Short communication

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

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A R T I C L E   I N F O

Article history:
Received 3 February 2012 
Received in revised form 8 June 2012 
Accepted 20 June 2012

Keywords:
Cross-contamination 
Foodborne diseases 
Foodborne pathogens 
Knowledge 

A B S T R A C T

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; Jevsnik, 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-Villegas, & 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, & Kendall, 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 (Jevsnik et al., 2008).
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 (Rasper, 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 χ² 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 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) are 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 of respondents 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 microorganisms in foods is:

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

* Expected correct answer.
bacteria. In the matter of washing hands before preparing raw meat consumers responded correctly up to 92.5%.

Over half of the respondents (59%) believed to know whether food was contaminated with pathogenic bacteria, by visual, olfactory or taste checks. The majority (85%) knew that diarrhea was a symptom of foodborne disease. The majority (54.5%) was aware that insects and raw food were sources of bacteria being brought into the kitchen.

Three quarters of the respondents recognized prolonged time of preparation and consumption of mayonnaise increases the probability of proliferation with Salmonella. In this study, 43.8% correctly answered about the causes of foodborne diseases (Table 3). For only 12.5% the raw/undercooked meat would be a problem, whereas 17.5% identified non-pasteurized milk or soft cheese. In 19.0% of the cases raw eggs alone were identified as a cause of foodborne disease. An association was found between being a woman and a correct knowledge about cross-contamination. These results are similar to those found by Haapala and Probart (2004), Jevsnik et al. (2008) and Walker et al. (2003). Since, 47.3% of the respondents prepared their own food, they put in risk themselves and other consumers.

Commercial mayonnaise may be regarded as a safe food when properly handled. Most harmful bacteria die within hours, largely due to the high acidity of mayonnaise. However, in Portugal, mayonnaise is still a hazardous food, as people traditionally continue to use and make it with unpasteurized eggs. In addition, the prevalence of Salmonella in the country is very high (Correia, Gonçalves, & Saraiva, 2004; Little et al., 2007). Furthermore, this homemade mayonnaise, unlike the commercial ones, might not contain enough salt and vinegar to avoid the growth of harmful bacteria. Three quarters of the participants in our study recognized mayonnaise as a food of high risk, associating it to contamination with Salmonella. In a study by Angelillo, Viggiani, Rizzo, and Bianco (2000), on the identification of foods that can cause disease, most of the respondents pointed foods prepared with raw eggs as the answer. This awareness may be due to outbreaks of Salmonella, in the late 1980s, in foods that contained eggs. In this same study, authors also identified raw meat as the main vehicle for foodborne diseases.

Several published studies (Howes, McEwen, Griffiths, & Harris, 1996, Powell, Attwell, & Massey, 1997) indicate that level of school education could increase the knowledge about food safety, but this does not always lead to positive change of behavior on food handling (Rennie, 1995).

According to our results, women had more accurate knowledge on how to avoid cross-contamination. These results are consistent with those found by investigators Sharif and Al-Malki (2009), who claim that women have a higher knowledge about cross-contamination of food than men. In many societies, women are better informed about the proper methods of food storage and manipulation, revealing a considerable concern on the subject (Karabudak et al., 2008). This happens mostly because women are usually the ones that cook for their family, even the ones that work outside their homes.

The role of information is crucial to the attention of food safety assessment. However, our study shows that consumers with a high school level of education had more knowledge than holders of bachelor or master degrees. Nevertheless, this difference may rely on the fact that those degrees were obtained in study areas not linked with food safety.

The results of this study reveal that the knowledge of food pathogenic agents is low, since 30% of participants failed to identify today have more access to TV and internet and do share knowledge with each other. Nowadays, these issues are being increasingly introduced in schools, through awareness campaigns, papers done by students, and schools also taught specific subjects in this area.

A study in the 1990s stated that people relied more on books than on governmental sources for information about food safety (Buzby & Ready, 1996). A decade later, respondents to another survey in the United States of America reported that they used to obtain information about food safety firstly in newspapers, television and radio (Ralston, Brent, Starke, Riggins, & Lin, 2002). According to these authors, TV access and use is easier these days for young people, so it is normal that they are more comfortable to understand issues related to food safety, such as temperature as the most conducive factor to the multiplication of food pathogens.

In our investigation, 66% of consumers said that the methods of detection of food contamination are mainly visual inspection, smell or taste. Results showed clearly that most consumers did not understand that the organoleptic evaluation of food is insufficient to identify contamination by pathogens. Consequently, they relied on incorrect physical attributes for food safety. These results are similar to those found by Haapala and Probart (2004), Jevsnik et al. (2008) and Walker et al. (2003). Since, 47.3% of the respondents prepared their own food, they put in risk themselves and other consumers.

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any organism when confronted with a list. However, we can see that 50% of respondents correctly identified at least three pathogenic agents. These results are consistent with those of Angelillo et al. (2000). In a study performed by Santos (2006), about 60% of respondents recognized only one pathogen agent that can cause food poisoning. Our work suggests that the population does not have good knowledge about agents that can cause diseases with food origin, so it is necessary to promote further training and information in this area. The knowledge about food pathogenic agents is important to put in practice the recommended behavior actions against those pathogens.

5. Conclusion

The results show a high level of knowledge on foodborne diseases in general. However, there are gaps associated to age and lower level education groups. With the current low knowledge revealed by people aged more than 25 years as well as by individuals with lower level education, consumers’ education on foodborne diseases should be given in different ways to different groups in northeastern Portugal.

Acknowledgments

To the population of Mirandela, whose participation has made this study possible. The work was supported by the strategic research project PEst-OE/AGR/UI0772/2011 financed by the Foundation for Science and Technology (FCT), Ministry of Education and Science, Portugal.

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