

Perception of biological risk and food choices in university students in Naples

Teresa Cirillo¹, Erminia Agozzino², Renata Amodio Cocchieri¹, Umberto Del Prete²

¹Dipartimento di Scienza degli Alimenti, Sezione di Microbiologia e di Igiene, Università di Napoli "Federico II", Napoli, Italy; ²Dipartimento di Medicina pubblica, Clinica e Preventiva, Sezione Igiene, Seconda Università di Napoli, Napoli, Italy

Corresponding to: Teresa Cirillo, Dipartimento di Scienza degli Alimenti, Sezione di Microbiologia e di Igiene, Università di Napoli "Federico II", via Università 100, 80055 Portici, Napoli, Italy. E-mail: tcirillo@unina.it

Abstract

The aim of the present survey was to assess the perceived risk of foodborne infections in young adults with a high education level. The authors investigated their knowledge of foodborne infections, the preparation and storage of food that favour these infections and the rules of food safety and hygiene for consumer protection, as well as their behaviour regarding personal hygiene and their eating habits outside the home. The results showed that they had a good level of knowledge across all of the fields investigated, but outside the home they tended to favour food products that have a high risk of foodborne infection. This confirms that lifestyle and eating habits are strongly influenced by socio-economic factors, fashion, the media and by the market demands of the food industry.

Key words: foodborne infections, food safety, eating habits

Despite the undeniable improvement in the hygiene conditions for food production and the heightened awareness of the causes of food poisoning, foodborne infections are still a source of concern because of the high number of episodes, which are markedly underestimated. Of particular importance are the infections ascribed to the pathogens of animal origin (*Escherichia coli*, *Listeria monocytogenes*, *Campylobacter jejuni*, *Salmonellae spp*), which are continually on the increase due to factors like market, the spread of collective restoration [2], the application of inadequate food processing and preservation techniques and the increase in the elderly population, etc. [3].

The consumer today seems to be more perceptive of the risks that are of a chemical nature, highlighted by the increase in media coverage, rather than those of a biological source, for example, the persistence in some areas of deep-rooted customs such as the consumption of raw seafood. As each individual is responsible for his/her own food choices, there is an evident need for active education programmes in this field. This has in fact also been highlighted by the WHO, which regards health education as the primary tool world-wide in the prevention of foodborne infections [4-8]. Likewise, the European Union, in the *White Paper on Food Safety* [9], includes risk assessment and communication amongst the priorities to guarantee better food safety standards. In our country, these objectives are also

indicated as tools for primary prevention, to be developed in schools and in the adult population [10,11]. Any education program must, however, take into account an assessment of what is currently known. The aim of this study was, therefore, to assess, in a pre-selected sample of the population, the knowledge and perception of infection risk related to the consumption of food outside the home.

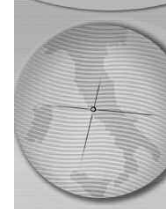
Materials and methods

The study involved 1213 university students, i.e. about 50% of those enrolled in the first and second year of three different science faculties of the two universities in Naples.

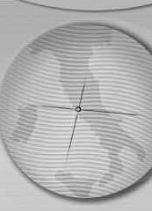
University students from the science faculties were chosen in order to population group with a limited age range, of a medium to high cultural level, whose attendance is compulsory and who use collective catering facilities such as either the university cafeteria or commercial eating places. The survey was based on direct interviewing techniques using a questionnaire purpose designed, as used in other studies [3,12,13] during the academic year 2002-2003 (Table 1).

The questionnaire was made up of six sections, five of which contained questions with a yes/no answer, covering the following topics:

1. **foodborne infections**, with questions relating to the meaning of the term "*pathogenic germ*" and on the main aspects of infections which are commonly related to food consumption;


Table 1. Questionnaire to young university students on their knowledge of foodborne infections and on their food choices.

