Analecta
REVIEW OF FACULTY OF ENGINEERING
Analecta Technica Szegedinensia
ISSN 2064-7964

Vol. 9 No. 1

FOOD SAFETY IN THE PUBLIC AWARENESS – SURVEY AMONG PRIMARY AND HIGH SCHOOL STUDENTS

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ABSTRACT

National and international surveys show that people still do not have appropriate knowledge of and attitude to food safety. Therefore more and more countries organize educational courses to improve skills and knowledge regarding food safety. In Hungary the National Curriculum 2012 contains the program for food safety education.
The aim of our survey was investigation about knowledge and attitude of primary and secondary school students towards food safety. The questions, according to international surveys, fell into 5 categories: personal hygiene, keeping food at safe temperatures, adequate cooking, avoidance of cross-contamination, and safe source of foods. Statistical evaluation was done using SPSS 20 software. Significant differences were evaluated by logistic regression, Chi square test, and crossing table analysis.
Results showed that there was no significant difference among primary school students regarding gender or residence (village or town) in knowledge of food safety. Their attitudes showed more significant divergence. Logistic regression investigation has showed that there was a good correlation between knowledge and attitude of personal and kitchen hygiene.
In conclusion, our students have presented more or less the same results as the others from international questionnaires. Even though, we need to improve knowledge and skill in food safety.

Keywords: attitude, food safety, knowledge, logistic regression, primary school, secondary school

1. INTRODUCTION

Importance of hygiene to avoid diseases has been recognized thousands of years ago. The Bible says people should wash their hands before eating and should not store meat in hot places because it could cause poisoning. In the 12th century Moses ben Maimon, a Jewish doctor, recommended not to consume uncovered and discolored meat [8]. Nowadays, in spite of general knowledge about the importance of hygiene, the incidence of food-borne illnesses is high. A FAO/WHO assessment in 1983 said that consumption of infected food caused most of the illnesses and the biggest expense around the world [3].
Consumers, being the last and very important element in the food chain, need to have adequate knowledge on food safety in order to minimize food-borne risk at home. Consumers' responsibility has been laid down in the directive of the Codex Alimentarius Commission, stating that consumers should learn the rules of hygiene and food handling [3], in the micro environment of family and in the macro environment of school. In Hungary, the National Curriculum 2012 includes education in food safety: teachers have to teach the rules of correct food handling and purchase [10].
According to literature data, the main causes of food borne illnesses are poor personal hygiene, cross-contamination, and insufficient cooking. Scientists therefore suggest that education should primarily focus on proper hand washing and avoidance of cross-contamination [6]. In the last decades a lot of countries began to teach people how to fight pathogens to reduce the occurrence of food-borne illnesses. The campaign called Fight BAC in the USA, for example, had four keywords: clean, separate, cook, cool [5]. In Hungary, the National Food Chain Safety Office (NEBIH) determined five basic rules: clean kitchen, clean water, safe raw material, clean hands, separation of raw and cooked food [9]. Besides these, the WHO also defines and suggests some rules: use raw materials from reliable source only; cook food thoroughly; eat prepared meal quickly; keep food at adequate temperature; eat leftover meal only after reheating it [3]. The kindergarten and primary school should be the first places for hygiene and food safety education.

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2. METHODS

The aim of our survey was to assess knowledge and attitude to food safety among primary school students, secondary grammar and technical school students, and their teachers. We searched for differences in gender, place of residence and age, and for correlation between attitude and knowledge. It was hypothesized that females, older people and urban habitants could perform better in our tests. Two set of tests was used, one for primary school students, and one for the adolescents and adults. All responders lived in South-East Hungary. Filling out the questionnaires was anonymous and voluntary, and the permission of school directors and parents had been obtained. The questions fell into 5 categories: personal hygiene, safe temperatures for food storage, adequate cooking, avoidance of cross-contamination, and safe source of foods. Questions from various national tests [2], [4], [7] were used and applied to Hungarian practice to create suitable questionnaires for our subjects. Knowledge of primary school students was tested with five yes/no questions, and their attitude, with 4 multiple choice (never, seldom, often, and always) questions. The yes/no questions covered all five categories while attitude questions covered three subjects: personal hygiene, cross-contamination and safe food storage temperatures. Children in this age usually do not cook or purchase foods alone thus questions regarding cooking and safe source of food were omitted from their questionnaire. The questionnaire for adolescents and adults contained 14 yes/no questions regarding food safety knowledge and 15 multiple choice questions regarding attitude. The knowledge questions include all topics: personal hygiene, adequate cooking, cross-contamination, safe food storage temperatures, and avoidance of unsafe source. The multiple choice questions covered all these categories, too.

