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## THE ROLE OF KNOWLEDGE AND TECHNOLOGY IN FOOD SAFETY AT SCHOOL CATERING SERVICES IN HUNGARY

### ROLA WIEDZY I TECHNOLOGII W ZAKRESIE BEZPIECZEŃSTWA ŻYWNOŚCI W SZKOLE GASTRONOMICZNEJ NA WĘGRZECH

**Key words:** foodborne diseases, food safety, school catering, knowledge

*Słowa kluczowe:* choroby pokarmowe, bezpieczeństwo żywności, catering szkolny, wiedza

**Abstract.** Providing the population with safe and good quality food is one of the most important objectives of every country. The outbreak and spread of foodborne diseases is independent of a country's location or development level, and may occur everywhere. As most children spend their days at educational institutions, we shall focus on their food safety. Not only for their present state of health, but also because childhood nutrition and diet will basically determine their health in their adulthood and thus, influence the future economic and social performance of their society. This paper introduces background information about school catering in Hungary, based upon the results of an overall food safety survey. The results of our research showed that the food safety level of the different kitchen units is mostly determined by the level of food processing activities. The technical and technological level of the school kitchens did not significantly influence the food safety level of the kitchens. According to the results of our survey, improving the knowledge and the attitudes of employees in school kitchens is more important than technical and technological conditions.

### Introduction

One of the most important marketing channels of sustainable food-systems is public catering, particularly kindergarten and school catering systems. Public catering such a typical alternative food-system, which operates local elements of food production, food distribution and food consumption in a network in accordance with a system approach [Balázs et al. 2010]. Several surveys and research have been conducted in the past few years for exploring the performance of school catering systems and its social effects and their impacts on human health [Fox et al. 2009, Ohri-Vachaspati 2013, Vieux et al. 2013, Wordell et al. 2012]. The impacts of catering on human health are determined by not only the raw materials, but also by appropriate physical conditions, the used technology and serving practices. The increased prevalence of food intolerances, food allergies and the increase of diseases transmitted by food require increased attention from all players of the food and catering industry. The appearance of foodborne diseases (i.e. diseases transmitted by food) has a significant importance in both human health and economic aspects and may carry serious hazards.

A spreading phenomenon of our days is the very low-level food culture of children, with its roots in the accelerated life style of our times, and which causes distorted and deficient eating habits. Former family patterns have changed, and the children cannot see the good practice of eating at home, they do not have an appropriate model of eating habits and food culture. This gap may be – or should be – filled by a high quality and well operated school catering system.

In 2013, more than 900 000 Hungarian children received the daily services of kindergarten and school catering companies daily. The school catering system generally contains one main meal (lunch) but in kindergartens it is substituted by breakfast and morning and afternoon snacks as well. The demand for different meals may be differentiated according to the age group of children. In kindergartens (3-6 years old children) the use of catering is compulsory, while for school children catering is optional. The direct costs of the different meals (i.e. raw material norms) are paid by the consumers – in this case the parents of the children – but the supplementary costs are paid by the owner institutions (most of the schools in Hungary are under the control of local authorities).

In Hungary, the number of customers of public catering services (including school catering) is relatively low. According to a comprehensive survey of the National Institute for Food and Nutrition Science (with the Hungarian abbreviation OÉTI) in 2008 only 20% of secondary school students took part in school catering programmes. According to our survey that was carried out in 41 secondary schools of the capital, Budapest (24 thousand students in total) this rate was only 7.4%.

Food safety is a basic requirement for catering services, and it should be kept in focus in school kitchens in particular as foodborne diseases may spread more easily in large kitchens and with ready-made food. Nevertheless, in Hungary, these diseases mostly occur in households, but the media reaction is higher in case of diseases at catering services. Children at kindergartens and the lower classes of primary school are more sensitive to this type of disease; therefore the appropriate hygienic features of school kitchens have higher importance. The number of foodborne diseases that occurred in kindergarten and school catering services are summarized by table 1.

