5%). The most frequent problem at serving kitchens was related to separated storage of dietary food. Nevertheless, as in most of the serving kitchens dietary meals are served in individually packed form for the students concerned, these problems did not cause serious risks. In two of serving kitchens, dietary food was delivered in bigger portions in heat storing dishes, but in these locations, the separation of the utensils was correct.

### 3.3. Types of the special diets

In this section, a brief summary of the represented diets is given based on literature

sources and the main characteristics of the diets in our survey results are displayed.

#### 3.3.1. Gluten-free diet

In our sample 62 schoolchildren in 37 institutions needed special diet due to gluten intolerance (celiac disease).

In allergen management aspects, the preparation of gluten free meals represents special problems. Gluten is a protein fraction, which is insoluble in water, it is found in wheat, barley, rye and their hybrids, as well as in products derived from these grains. Approximately 1% of the European population suffers from celiac disease, which is the most serious form of gluten intolerance (Lionetti *et al.*, 2015). Presently, the only treatment for this disease is the lifelong diet, where all ingredients and food containing gluten shall not be consumed. After the diagnosis, the specialists prescribe the diet for the patients, and from this point, the patient is responsible for keeping the diet, which represent a huge challenge for them, their families and even for the catering services. Gluten must be totally excluded from the diet (Do *et al.*, 2018). In many countries (e.g. as it is regulated by EU Regulation 828/2014), the gluten content of gluten free meals and food products must be lower than 20 mg/kg (EC, 2014). Food products shall be labelled by 'very low gluten' indication, when their gluten content is lower than 10 mg/kg (Popping and Diaz-Amigo, 2018).

In public catering systems, the main problem is cross-contamination, as the processes of preparing conventional and gluten-free meals are conducted simultaneously. In the preparation process of gluten-free meals, the separation in time and space must be kept strictly during the preparation, storing and handling phases. Moreover, different and separated utensils (even different cutlery, plates and glasses) shall be used and shall be stored separately, in closed storage site. According to research results, by keeping the strict separation rules the safe preparation of gluten-free meals can be managed successfully (Vincentini *et al.*, 2016).

### 3.3.2. Milk-free diet

Milk allergy is an adverse immune reaction to one or more proteins in cow's milk, most frequently to casein. In our research sample, 53 children of 34 schools were affected by milk-free diet. Milk allergy could be cured by the total exclusion of milk proteins although milk – from dietetic point of view – is one of the most important nutrient and mineral source, which can be hardly substituted (Di Constanzo and Berni Canani, 2018). The most frequent reason of product withdrawals due to allergenic content is not labelled milk content (Bucchini *et al.*, 2016). Many food products contain hidden milk and milk derivatives, so the risk of contamination with milk protein is very high (Do *et al.*, 2018), therefore, a strict separation should be secured in the handling process of milk-free food and meals.

### 3.3.3. Lactose-free diet

A common problem in public catering is that many food handlers confuse the meaning of lactose-free diet and milk-free diet (Di Constanzo and Berni Canani, 2018). Lactose intolerance is such a condition, when the patient is not able to digest lactose (a sugar found in dairy products). The problem refers to the lack of lactase enzyme, but the symptoms may occur temporarily, even due to adverse drug reactions or reactions for other bowel diseases. In technological aspects, the preparation of lactose-free food is easier than in case of milk-free meals, as lactose-free ingredients may be used in lactose-free diet and not only plant-based milk substitutes are allowed to use.

In our research sample 44 children kept lactose-free diet in 30 school kitchens. Although the proper regulation of lactose-free products is still not defined properly, according to suggestions 100 g meal shall contain maximum 10 mg lactose in this diet (Suri *et al.*, 2019).

### 3.3.4. Low energy diet

In many countries of the world the number of obese people is growing (Lobstein *et al.*, 2015), in the USA the proportion of obese children of 2-19 age group is 18,5% (Hales *et al.*, 2017). This trend is reflected in our sample

as well, as quite a big number, 34 schoolchildren needed low energy diet.

Low energy diet is prescribed for overweight or obese children. The main characteristics of this diet are reduced fat and carbohydrate content. The Hungarian school catering practice does not prescribe defined caloric values for the served portions, but the meals are prepared without sugar, with low-fat meats and reduced amount of fats. In technology aspects, low energy diet does not represent any problems, as the meals and ingredients are not sensitive for cross-contamination.

### 3.3.5. Diabetes diet

The insulin dependent diabetes mellitus (IDDM), also known as type 1 or childhood diabetes showed an increasing tendency until the early 2000s between 2,8-3,9%, but since then this growth rate has slowed down (Patterson *et al.*, 2019). Formerly, type 2 (non-insulin dependent) diabetes was considered as a disease of adult people, but nowadays, the occurrence of this diabetes type is increasing among children (Candler *et al.*, 2018). Children with diabetes mellitus must control their carbohydrate (CH) intake strictly and doctors define the maximum CH amount of each meals.

