



## Short communication

## Investigation on the knowledge associated with foodborne diseases in consumers of northeastern Portugal

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## ABSTRACT

Foodborne diseases represent a widespread and growing public health problem worldwide. The global occurrence of these diseases is difficult to calculate, but high levels of mortality have been reported. The aim of this study was to investigate the knowledge of food handler's and consumers concerning foodborne diseases, personal hygiene, risk groups, temperature control, cross-contamination and cleaning in the municipality of Mirandela, northeastern Portugal. Data were collected through a self-administered questionnaire from a convenience sample of 400 adults aged 18 years or older. The majority of respondents had a level of knowledge regarded as sufficient about the control of temperature in food. In addition, participants also demonstrated to be well informed on measures of hygiene. Most of the participants correctly answered questions about knowledge related to cross-contamination.

This survey showed that there is a gap in the consumers' knowledge on foodborne microbiological and parasitological agents. The respondents with a lower level of public education presented significantly higher knowledge than participants with an academic degree. In conclusion, in order to reduce occurrence, it is necessary to continue improving the knowledge on foodborne diseases, not only for the final consumer but also throughout of the whole production and distribution chain, as well as in restaurants.

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## 1. Introduction

Foodborne diseases represent a widespread and growing public health problem worldwide. In industrialized countries, the percentage of people suffering from foodborne diseases each year has been reported to be up to 30% (WHO, 2007) and seem to have globally increased in recent years due to the industrialization of animal production, mass food processing and distribution, globalization of food trade, and increased mobility of people and goods around the world (Lindberg, 1999). Better reporting could also be responsible for increased foodborne disease reports. Recent studies have provided useful information on how to analyze consumers' increasing concerns on the knowledge of food quality and safety and their effects on food choice (Bolton, Meally, Blair, McDowell, & Cowan, 2008; Conter et al., 2008; Henson & Northen, 2000; Jevnsnik, Hlebec, & Raspor, 2008; Karabudak, Bas, & Kiziltan, 2008; Rohr,

Luddecke, Drusch, Müller, & Alvensleben, 2005). Some studies have shown that knowledge about food safety tends to increase with age, level of education, and experience in food preparation (Rimal, Fletcher, McWatters, Misra, & Deodhar, 2001; Unusan, 2007). Other studies have shown that knowledge on food safety among young people might be insufficient (Sanlier, 2009; Zorba & Kaptan, 2011).

Most of the work during the last few years has been centered on hazard control in the production sector, but an equal effort has not been dedicated to improving consumers' education on food (Garayoa, Cordoba, Garcia-Jalon, Sanchez-Villagas, & Vitas, 2005).

Epidemiologic surveillance of foodborne diseases clearly indicates that consumer behavior such as ingestion of raw/undercooked foods and poor hygienic practices are important determinants of foodborne diseases outbreaks (Patil, Morales, Cates, Anderson, & Kendal, 2004). In Europe, North America and Australia a substantial proportion of foodborne disease is attributable to improper food preparation practices of consumers at home (Redmond & Griffith, 2003). Most of the research on consumer food safety conducted to date has consisted of surveys examining consumers' attitudes, knowledge and behavior regarding food safety (Jevnsnik et al., 2008).

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World Health Organization (WHO, 2002) reported that about 40% of foodborne illnesses resulted from the consumption of food prepared at home. It is clear, therefore, that private homes are a crucial location in which foodborne illnesses are engendered (Karabudak et al., 2008).

Therefore, an important objective in food safety is to educate the public about safe food handling and the preparation of foods using a system of good hygienic practices that emphasizes hazardous food handling techniques and the infectious causes of foodborne diseases (Raspor, 2004).

The aim of this study was to investigate the knowledge of food handlers and consumers concerning foodborne disease, personal hygiene, risk groups, temperature control, cross-contamination and cleaning in a municipality of northeastern Portugal.

## 2. Materials and methods

### 2.1. Study design

A cross-sectional study was conducted from October to December 2009 on food safety knowledge. Research was performed on 400 randomly and voluntarily recruited food consumers aged 18 years or older (representing 1.67% of the local population) through a self-administered questionnaire delivered in public spaces of the municipality of Mirandela, northeastern Portugal.