Table 1. The number and origin of foodborne diseases in the Hungarian kindergarten and school catering system between 2008 and 2012

*Tabela 1. Liczba i pochodzenie chorób pokarmowych w węgierskim systemie gastronomii przedszkolu i szkole między 2008 i 2012*

Origin of diseases/ <i>Źródło chorób</i>	Number of diseases/ <i>Liczba chorób</i>					
	2008	2009	2010	2011	2012	2008-2012
Cross-contamination/ <i>Zanieczyszczenie krzyżowe</i>				1	1	2
Infection from food handling staff/ <i>Zakażenie od personelu obsługi żywności</i>	1		1			2
Non-appropriate heating/ <i>Niewłaściwe ogrzewanie</i>		1		2		3
Non-appropriate cooling/ <i>Niewłaściwe chłodzenie</i>		1	1			2
Non-appropriate temperature/ <i>Nieodpowiednia temperatura</i>			1			1
Unknown origin/ <i>Niewiadomego pochodzenia</i>	5	3	4	6	10	28
Total/ <i>Razem</i>	6	5	7	9	11	38

Source/*Źródło*: National Institute for Food and Nutrition Science

School kitchens are at the end of food chain, and food safety depends mostly on their hygienic features. The use of HACCP is compulsory for this sector, but its effectiveness is influenced by many factors. The most critical point is working practice, the quality of work and the attitudes of the kitchen staff. Therefore, our survey focused on the problems of the present system, the reasons for non-effective operation and the compliance level of food safety requirements.

For exploring the present situation in Hungary, we conducted a survey in school kitchens and canteens of schools in the capital, Budapest, and in settlements of Pest County, which is in the Central Region of Hungary. The survey focused on food safety issues, but we also made efforts to determine the most important factors which may influence the number of customers of catering services.

### Material and methods

In our research, we made a detailed analysis of the kitchens of 22 schools. In this sample, in 15 school kitchens the food was prepared on the spot, while in the other 7 school kitchens (in so called serving kitchens) only the delivery and the portioning of the ready meals were conducted. Our survey was fulfilled through personal visits. In the school kitchens of this sample, 101 kitchen workers were employed in different kinds of jobs, which need different educational levels, such as catering manager, cook, kitchen maid and storekeeper. The main features of the kitchen workers of the sample are given in table 2.

Table 2. The number, age and professional experience of the kitchen staff in the examined sample (mean  $\pm$  standard deviation) according to different working positions

Tabela 2. Liczba, wiek i doświadczenie zawodowe personelu kuchni w badanej próbie (średnia  $\pm$  odchylenie standardowe) według różnych stanowiskach pracy

Working position/ <i>Stanowisko pracy</i>	Number/ <i>Liczba</i>	Average age [years]/ <i>Średni wiek [lata]</i>	Professional experience [years]/ <i>Doświadczenie zawodowe [lata]</i>
Catering manager/ <i>Kierownik zaopatrzenia</i>	7	53 $\pm$ 5.08	15 $\pm$ 13.06
Cook/ <i>Kucharz</i>	18	48 $\pm$ 9.51	18 $\pm$ 14.53
Kitchen maids/ <i>Pomoc kuchenna</i>	67	49 $\pm$ 9.61	6 $\pm$ 8.68
Storekeeper/ <i>Magazynier</i>	7	52 $\pm$ 5.68	7 $\pm$ 9.11
Total/ <i>Razem</i>	101	50 $\pm$ 8.97	9 $\pm$ 11.27

Source: own study

*Źródło: opracowanie własne*

Our survey was based on a modular compliance checklist, where the physical, environmental, technological, hygienic, food safety and quality assurance factors were assessed. The compliance could be answered clearly, by simple answers “yes” or “no”. In the course of the compliance checklist, firstly we determined those features of the process, which may be observed or measured, secondly, we set up requirements and thirdly, we assessed the whether they are fulfilled or not. In the survey the answers “yes” means that the given indicator was appropriate, while “no” means that it was inappropriate. The checklist of our survey was developed using the principles given in international literature sources [Santana et al. 2009, Veiros et al. 2009] in order to lay down the basis of a future international comparison. The checklist was adapted to the Hungarian circumstances.

We assessed the physical condition and the technical level of the used equipment and utensils of the examined school kitchens. This assessment involved the conditions of kitchen area, energetics, water supply, construction of working area, construction of preparatory places, rest rooms, locker rooms, ventilation, sewage disposal, storage of waste and food leftover, floors, walls, ceiling, windows, doors, and dining hall. The assessment of equipment and utensils involved the kitchen furniture, condition of machines, and condition of utensils.