2.1. Statistical analysis

Data were analyzed using SPSS 20 Statistical Package. Significance was determined at 95% ($P < 0.05$) level. Cross-tab analysis was used for percentage distribution of the variables. Chi-square analysis and logistic regression were employed to identify significant differences by gender and place of residence, and to explore the correlation between knowledge and attitude. The sum of true and false responses was converted to percentages.

3. RESULTS

Our questionnaires were filled out by 398 persons: 141 primary school students, 215 secondary school students, and 42 teachers.

3.1. Primary School Students

Among the 7-14 years old children who completed the questionnaire there were 72 boys and 69 girls, of whom 69 lived in towns and 72 in villages. Responses showed that more than 98% of the pupils knew, hand washing with soap is very important (Table 1). In Pennsylvania, for example, 15% of the students gave wrong answer to this question (Haapala et al., 2004). About 90% stated that dairy products have to put in refrigerator within 2 hours. On the other hand, about 40% thought that one should not isolate cooked and raw meat in the refrigerator, while in Pennsylvania the rate of correct answers was 91% [2]. The answers given to the question on the hazard of eating meals prepared with raw eggs showed that the pupils had limited knowledge about microbes and their role in food-borne diseases. Logistic regression and Chi-square analysis did not show correlation between knowledge and gender or place of residence.

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Table 1. Food safety knowledge statements among primary school students: percentage of correct responses

Knowledge statement	Correct answer	Boys %	Girls %	Urban %	Rural %
We should wash our hands with soap before eating	Yes	98.7	98.6	98.5	98.6
Meals made with raw eggs might cause illness	Yes	50.7	58.0	61.8	48.0
In the refrigerator we have to separate cooked and raw meats	Yes	61.6	56.5	61.8	63.0
Milk and dairy products should be chilled (refrigerated) within 2 hours to keep them safe	Yes	84.9	92.8	94.1	84.9
In improperly cooked meal dangerous microbes may be found	Yes	67.1	82.6	80.9	83.6

Schoolboys' attitude was better than their knowledge about food safety (Table 2). Most of them washed their hands before eating at home. Unfortunately about 20% of students did not wash their hands before eating in the canteen. In Pennsylvania only 29% of the schoolboys washed their hands at home and in the school canteen [2]. The logistic regression showed significant difference between genders according to washing fruits and vegetables before eating ($p<0.003$), and putting remaining food into the refrigerator within two hours ($p<0.004$). In both attitude question girls performed better.

Table 2. Results of food safety attitude questions among primary school students

	Often and always (%)				Seldom and never (%)			
Attitude statement	boys	girls	urban	rural	boys	girls	urban	rural
I wash my hands before eating at home	88.9	97.0	89.9	94.4	11.1	3.0	10.1	5.6
I wash my hands before eating in the school canteen	75.0	88.1	72.4	80.9	25.0	11.9	27.6	19.1
I wash my hands after stroking a pet	94.4	95.7	89.9	97.2	5.6	4.3	10.1	2.8
I wash fruits and vegetables before eating them	86.1	97.0	91.3	87.5	13.9	3.0	8.7	12.5
I put remaining food into the refrigerator within 2 hours	76.4	95.7	91.3	80.6	23.6	4.3	8.7	19.4
I have already had indigestion	4.2	7.3	46.4	6.9	95.8	92.8	53.6	93.1