### 2.2. Structured questionnaire

Questionnaire was developed based on a literature review (Byrd-Bredbenner et al., 2007; Sharif & Al-Malki, 2009; Thompson, Ribera, Wingenbach, & Vestal, 2007; Walker, Pritchard, & Forsythe, 2003). Questions were designed to obtain information about food handlers and consumers personal hygiene, temperature control, cross-contamination and knowledge on foodborne diseases. Furthermore, four questions were related to demographic characteristics of the respondents (gender, age, level of education and civil status) (available upon request).

The knowledge assessment part of the questionnaire consisted of 22 multiple-choice questions each with four or five possible answers. To reduce the possibility of food handlers selecting the correct answer by chance, the multiple-choice answers included the item "I don't know".

### 2.3. Pilot study

A pilot study was used to assess the clarity of questions, instructions, layout and time requirement. The questionnaire was piloted on 30 consumers of the municipality of Vila Real, northern Portugal. Following the pilot test, terms were revised and discussed with other researchers, resulting in a few changes. Results of this pilot study were not included in the main study.

### 2.4. Data analysis

Data analysis was done with SPSS 16.0 software for Windows considering a probability ( $p$ ) of less than 0.05 as statistically significant. The  $\chi^2$  test was used to examine association between variables.

## 3. Results

The survey generated a total of 400 valid questionnaires. Distribution of socio-demographic characteristics of the study population is presented in Table 1. The sample consisted of 232 (58.8%) women and 169 (42.3%) men. The most common age group

**Table 1**  
Socio-demographic characteristics of the respondents.

Socio-demographic characteristics	<i>n</i>	%
Gender		
Male	169	42.3
Female	232	57.8
Age		
18–25	246	61.5
26–35	75	18.8
36–45	44	11.0
46–55	22	5.5
>55	13	3.3
Civil status		
Bachelor	296	74.0
Married	92	23.0
Divorced	8	2.0
Widower	4	1.0
Level of education		
Primary school	10	2.5
Junior high school	37	9.3
High school	252	63.0
University	101	25.3
Food preparation		
Own	189	47.3
Other	211	52.8

of the respondents was that of 18–25 years old (61.5%). High school respondents were 63.0%. The majority lived alone 296 (74.0%). Around 47.3% ( $n = 189$ ) confectioned their own food, and 52.8% ( $n = 211$ ) ate food prepared by others.

From Table 2, 5% answered that freezing kills all bacteria. Sixty-nine percent correctly answered that the temperature of food in a refrigerator should be at or below 8 °C. Fifty-seven percent correctly identified that food bacteria grow at 37 °C, but 8% answered "Die", and 9.8% answered "Grow slowly". Twenty-six percent thought that pasteurized milk was sterile. In this study, 76.0% of respondents answered that the factor most conducive to multiplication of microorganisms in food was room temperature (Table 2). Respondents with age between 18 and 25 years were more concerned with control temperature and more correctly identified the temperature as an important factor for bacteria growth ( $p = 0.009$ ).

Eighty-five percent of consumers knew that raw and cooked foods should be separated in order to prevent bacterial transference (Table 3). Knowledge of cleaning practices indicated that about 13% thought that detergents and cold water were the best for killing

**Table 2**  
Food poisoning knowledge of 400 consumers.

Questions	Answers	%
Temperature inside a refrigerator should be at or below:	10 °C	11.8
	2–8 °C <sup>a</sup>	69.5
	–18 °C	8.5
	I do not know	10.3
At one's body temperature (37 °C) what will happen to food bacteria?	Die	8
	Do not grow	5.8
	Grow quickly <sup>a</sup>	57.3
	Grow slowly	9.8
	I do not know	19.3
Which of the following is sterile?	Yogurt	11.3
	UHT milk <sup>a</sup>	42.8
	Pasteurized milk	26.5
	I do not know	19.5
	Refrigeration	3.3
The more propitious factor to the multiplication of microorganisms in foods is:	Congelation	2.3
	Ambient temperature <sup>a</sup>	76.0
	Pasteurization	2.5
	Sterilization	0.8
	I do not know	15.3

<sup>a</sup> Expected correct answer.

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