Are pathogens harmful to public health?
Are pathogens always present in fruit and vegetables?
Are pathogens always resistant to cooking?
Is the cause foodborne infection:
the unsuitable temperature at which food is stored?
Are the symptoms brought on by foodborne infections dependent on the type of germ?
Do foodborne infections cause vomiting and diarrhoea?
Do foodborne infections cause a sore throat and coughing?
Are the following considered at risk for foodborne infections:
bread and pasta?
raw seafood?
cooked fruit and vegetables?
meat and eggs?
milk and cheese?
Does contaminated food that can cause foodborne infections always have:
a different colour and smell?
a different taste?
a swollen container?
15 answers
Is the development of germs in food favoured by:
leaving food at room temperature for a long time?
leaving cooked food in contact with raw food?
consuming food immediately after cooking?
using leftovers?
keeping good hygiene standards in the kitchen?
keeping cooked food separately from raw food?
Can germs breed rapidly in all cooked food left at room temperature?
Do cooking times influence the killing of microorganisms?
Do you think it is dangerous to serve an omelette on the plate used to beat the eggs?
Can dairy products like milk, cream and fresh cream or eggs be kept at room temperature?
Does reheating cooked food guarantee the killing of microorganisms?
Should perishable food (soups, creams, etc.) be kept in the refrigerator?
Does the proper use of the refrigerator entail:
leaving space around the articles of food so that the air can circulate?
always keeping the refrigerator full?
keeping the refrigerator away from a heat source?
Does refrigeration kill all pathogens present in food?
Does refrigeration preserve food against the spread of germs for a short time?
Does refrigeration facilitate the spread of germs in food?
18 answers
Is handwashing important:
to eliminate the dirt?
because it is good manners?
to reduce the germs present?
for personal comfort?
Should hands be washed:
after smoking?
after coughing or sneezing?
before handling food?
before going to the toilet?
after going to the toilet?
before eating?
after eating?



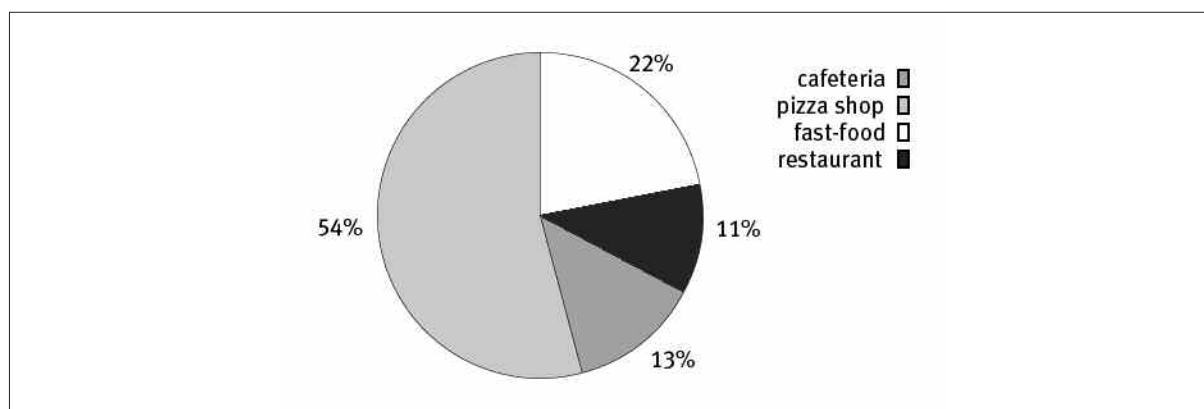
Does proper handwashing entail:
using a hot air hand dryer?
using communal towels?
using soap?
using disposable towels?
using liquid soap?
using water only?
18 answers
Do you eat meals outside the home? (if "yes"):
Where most frequently (tick only one):
at the university cafeteria
at a pizza shop
at a fast food restaurant
at a restaurant
How many times a week? (n°)
What first course dish do you most frequently eat outside the home?
What main course dish do you most frequently eat outside the home?
What side dish do you most frequently eat outside the home?
What salad dish do you most frequently eat outside the home?
What do you most frequently eat for a quick lunch outside the home?
At a café or pastry shop what cake or pastry do you generally choose?
9 answers
Should unpackaged ice cream be served using:
a spatula kept in water?
a spatula for each tub of ice cream?
In a snack bar should the cooked food to be eaten hot:
be kept at room temperature?
be kept refrigerated after cooling?
Is it compulsory that food be prepared at a different counter from where it is sold?
What written information do you think is important to protect the consumer from foodborne infections:
the name of the product to be sold?
the net quantity expressed in weight and volume?
the name and address of the producer?
a list of the ingredients?
a list of the additives?
nutritional information?
instructions for use?
storage indications?
expiry date?
How should food handlers be dressed:
in a white coat or jacket and gloves?
in light-coloured overalls and cap?
as they like as long as their clothes are clean?
Should food-handlers handle money?
18 answers

