

Consumers' awareness of food safety from shopping to eating

Food safety is of crucial importance to the consumer, food industry and economy. Calculation of annual cases of salmonellosis and campylobacteriosis shows that the yearly number of cases in Europe is likely to exceed five million, demonstrating that economic losses and human distress resulting from foodborne diseases can no longer be neglected. What do consumers know about food safety principles and what do they do to protect themselves from foodborne diseases? The results of consumer studies concerning food safety knowledge and practices have shown that consumers are aware of and are thinking about food safety, although there are also many gaps in food safety knowledge and practices that may result in foodborne diseases. The aim of this study was to investigate the actual level of food safety knowledge and relevant practices in food handling at home.

Sampling plan

A study of consumer food safety knowledge and practices was conducted from January to March 2006 in different parts of Slovenia. A food safety and nutrition questionnaire was designed, which consisted of demographic questions (gender, age, education, marital status) and 48 questions covering issues related to food safety and nutrition habits. The first part of the study is presented in this paper.

The revised questionnaire was divided into four sections: (1) a demographic section, (2) food safety knowledge, (3) food safety practices from purchase to home, and (4) food handling practices at home. Each questionnaire took approximately 20 min to complete. Data were collected on weekends and weekday afternoons when a member of the particular target group would most likely be at home or in the shopping centres. A quota sample of 1030 consumers was obtained. Gender and age distribution were controlled (to assure a balanced structure of the sample) by 35 interviewers, each of whom distributed 30 questionnaires. Interviewers were trained, final-year university students, who visited selected households or interviewed consumers in larger shopping centres. Interviewers briefly explained the purpose and nature of the study to the potential adult respondent (over 18 years of age), and sought permission for inclusion of their views in the survey. To guarantee anonymity of respondents and enable easier identification of questionnaires, identity numbers were assigned to each questionnaire. As students conducted interviews in their home cities, a considerable geographical distribution of data was obtained.

Profile of respondents

A total of 1030 questionnaires were obtained. Characteristics of survey participants are listed in Table 1. The majority of respondents were female (60.1%). Most of the respondents were married with an average age of 38 and had a secondary school education.

Food safety knowledge

The place of purchase (possible answers were: shop, market, farm, self-produced, and not buying) depended on the foodstuffs they wished to buy. Milk products (97.6%), milk (85.4%), meat products (86.2%), raw meat (71%), poultry (81.8%), eggs (56.5%), fresh fish (68.6%), fruit (78.3%) and tofu (20.3%) are mainly bought in shops. Foodstuffs that are most commonly self-grown or self-produced include vegetables (19.9%), eggs (16.5%), raw meat (12.8%), milk (7.8%), poultry (6.8%) and fruit (6.5%). From farmers, respondents tended to buy predominantly eggs (21%) and less of other products, e.g. raw meat (11.6%), poultry (6.7%) and milk (5.3%). Respondents who believe that home food production provides the best assurance for food safety were also more likely to claim that food produced by farmers and sold in food markets was safer than food sold in shops. The results showed a positive impact regarding the type of home-produced food, milk products and meat and the confidence that food bought in a market or from a farm is safer. Consumers believe that they are not responsible for food safety to the same degree as food handlers (farmers, food industry, retail, catering). They also believe that the Slovene Consumers' Association is not as strongly responsible as food handlers and other food safety institutions, such as the Inspection and

Ministry of Health (Table 2). Demographic characteristics have no association with attitude toward consumers' responsibility for food safety, with the exception of gender. More women are aware of the responsibility of consumers for food safety than men

Food safety practice from purchase to home

When shopping, the respondents most often checked the date of durability and the state of packaging (Table 3). Most respondents always checked the date of durability (54.2%) or often (29.7%) and the state of packaging was always checked by 48.6% and often by 25.5% of respondents. The results show a positive impact of gender and age group on purchasing behaviour. Women ($F = 21,003$, $p < 0.001$) significantly more often checked the date of durability than men, and younger respondents (<30 years of age) ($F = 2,872$, $p < 0.001$) significantly more often checked the date of durability than older respondents.