In this part of the survey, we examined the compliance of the following processes: dishwashing, cleaning, the personal hygiene of the workers, the food receiving and distribution (food serving) and the food waste management activities. These processes may bear critical points in food safety aspects. The checklists were filled in during our personal visits. The results were classified according to the compliance results, expressed by the share (per cent) of the possible maximum result.

We assessed the physical and technological level of the working units and the technical level of the used equipment and utensils of the examined school kitchens. Physical and technological level assessment involved the conditions of the kitchen area, energetics, water supply, construction of working area, construction of preparatory places, restrooms, locker rooms, ventilation, sewage disposal, storage of waste and food leftover, floors, walls, ceiling, windows, doors, and dining hall. The assessment of equipment and utensils involved the kitchen furniture, condition of machines, and condition of utensils.

The data were analysed by descriptive statistics, Student’s t-test and Pearson’s correlation.

## Results and discussion

The average performance result of the total examined school kitchens was 69%. From food safety aspects 11 school kitchens reached the good level (above 70%), 8 kitchens showed an average result (medium level between 60-70%) and 3 failed (below 60%).

The assessment of kitchens was taken in two steps: the evaluation of technical level (conditions of physical facilities and the equipment) and technology (the main features of the different working processes).

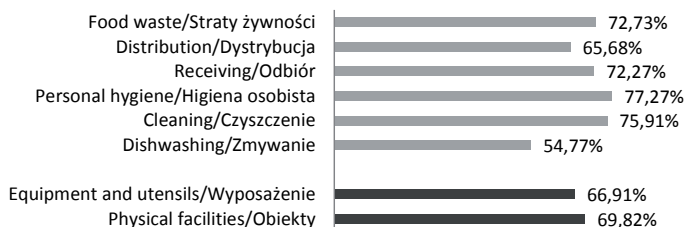


Figure 1. The average results of our assessment in the examined kitchens (maximum result is 100%)

Rysunek 1. Średnie wyniki naszej oceny przeprowadzanej w badanych kuchniach (maksymalny wynik 100%)

Source: own study

Źródło: opracowanie własne

In the evaluation of the physical facilities and the equipment we assessed the condition and the design of the different kitchens (both the kitchen and canteen): the state of windows, walls, ceiling and floor, the energy and water supply facilities, ventilation, and waste storage possibilities. During the assessment of the equipment and utensils, we examined the kitchen equipment (furniture and devices) and the utensils used in the course of the daily work. The results of the assessment were quite similar: physical facilities reached 70%, while equipment and utensils reached 69%. In statistical terms, there was no difference between the results of these two factors (Student's t-test,  $p \leq 0.05$ ), but a significant correlation could be found, i.e. in kitchens with better physical facilities the equipment and utensils are also in better condition (Pearson's correlation coefficient  $r = 0.783$ ).

When analysing the different working processes, most deficiencies were observed in the correctness of dishwashing (54.77%). The processes connected to personal hygiene, cleaning, and receiving were good (above 70%), but the results of distribution (i.e. heating and serving the pre-cooked food) were slightly lower and reached just average level (65.68%). Figure 1 summarizes the average results of the two aspects of our assessment in the 22 examined school kitchens. The black columns illustrate the average results of technical condition (i.e. physical facilities and equipment) and grey columns show the average results of technological features (i.e. the different critical processes) in the examined sample.

The results of management and storage of food waste was also appropriate (72.73%) as an average, but the standard deviation was the largest. Six kitchens failed and three of them reached only 20 points of the 100, which draws attention to the possible problems of waste management.

According to our results, the technical level of the kitchens does not influence the compliance of the conducted processes, i.e. it will not influence the food safety level of the kitchens. Kitchens, which have the minimum necessary tools for the different activities (even with a lower level of physical facilities) may be operated in an appropriate way. Figure 2 illustrates the results of the assessment of technical conditions (black) and technological features (grey) in the examined 22 kitchens. As