- 2. the sources of contamination and factors favouring the development of pathogens in foods**, comprising of questions on the reservoirs and sources of infection, personal behaviour relating to the use of the refrigerator and on the preparation and preservation of raw and cooked foods, including cooking times and temperatures;
- 3. behaviour regarding personal hygiene**,

- with questions on the importance, frequency and methods of hand washing, and behaviours that impact on the spread of pathogens to food substrates during handling (cigarette smoke, coughing, the use of handkerchiefs, toilets, etc.);
- 4. food choices outside the home**, consisting of questions on the type of foods usually consumed in the university cafeteria or in commercial outlets;

Table 2. General characteristics of the study participants (n°1213).

Sample description		N°	%
Age	≥ 20	572	47.2
	< 20	641	52.8
	Mean (SD)	20.1 (1.9)	
Sex	Males	582	48.0
	Females	631	52.0
High school	Academic	776	64.0
	Technical	437	36.0
Mother's education level	Lower Secondary	387	31.9
	High school	536	44.2
	University	290	23.9
Father's education level	Lower Secondary	336	27.7
	High school	536	44.2
	University	341	28.2
Place of residence	City	493	40.7
	Province	720	59.3

Figure 1. Eating places (%) usually frequented by the students interviewed.


5. food safety legislation, with questions on what the laws establish and how they are observed in the food outlets most commonly frequented.

The sixth section asked for information on age, gender, type of high school diploma (academic or technical diploma), place of residence (city or provincial town); parents' education level (lower secondary, high school or university) and how often and where food was normally consumed outside the home.

The first five sections of the questionnaire awarded one point for each correct answer. For each section knowledge was considered: *insufficient* if up to 33% of the answers were correct; *sufficient* if between 34 and 66% of the answers were correct and *good* if the percentage of correct answers were 67% or greater.

Chi² statistics were used to analyse the results in order to calculate the associations between the relative variables and were processed using SPSS computer software.

Results and considerations

The results obtained in this study are shown in tables 2, 3 and 4 and in figure 1.

Overall, 1213 students took part in the study, 48.0 % of whom were males, the mean age was 20 years, 59.3 % were resident in a provincial area and 60% of those interviewed reported having an academic high school diploma. As regards to the level of education of the parents, 68.1% and 72.4% stated that their mother or father had a high school or university education respectively (Table 2).

Ninety-nine per cent stated that they ate at least once a week outside the home, usually at a pizza parlour (54 %), at a fast food restaurant serving pre-packed single portions (22%), at the university cafeteria (13%) or at a restaurant (the remaining 11%) (Figure 1).

On the basis of the answers obtained across the different areas of the questionnaire, participants were assigned a knowledge level of *good* for: personal hygiene, 94.6 %; foodborne infections, 56.6%; factors favouring microbial development,

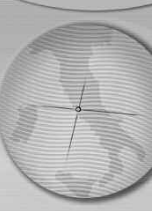


Table 3. Assessment of knowledge of foodborne biological risk (n° 1213).

	Assessment					
	Insufficient		Sufficient		Good	
KNOWLEDGE	N°	%	N°	%	N°	%
foodborne infections	73	6.0	453	37.4	687	56.6
Factors favouring microbial development	44	3.6	622	51.3	547	45.1
Personal hygiene	28	2.3	38	3.1	1147	94.6
Food safety regulations	44	3.6	622	51.3	547	45.1
BEHAVIOUR						
Food choices	309	25.5	870	71.7	34	2.8

Table 4. General characteristics of the study participants (%) in relation to their knowledge of foodborne infections (n°1213).