The least important parameter for consumers was the temperature in a retail cold chain unit. The majority of respondents (67.8%) never checked the temperature. However, we must consider whether consumers trust shop managers or simply assume that they cannot influence the temperature settings. More than half of the respondents (55.1%) were aware of the correct temperature range (1–5 °C) for retail refrigerator units (Table 3).

Most of the respondents evaluated the hygiene practices of sale assistants pretty positively in relation to their handling of delicatessen products, bread and raw meat. All characteristics were graded on average above 2.7.

We wanted to discover whether consumers maintain a cold chain from the point of purchase to the home. Raw meat and tofu were chosen as the perishable foodstuffs in order not to exclude vegetarians. However, since the percentage of respondents not eating meat proved to be very low (3.4%), we will restrict further discussion to results concerning raw meat. Most consumers took raw meat sometimes during their shopping (36.4%) or depending (36.1%) on when they **came across** it, while 14.4% took it as soon as they entered the shop. Only 10% of respondents collected raw meat at the end of their shopping (Table 4).

Food handling practices at home (Table 5)

Respondents were asked about their food handling practices at home. More than half (53.8%) of the respondents learned cooking practices from their parents and 21.7% learned by themselves. When preparing lunch, 45.1% of respondents use an established preparation sequence for meat or salad (*i.e.* in a sink, washing salad first, followed by meat). Over half of the respondents (54.4%) refrigerate raw meat intended for immediate use, while they freeze the rest. Over a quarter of respondents (27.8%) mostly freeze raw meat. This study revealed that the majority of respondents thawed meat improperly, *i.e.* on a kitchen counter (50.4%) or in hot water (12.8%). We established that among those who defrosted meat on the kitchen counter, the greatest proportion was represented by those who learned cooking practices by themselves (57.1%).

We asked consumers if they knew the temperature of their refrigerator to establish whether they find storage conditions important. Almost forty-four percent of respondents did not know the temperature in their refrigerator. Over half (53.5%) of the respondents in our study cool leftovers to room temperature and then put them in the refrigerator but 12.5% leave leftovers on the kitchen-range until they are eaten. Respondents were asked how they washed their hands and the length of time taken to perform this action. The proportion of respondents who wash their hands prior to food preparation was 86%, and includes individuals who will only wash their hands depending on what they were doing previously (7.9%) or what kind of food they are going to prepare (5.8%).

After handling raw meat, poultry or fish during food preparation, 57.1% of respondents wash their hands properly with soap and hot water, although a significant number (33.9%) washed their hands with water only or did not wash at all (1.6%). One of the worrying discoveries of this study was that 52% of respondents wash their hands for only 10 s or less. We investigated whether respondents thought that some food handling practices could lead to cross-contamination. A considerable percentage of respondents do not use effective means to properly clean cutting boards (20.3%) and

knives (19.9%) after cutting raw vegetables before using that utensil/surface again for something that is not intended to be cooked. The respondents are therefore performing an unsafe food handling practice that could lead to cross-contamination of finished food with microorganisms from the raw food. More than one-third of respondents engage in an improper practice by re-using without effective cleaning the same cutting board/knife for food that is not intended for cooking. Only one-third of respondents answered correctly “with hot water and a detergent” (23.7% for cleaning knife, 26.3% for cutting board) and “use another knife/cutting board” (10.1% for cleaning knife, 10.4% for cutting board).

Finally, less than half of the respondents (42%) believe there is a strong possibility of poisoning when using the same knife for cutting cooked and raw meat, 39.8% believe that the possibility is slight, and 17.8% believe that **this** does not affect potential poisoning. Those respondents who believe that there is a high possibility of poisoning when using the same knife or cutting board for cutting cooked and raw meat are less likely to use the same knife, wipe it with a damp cloth or wash it with hot water without a detergent, and more likely to wash the knife and cutting board with hot water and a detergent or use another knife. When respondents were asked how often they cleaned their kitchen sink and kitchen counter, most (59.7%) indicated that these kitchen areas were cleaned after every use or after every meal (23.2%).