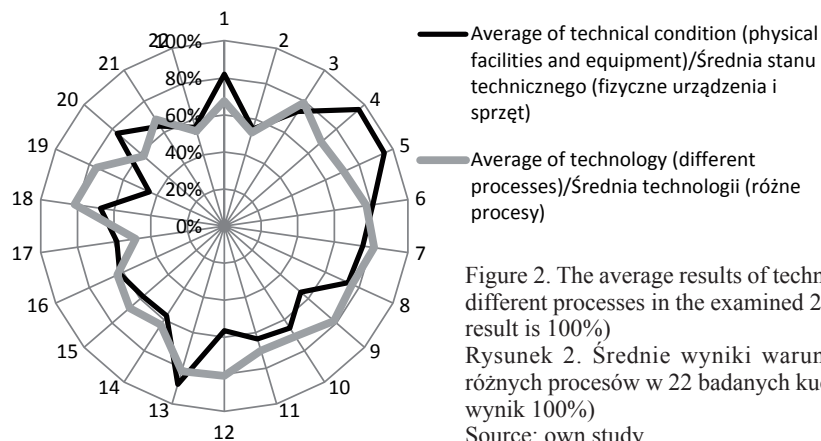


Figure 2. The average results of technical condition and the different processes in the examined 22 kitchens (maximum result is 100%)

Rysunek 2. Średnie wyniki warunków technicznych i różnych procesów w 22 badanych kuchniach (maksymalny wynik 100%)

Source: own study

Źródło: opracowanie własne

figure 2 shows, that kitchens with the highest technical condition (4, 5) has reached only medium results in the conducted processes, while kitchens with the lowest technical level could reach better results (e.g. kitchens 9, 12, 17 could reach the good technology level). In most cases, the results of the different processes exceed the technical level, which implies that the role kitchen workers, their working methods, behaviour and their right attitudes are the determinant factors of food safety requirements. Similar results may be found in international literature sources [da Cunha et al., 2013; Jevšnik, Hlebec, Raspor, 2008; Liz Martins, Rocha, 2014]. These findings call the attention for that besides improving the technical level of the school kitchens it is quite important to improve the knowledge of the kitchen staff and the correctness of the different processes in order to increase the overall performance of the service.

A key result of our research was that the attention of the local authorities (i.e. who maintain the educational institutions) has been drawn for the non-appropriate food safety conditions in the school kitchens. In addition to financing the different non-food costs of school catering, the local authorities (as owner institutions) shall deal with the appropriate conditions of the school kitchens, which should cover not only the physical and technical condition of the working units, but also the compliance of the different processes, the knowledge and the attitudes of the kitchen staff.

Although the local authorities have already established the regulatory background for the different processes, the individual units cannot work properly in a unified way. Our research highlighted that the an overall assessment of all Hungarian school kitchens should be conducted, for which the methodology of our researches could present a good base.

A very important question in improving the school catering system is the number of consumers, i.e. the schoolchildren. In our sample, the number of children using the services of school catering services is was primarily determined by the capacity of canteens. The correlation between the capacity of canteens and the number of children (Fig. 3) is strong positive (Pearson's  $r = 0.801$ ).

Interestingly, the number of pupils attending school had no strong correlation ( $r = 0.224$ ) with the num-

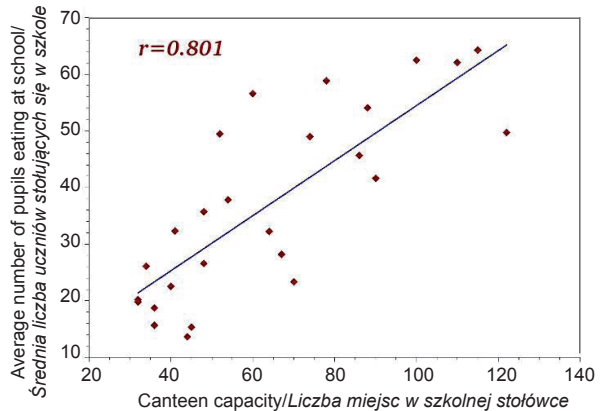


Figure 3. Correlation between the average number of pupils eating at school and canteen capacity ( $n = 46$ )

Rysunek 3. Korelacja pomiędzy średnią liczbą uczniów jedzących w szkole a liczbą miejsc na stołówce ( $n = 46$ )