SAMPLE CHARACTERISTICS	Foodborne infections				Microbial food contamination and development			Personal Hygiene			Food safety regulations				Behaviour - Food choices			
	I	S	B	χ² (p)	I	S	B	I	S	B	I	S	B	χ² (p)	I	S	B	χ² (p)
Sex Males	5.8	37.6	56.6		3.1	49.9	47.0	1.8	2.4	95.8	4.7	73.1	22.2	8.196	24.6	72.2	3.3	
Females	5.2	37.1	57.8		3.2	52.3	44.6	1.8	3.5	94.7	2.7	68.9	28.4	(.017)	25.2	72.3	2.5	
Age ≥ 20	6.0	41.2	52.8	7.066	4.9	49.9	46.1	2.4	3.5	94.1	4.4	70.3	25.4		27.2	70.9	1.8	6.826
< 20	5.0	34.3	60.7	(.029)		52.4	45.7	1.3	3.5	96.4	2.3	71.8	25.9		22.7	73.3	3.9	(.033)
High School:																		
Academic	4.9	35.5	64.0		2.2	51.0	46.9	1	2.9	96	3.6	71.2	25.3		25.0	71.4	3.6	
Technical	6.1	40.6	53.3		4.1	52.8	43.1	2.9	3.4	93.7	2.0	70.0	26.0		25.3	73.2	1.5	
Mother's Education level:																		
Lower Secondary	4.4	38.1	57.5		2.1	51.0	46.0	1.8	3.5	94.7	2.6	68.6	28.7	16.285	27.3	71.0	1.8	9.416
High school	5.5	37.2	57.3		1.9	52.0	46.1	1.5	2.5	96.0	1.7	71.7	26.6		25.4	72.3	2.3	(.052)
University	5.9	33.2	60.9		4.3	50.8	44.9	1.2	3.5	95.3	6.3	73.4	20.3	(.003)	22.3	72.3	5.5	
Father's Education level:																		
Lower Secondary	5.8	38.0	56.2		3.4	50.3	46.2	2.1	4.5	93.5	2.7	68.2	29.1		26.0	71.6	2.4	29.310
High school	5.4	36.7	57.9		2.1	53.6	44.2	1.3	2.4	96.4	2.1	72.3	25.5		27.7	71.7	0.6	(.000)
University	4.4	35.0	60.6		2.7	49.5	47.8	1.0	2.7	96.3	4.7	71.7	23.6		20.9	72.1	7.1	
Residence:																		
City	4.8	38.9	56.2		3.3	51.4	45.3	1.1	2.8	96.1	4.6	70.0	25.4		24.3	72.0	3.7	
Province	6.2	35.8	58.0		2.9	50.9	46.2	2.0	3.2	94.8	2.7	71.7	25.6		25.6	72.1	2.3	

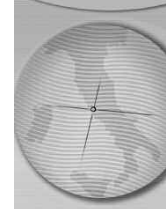
I= Insufficient S = Sufficient B = Good

45.1% and food safety regulations, 45.1%. if we take into account the level knowledge considered to be *sufficient*, the percentages for knowledge of foodborne infections rise by 37.4% and for factors favouring microbial development and food safety regulations by 51.3%.

On the contrary, with regards to food choice, only 2.8% avoided the more dangerous foods from a microbial viewpoint, with a quarter of the participants (25.5%) showing a preference for foods that were associated with the highest risk (Table 3).

The analysis of the relationships between individual and family factors (sex, age, education level of the parents, place of residence) and the degree of awareness of foodborne biological risks (Table 4) showed no significant gender

differences in the levels of knowledge of the participants, with a similar distribution between males and females in all sections of the study, except for the food safety legislation (p=0.017). across the age distribution, differences emerged in the knowledge of foodborne infections, which was assessed as *good* in a significantly higher number of students under the age of 20 (p=0.029); this group also showed greater competence in their choice of food (p=0.033) finally, a certain degree of influence seems attributable to the university education level of the parents in determining their children's ability to make better food choices (p=0.052 mother; p=0.000 father). The education level of the mother also influences their children's knowledge of the food safety legislation (p=0.003).



Discussion and conclusions

From the results obtained in this study it would appear that knowledge of the dangers does not determine an individual perception of the risk of foodborne infections, as demonstrated by the wide discrepancy between what the students knew and what they did. In fact, a high percentage of the participants (94.0-97.7%) had a good or sufficient level of knowledge across all of the fields studied, whereas 25.5% showed that they made incorrect food choices, favouring meals considered risky, such as baked rice or lasagne, meatballs in sauce, hamburgers, veal with tuna fish sauce, mozzarella, chicken salad with mayonnaise as well as cream cakes and pastries. These findings agree with reports from similar national and international studies, which showed that, where food handling is concerned, personal behaviour did not correlate with the knowledge of the infection risk and that knowledge of these dangers did not necessarily correspond to the individual having a correct and lasting perception of the health risks involved [14,12,16]. In addition, the majority of those interviewed entrusted the authorities with the fundamental role of surveillance and the control of food safety [15,17,2].