It has been suggested that knives, cutting boards and food preparation surfaces should be washed with hot water and soap after contact with raw poultry, meat and seafood. Cross-contamination is the second most important behaviour leading to outbreaks of *Campylobacter jejuni*, *Salmonella*, and *Yersinia enterocolitica*. Even when food is thoroughly cooked, it can be re-contaminated by coming into contact with raw food or food preparation surfaces, serving utensils, or even the preparer’s hands if they were not properly cleaned. Proper refrigeration of cold foods and leftovers is essential to prevent any pathogens in food from multiplying to dangerous levels. Numerous microbiological surveys have found the presence of pathogenic bacteria in many foods consumed and prepared in consumers’ homes.

Conclusion

This study highlighted some gaps in food safety knowledge and practices that occur from shopping to eating. Consumers react to subjective risks that can be recognised and evaluated by themselves so it is essential to understand consumers’ awareness regarding home food safety and home food preparation practices in order to plan proper education programs.

We can conclude on the basis of these results that respondents are not familiar with their role in the food safety chain or with the importance of maintaining a cold chain, and that they allow numerous opportunities for microbiological contamination of food. The most important issues were incorrect defrosting practices, poor cooling of cooked food, re-heating of cooked food, lack of knowledge regarding refrigeration temperatures, lack of knowledge concerning cross-contamination and its control, and a lack of knowledge with respect to hand hygiene. If one reflects on our findings and the most important foodborne pathogens appearing regularly in the area of foodborne diseases, it becomes obvious that there is significant commonality between factors causing foodborne diseases and food handling deficiencies reported in this survey. The results indicated that women adhered to safer food handling practices to a greater degree than men.

The results obtained from our survey revealed the need for consumer education regarding safe food handling practices from the point of purchase to the home, as well as within the home. We have to educate consumers so that they can cope with all novelties in the field of food safety on a daily basis. The attitudes of consumers towards food safety and their practices concerning food are themes of interest to food producers and retailers, public authorities and health educators. Food safety messages should focus on the younger members of a population with educational programs, but more importantly, with relevant training. **It** is also of vital importance to properly educate educators and teachers in order to transmit food hygiene principles to children, and through them, to their parents.

Table 1: Demographic characteristics of respondents

1. Demographic characteristics	
Gender (n = 1028)	
Male	410 (39.9%)
Female	618 (60.1%)
2. Age group (n = 1023)	
Less-than-or-equals 30: 417 (40.8%)	
31–49:	380 (37.1%)
Greater-or-equal 50:	226 (22.1%)
3. Education (n = 988)	
Primary school or less: 344 (34.8%)	
Secondary school:	426 (43.1%)
Higher education:	218 (22.1%)
4. Marital status (n = 985)	
Married or living together	
as married:	612 (62.1%)
Single:	203 (20.6%)
Separated or divorced:	170 (17.3%)

Table 3: Respondents' opinions toward food safety and food quality elements during purchase

1. How often do you check ...	
...in which country a foodstuff has been grown/produced	1027 (2.22)
...if a foodstuff is organic	1025 (1.86)
...the name of the grower/manufacturer	1022 (2.42)
...date of durability	1025 (3.35)
...if the package is damaged	1008 (3.15)
...the refrigerator temperature in a store, where yoghurts, cheese, fresh meat, etc. are kept	1019 (1.45)
...presence of artificial additives	1025 (2.12)
...presence of vitamins, minerals, fibres, etc.	1025 (2.17)
...energy value	1026 (2.03)
2. In your opinion, how often have sale assistants, who are serving you delicacies, bread or raw meat...	
...clean hands	918 (2.86)*
...a protective hair net	973 (2.75)
...clean working clothes	953 (2.94)
...clean utensils (knife, cutting board, etc.)	872 (2.79)

*Respondents used a four-point scale:

1 – Never, 2 – Sometimes,

Table 2: Consumers' opinion concerning responsibility for food safety

Food safety participants	
Consumers	990 (3.37)*
Farmers	993 (4.22)
Food industry	1007 (4.69)
Retail	1004 (4.56)
Catering	1004 (4.64)
Food safety inspectors	985 (4.50)
Ministry of Health	960 (4.17)
Slovene Consumers' Association	945 (3.89)

* Opinions were ranked from 1 (not at all) to 5 (very much).