3.2. Secondary School Students and Teachers

This questionnaire was filled out by 215 secondary school students: 134 boys and 81 girls. Concerning their residence 168 lived in towns and 47 in villages. The responses (Table 3) showed that the subjects' knowledge was inadequate in two topics: keeping food at safe temperatures, and avoiding unsafe source of food. These same problems were also recognized in other countries. About 60% of our responders knew that leaving leftover food on the table for hours is a food safety risk. However, in the United States, 89% thought that leftover hamburger without chilling was correct to eat [4]. These results showed that people have very limited knowledge about pathogenic microbes and their growth in food. Researchers suppose that 31 to 38% of food-borne illnesses are caused by keeping food at unsafe temperatures. This problem affects more than half million people every year [5]. About 80% of the subjects answered correctly that milk purchased directly from the farm should be boiled. Hungarian researches showed that consumption of raw food caused 6% of food-borne illnesses [1]. Logistic regression and Chi-square analysis showed significant difference between genders in questions to cooking with diarrhea ($p<0.026$), using the same cutting board for vegetables and raw meat ($p<0.004$), and separation of raw and cooked food ($p<0.049$).

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Boys knew better that cooking with diarrhea is not correct although generally they spend less time in the kitchen than girls. However, girls decided to separate raw and cooked food, and to use a new cutting board for vegetables. No correlation was found with place of residence.

Table 3. Food safety knowledge statements among secondary school students: percentage of correct responses

Knowledge statement	Correct answer	Boy %	Girl %	Urban %	Rural %
One should wash hands with soap before cooking	Yes	94.8	100	95.8	85.1
If one has diarrhea, it is okay to prepare food for others if one washes hands	No	61.2	55.6	60.9	42.6
Microbes are killed in hard-boiled eggs	Yes	80.6	81.5	62.5	70.2
Meals made with raw eggs might cause illnesses	Yes	69.4	76.5	71.4	57.4
Insufficiently cooked meat causes illnesses	Yes	61.2	56.8	65.5	53.2
One can use the same cutting board for raw chicken and raw vegetables if it is wiped off between uses	No	69.4	91.4	81.0	56.6
After touching raw meat, one has to wash our hands with soap before preparing other meal	Yes	78.4	90.1	81.0	63.9
In the refrigerator, cooked and raw meats need to be separated	Yes	89.6	98.8	91.1	83.0
Milk and dairy products should be chilled (refrigerated) within 2 hours to keep them safe	Yes	87.3	92.6	89.9	76.6
It is safe to leave leftover cooked meat on the table from lunch to dinner	No	65.0	65.4	69.7	51.1
It is safe to leave leftover pizza and hamburger on the table if it is eaten within 4-5 hours	No	28.4	38.3	31.6	27.7
It is okay to taste milk to check if it is still safe to drink	No	51.5	61.7	63.7	53.2
Dairy products with bulging cover foil are not useable	Yes	48.5	49.4	44.7	42.6
Milk directly from a farm has to be boiled before drinking	Yes	74.6	84.0	76.1	63.9

As to the attitude questions, some students do not wash their hands before eating in the canteen. Too little time for eating, and improper location of the wash basins, play presumably also a role in this situation. There are lots of false beliefs, such as the need to wash egg before putting in the refrigerator. On the contrary, washing the eggs will remove the protective layer which saves eggs against attack by microbes. Furthermore, there are only a few pathogens on the shell, the majority is found in deeper layers. Regularly, about 30% of the responders wash eggs before they put it in the refrigerator (Table 4). The frequency of cleaning the refrigerator is too low, which is dangerous because it could cause cross-contamination or pathogens growth. Logistic regression and Chi-square analysis showed significant difference between genders in terms of washing fruits before eating ($p<0.049$), washing eggs before using ($p<0.046$), cleaning the refrigerator ($p<0.024$) and having indigestion ($p<0.003$). Girls washed fruits and vegetables more frequently before eating than boys. More boys than girls have had indigestion because of the food consumed. This might be linked to other areas for example lack of personal hygiene, as boys wash their hands before eating or after stroking of pets less often than girls. Moreover they are more likely to consume