Source: own study

Źródło: opracowanie własne

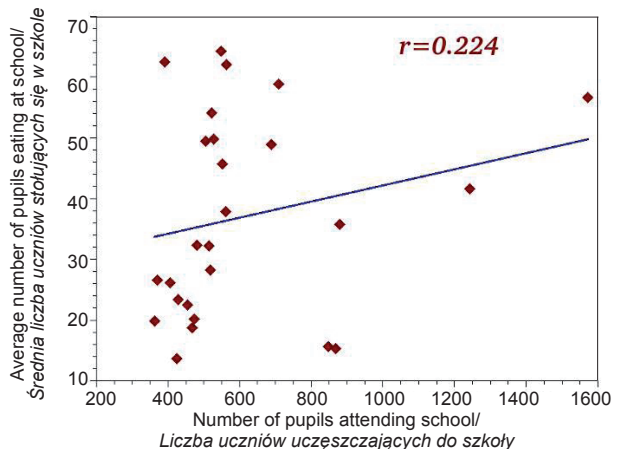


Figure 4. Correlation between the average number of pupils eating at school and the number of the pupils attending school ( $n=46$ )

Rysunek 4. Korelacja pomiędzy średnią liczbą uczniów stołujących się w szkole a liczbą uczniów uczęszczających do szkoły ( $n = 46$ )

Source: own study

Źródło: opracowanie własne

ber of those eating at school (Fig. 4). Our results clearly show that the increase in the number of pupils will not result in an increase of the consumers of the school catering service.

In Hungary, the state or local authorities support the costs of school catering by 50% or 100% depending on the social status. Therefore, an interesting correlation was observed between the number of pupils eating at school and those who are entitled for support of eating costs. This correlation showed a medium but negative result ( $r = -0.489$ ). It means that in those canteens where less children eat regularly; their greater part is entitled for a 50% support. Most of the students prefer to have their daily meals outside the school. According to the present results of our survey, we could not recognize those factors which influence that some of the school canteens are popular, and others are rejected by the students. It is possibly because of quality problem, therefore a basic task for school catering services is to ensure conditions in order to increase the number of catering consumers.

### Conclusions

In Hungarian educational institutions, there is an increased interest in connection with the food of schoolchildren. The nutrition content and the quality of food determine both the physical and the mental development of children, thus it will strongly determine their health status, their performance and life quality in their adulthood, that their life as active employees.

The school catering system should be developed and improved, because a well-operated catering system may provide the children with healthy, nutritious meals with good quality, which may fit to the requirements of our age. School kitchens could be an excellent opportunity for children to get the right food at the right place, with their classmates. Parents might be sure that their children are safe and have the appropriate facilities during school time. For improving the present situation, the conditions and the quality of school kitchens and canteens should be developed. Our results highlighted that it is possible to operate school kitchens at an appropriate food safety level even with poor physical and technological facilities. The key determining factor of an appropriate operation level is the attitude and the behaviour of the kitchen workers.

In school kitchens, the last members of the food distribution chain are kitchen workers, therefore their responsibility in protecting against food borne diseases is very high. In order to change possible bad food handling practices, staff needs knowledge about the impacts of inappropriate practices and behaviour. This knowledge will be the prerequisite and the motivating factor of changing their attitude, and the acceptance of the appropriate food handling processes. By improving the knowledge of kitchen workers, not only the food safety conditions but also the quality of the meals might be improved, which could attract the pupils – and their parents – to school catering services.

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### **Streszczenie**

*W pracy przedstawiono informacje na temat żywienia w placówkach szkolnych na Węgrzech, oparte na wynikach ogólnej ankiety dotyczącej bezpieczeństwa żywienia. Zapewnienie ludności bezpiecznej żywności o dobrej jakości jest najwyższym priorytetem każdego kraju. Ponieważ większość dzieci spędza swoje dzieciństwo w placówkach dydaktycznych należy skupić się na bezpieczeństwie serwowanej w nich żywności. Nie tylko ze względu na obecny stan zdrowia dzieci, ale również dlatego że odżywianie w znacznym stopniu determinuje zdrowie młodych ludzi, co wpływa na przyszłe osiągnięcia ekonomiczne i socjalne danej społeczności. Wyniki badania wykazały, że poziom bezpieczeństwa żywienia w różnych stołówkach zależał przede wszystkim od poziomu przetworzenia żywności. Poziom techniczny i technologiczny kuchni szkolnych nie wpłynął w znaczący sposób na poziom bezpieczeństwa żywności w nich przygotowywanej. Zgodnie z wynikami ankiety, zwiększanie wiedzy i świadomości pracowników szkolnych kuchni było ważniejsze niż warunki techniczne i technologiczne.*

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