In our sample, 24 diabetic children were found, and all of their official documents were proper. It is probably due to the strict treatment of diabetic disease, as it is not a food intolerance or food allergy, and the therapy of the diet shall be prescribed by specialists.

### 3.3.6. Egg-free diet

Egg-free diet and preparing such meals is an important issue in public catering, mainly for the younger age groups, as babies and infants represent the mostly endangered age groups and the frequency of egg allergy decreases with age. In the examined schools, only 12 children needed egg-free diet. Egg-free diet affects about 0.5-2,5% of children and young people worldwide, but according to research results it shows an increasing tendency (Österlund *et al.*, 2019).

Egg is a popular and versatile ingredient of different meals in many cultures therefore it is not easy to exclude from meal preparation

processes. In case of egg-free diets, avoiding cross-contamination is very important step. The minimum limit of egg-free meals is represented by egg-protein content (0,03 mg/kg) according to the VITAL scheme (Taylor *et al.*, 2014).

### 3.3.7. Soybean-free diet

Soybean allergy is one of the most frequent childhood food allergy which affects 0,4% of children, but in most cases it children outgrow this allergy by the age of 10 (Savage *et al.*, 2010). Soybean is an important food ingredient and a popular meat substitute, moreover many meat products contain soybean as ingredient, and therefore it is not easy to prepare soybean-free meals. According to the VITAL scheme the required limit for soybean-free food is 1 mg/kg (Taylor *et al.*, 2014).

### 3.3.8. Peanut-free diet

Peanut allergy affects 0,6-1,0% of the population in well-developed countries, it is one of the most frequent causes of severe allergy attacks. Peanut allergy requires the highest attention as a tiny amount of its protein may cause life-threatening symptoms. Peanut allergy is not restricted to childhood age. Most of the registered anaphylactic shocks are caused by peanut or other nuts (Al-Muhsen *et al.*, 2003).

Due to these facts, from the kitchen technology aspects, the management of peanut allergy is the most complicated task. Peanut-free food and meals are very sensitive to cross-contamination. In general, due to the high risk, children with severe peanut allergy do not require for school catering services. Some schools in the United States have launched peanut-free regulations, but as the regulations are not unified, the efficient performance of these programs cannot be evaluated properly (Stukus, 2017).

### 3.3.9. Tree nut-free diet

Tree-nut allergy affects 0,1-4,3% of world population (Weinberger and Sicherer, 2018). Nuts show very strong cross-reactions with each other and most of allergic persons are sensitive for more types of nuts. Tree-nut allergy – together with peanut allergy – may cause severe, potentially fatal, allergic reaction. From treatment aspects, the different types of nuts are

considered similarly (Dantzer and Wood, 2019) although generally there are differences of sensitivity between individuals, and not all nuts should be excluded from the individual diets.

### 3.3.10. Other special diets

Nowadays, in school catering, the role of other diets such as diets due to religious reasons or reasoned by personal eating habits is increasing. In our sample, pork-free menu was required by 7 students, while 2 students claimed for vegetarian food. This phenomenon is regulated in different ways in different countries. In some places, the requests for religious or habitual diets are fully considered (EU JRC, 2015). In Hungary, it is compulsory to serve dietary food prescribed by specialists because of health problems and claims reasoned by religious requirements are also may be considered, but it is not mandatory to prepare food according to habitual diets based upon personal needs. In the latter case, the institutions (or food providers) prepare dietary food voluntarily.

## 4. Conclusions

Providing food for children with special dietary needs (food intolerances and allergies, eating prohibitions) put an extra load on the school catering services. Rules and regulations of school catering are different in different countries.

In Hungary, the regulation system is relatively strict, special dietary food and meals shall be justified by official documents issued by specialists. In the Hungarian school catering system, the existence of official health documents should be checked at the first claim, and shall be submitted by the parents towards the food provider at the beginning of each the school year, or in case of any changes. By this process, the food providers get the relevant information, for making proper food management decisions. In one hand, the exclusion of particular ingredients may cause nutrient deficiencies in the diet, which shall be compensated, and on the other hand, the preparation of special dietary food may bring

extra costs and extra conditions for the food providers, which need preliminary preparations.

Our research results, which were drawn based on a wide sample get insight into the present situation of dietary food provision in Hungary. In the upcoming years, the number of children requiring for special food may show an increasing tendency, therefore the knowledge and experience level of kitchen staff at school catering services should be raised and developed. Food handlers shall be trained and educated for these special challenges, either in physical or personal aspects. It is very important that besides the installation of special equipment and utensils for preparing appropriate dietary food, the special knowledge and experiences of food handlers/kitchen staff about the main characteristics of the diets, labelling information and cross-contamination problems during preparation and serving stages shall also be developed through target-oriented trainings.

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