Table 4: Respondents' food safety practices from purchase to home

1. During the shopping, at what stage do you purchase raw meat/tofu? (n = 1026)	
Straight away when I enter the shop	14.4
Sometime during the shopping	36.4
At the end, when I have already purchased all other items	9.9
Depends	36.1
I do not know	3.2
2. Do you ever use an isolated bag or cooling box to carry your frozen or refrigerated foodstuffs home (e.g. ice cream or raw meat)? (n = 1030)	
Yes	15.3
No, I did not think of that	51.7
No, I do not think it is necessary	33.0
3. At what temperature should raw meat/tofu in a retail refrigerator unit be stored? (n = 1029)	
Less than 1 °C	5.4
1–5 °C	55.1
6–10 °C	26.5
More than 11 °C	2.7
Do not know	10.2
5. How important is the duration of transport of raw meat/tofu from the time of purchase to the home? (n = 1028)	
Not important	5.3
Quite important	33.0
Very important	58.1
Do not know	3.7

3 – Often, 4 – Always.

Table 5

Respondents' food handling practices at home

1. How did you learn your cooking practices?
 - By myself
 - From cookery books
 - From parents
 - From my partner
 - Cooking is my profession
 - Other
2. When preparing a meal, do you follow a sequence of preparing meat and salad (i.e. to wash salad in a sink first, followed by meat)?
 - Yes
 - No
3. How do you store raw meat at home after purchase?
 - I do not preserve raw meat because I use it at once
 - I refrigerate raw meat intended for immediate use, and freeze the rest
 - Mostly in a freezer
 - Mostly in a refrigerator
4. Do you know the temperature in your refrigerator?
 - Yes
 - No
5. How do you defrost meat?
 - On a kitchen counter
 - In a refrigerator
 - In hot water
 - In a microwave
 - I do not defrost, I start to cook meat while it is still frozen
 - I do not defrost
6. What do you do with leftovers from your meal?
 - I leave them on the stove until they are eaten
 - I store them in the refrigerator while still warm
 - I cool leftovers to room temperature and then put them in the refrigerator
 - I freeze them
 - I throw them out
 - I use them to feed animals
7. How do you re-heat leftovers from your meal?
 - In a microwave
 - In an oven
 - In a frying pan, wok or saucepan
 - I do not re-heat them
 - Other method
8. How long are you re-heating a meal?
 - I do not re-heat it
 - For as long as it takes to become warm and ready for consumption
 - Until it boils
 - I leave it to boil for a while
 - Other

9. Do you wash your hands before food preparation?
 - It is not necessary to do so
 - Depends on what I was previously doing
 - Depends on the food I am going to prepare
 - I always wash my hands
10. How do you wash your hands after handling raw meat, poultry or fish?
 - I do not wash my hands, I dry them with a paper towel
 - I do not wash my hands, I dry them with a kitchen cloth
 - With cold or hot water
 - With warm water and soap (or detergent)
 - I do not wash my hands during food preparation
11. How long do you wash your hands?
 - 10 s or less
 - 11–20 s
 - More than 20 s
 - I do not know
12. How do you dry your hands after washing?
 - I do not dry my hands
 - With an apron
 - With a kitchen cloth used for wiping the dishes
 - With a disposable paper kitchen towel
 - With a kitchen cloth, intended for drying hands
 - With a bathroom hand towel
13. What do you usually do when cutting raw vegetables and later use the same knife for cutting food not intended for cooking?
 - I use the same knife
 - I wipe the knife with a damp cloth
 - I wash the knife with cold water without a detergent
 - I wash the knife with hot water without a detergent
 - I wash the knife with hot water and a detergent
 - I use another knife
14. What do you usually do when cutting raw vegetables and later use the same cutting board for cutting food not intended for cooking?
 - I use the same cutting board
 - I wipe the cutting board with a damp cloth
 - I wash the cutting board with cold water without a detergent
 - I wash the cutting board with hot water without a detergent
 - I wash the cutting board with hot water and a detergent
 - I use another cutting board
15. If you use the same knife for cutting raw and then cooked meat, there is a ...
 - ... strong possibility for food poisoning
 - ... slight possibility for food poisoning
 - This does not affect the potential for food poisoning
16. How often do you clean your kitchen sink and kitchen counter?
 - After every use
 - After every meal
 - Once a day
 - When they are dirty

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