Fein et al. [12], observed that, contrary to what might be expected, people who claim to have experience of foodborne infections and a high awareness of micro-organisms and food safety are in effect more liable to make incorrect food choices than those who are less aware of the risks.

Many people underestimate their personal risk of exposure to foodborne infections, and, although they know the potential consequences of their behaviour, they continue to consume unsafe foods [2].

With reference to our study in particular, regarding the food choices of young university students outside the home, a certain degree of importance can probably be attributed to the influence of fashion or their peer-group in deciding an individual behaviour. Furthermore, a non-negligible role can be attributed to the efforts of commercial restaurants who make, at any cost, the foods destined to this expanding sector of young consumers more appealing. Another factor is the new trends and products promoted by the media as alternatives to traditional foods.

The results reported confirm the need to introduce, at different educational levels, suitable teaching on food safety to heighten individuals awareness of their responsibility to adopt the correct behaviour in order to protect their own

health, and also to inform individuals of their right to food safety. This latter objective might also involve the co-ordination of consumer protection organisations and the relative authorities, in order to promote these issues outside the school, for example, using the media, who are known to exert considerable influence across the many diverse population groups.

References

- 1) Lake RJ, Baker MG, Garrett N, Scott WG, Scott HM. Estimated number of cases of foodborne infectious diseases in New Zealand. *The New Zealand Medical Journal* 2000;113:278-81.
- 2) Redmond EC, Griffith CJ. Consumer food handling in the home: a review of food safety studies. *Journal of Food Protection* 2003;66(1):130-61.
- 3) Alttekruse SA, Street DA, Fein SB, Levy AS. Consumer knowledge of foodborne microbial hazards and food-handling practices. *Journal of Food and Protection* 1995;59:287-94.
- 4) World Health Organization (WHO) (1984) The role of food safety in health and development. Report of a Joint FAO/WHO Expert Committee on Food Safety. Technical Report, No.705 Geneva.
- 5) World Health Organization (WHO) (1989) Rapport d'une consultation (1989) Le controle sanitaire et la gestion des manipulateurs des produits alimentaires. OMS, No. 785 Geneva.
- 6) World Health Organization (WHO) (1997). Foodborne disease - possibly 350 times more frequent than reported. Press release WHO/58. World Health Organization, Geneva.
- 7) World Health Organization (WHO) (2000) Food Safety: resolution of the executive board of the WHO. Resolution EB 105.R16, Geneva.
- 8) World Health Organization (WHO) (2000) Food Safety: Resolution of the executive board of the WHO W11A53.15. Geneva.
- 9) European Community Commission (1999) *White Paper on Food Safety*. Bruxelles 12.1.2000 COM719 DEF
- 10) Decreto legislativo 26/05/1997, n° 155 (G.U. n° 136 suppl. of 13 June 1997): CEE directives application, 93/43/ and 96/3/, on food Hygiene N.118/ L.
- 11) National Health Plan 2001-2003 "Progetto obiettivo per l'alimentazione e la nutrizione" Consiglio dei Ministri 7.2.2001.
- 12) Fein SB, Lin J. C.T., Levy AS. Foodborne illness: perceptions, experience, and preventive behaviors in the United States. *Journal of Food Protection* 1995;58(12):1405-11.
- 13) Parmenter K, Wardle J. Development of a general nutrition knowledge questionnaire for adults. *European Journal of Clinical Nutrition* 1999;53:298-308.
- 14) Frewer IJ, Shepherd R, Sparks P. The interrelationship between perceived knowledge, control and risk associated with range of food-related hazards targeted at the individual, other people and society. *Journal of Food Safety* 1994;14:19-40.
- 15) Sammarco ML, Ripabelli O, Grasso GM. Consumer attitude and awareness towards food-related hygienic hazards. *Journal of Food Safety* 1997;17:215-21.
- 16) Bevilacqua N, Branca F, Cairella G, et al. *Manuale di Sorveglianza Nutrizionale (Italian Surveillance Manual)*. Roma: I.N.R.A.N. 2003
- 17) Meer RR, Misner SL. Food safety knowledge and behaviour of expanded food and nutrition education program participants in Arizona. *Journal of Food Protection* 2000;63(12):1725-31.