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meal with raw eggs or buy something from unofficial sources. There were significant differences according to residence: mainly urban inhabitants reported to never wash hands before eating in the school canteen ($p<0.043$) or after stroking pets ($p<0.035$) and some of them never put opened juice into the refrigerator ($p<0.035$). Correlation between knowledge and attitude was evaluated for frequency of hand washing and consumption of raw eggs. Logistic regression showed that only those persons answered that hand washing was important before eating who never missed out washing their hands ($p<0.000$) and almost always wash hands after stroking a pet ($p<0.045$). There was no correlation between knowledge about the risk of raw egg consumption and eating meals with raw eggs; this result showed that sometimes there is a gap between knowledge and attitude. Most people know that eating raw eggs may be risky but on the other hand eggs are considered a healthy food. Controlled, fresh eggs with sanitized shell might bring less risk to the consumer but under Hungarian circumstances most of the eggs are sold in markets from non-controlled sources. It is very important to provide people with information about Salmonella and causes of salmonellosis.

Table 4. Results of food safety attitude questions among secondary school students

	Often and always (%)				Seldom and never (%)			
Attitude statement	boy	girl	urban	rural	boy	girl	urban	rural
I wash my hands before eating at home	91.0	96.3	91.7	78.7	9.0	3.7	8.3	21.3
I wash my hands before eating in the school canteen	22.4	22.2	16.1	31.9	13.4	7.4	8.3	8.5
I wash my hands after stroking a pet	94.8	98.8	94.6	87.2	5.2	1.2	5.4	12.8
I wash fruits and vegetables before eating	77.6	95.1	82.7	72.3	22.4	4.9	17.3	27.7
I wash eggs before putting in the refrigerator	29.1	28.3	29.2	29.8	70.9	71.7	70.8	70.2
I put opened juice into the refrigerator	74.6	79.0	75.0	63.9	25.4	21.0	25.0	36.1
I put the remainder meal into the refrigerator within 2 hours	90.3	86.4	89.3	70.2	9.7	13.6	10.7	29.8
I eat only correctly cooked meat	96.3	100.0	95.2	85.1	3.7	0.0	4.8	14.9
I eat meals with raw eggs	24.6	17.3	19.0	38.3	75.4	83.7	81.0	61.7
I wash eggs before using	51.5	61.8	56.5	46.8	48.5	38.2	43.5	53.2
I buy goods from unofficial venders	14.9	8.6	16.1	12.8	85.1	91.4	83.9	87.2
I check the best before date of foods	76.1	86.4	79.2	63.9	23.9	13.6	20.8	36.1
I taste expired food if it is good for consumption	30.0	30.9	28.6	25.5	70.0	69.1	71.4	74.5
I clean the refrigerator at least monthly	73.9	55.6	69.7	72.3	26.1	44.4	30.3	7.7
I have already had indigestion	9.7	3.7	9.5	6.4	90.3	96.3	90.5	93.6

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4. CONCLUSION

Some of the obtained results are in contrast with our hypotheses. We supposed that females had more information about food safety but this was not proved by the results. Among primary school children, e.g., more boys knew that one has to separate cooked and raw meat in the refrigerator. Among the adolescents and adults, more males gave correct answer to the question about cooking with diarrhea. In the other questions, the attitude of girls and women was more appropriate, and it was verified by the results.
Regarding place of residence, people living in towns had more information and better attitudes than rural people but this difference was significant only in some cases. Statistic revealed, similarly to other researches, that older people had more knowledge and better attitudes than adolescents. There was a strong correlation between knowledge and attitude. The performance of our subjects was similar to the results of other countries, with more or less the same lacks of knowledge. The easiest way of improving knowledge is education in early life. Part of this education should be a practice in the school kitchen where students could learn how to prepare safe food at home. The electronic media (television, internet) could be a good mediator for adults by giving basic information about food safety. Elimination of the deficiency in knowledge and attitude deserved further efforts because these can cause illnesses and lot of expenses.

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