



## Essential tools for food safety surveillance in catering services: On-site inspections and control of high risk cross-contamination surfaces



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### ABSTRACT

The aim of this study was to assess the routine food safety procedures carried out in catering services so as to provide a useful monitoring program for managers based on the relevant deviations detected in the observational survey and activities carried out in 15 catering services located in Navarra (region of northern Spain). The main hygiene standards, food handler practices and compliance with the HACCP system were evaluated by means of visual inspections (checklist), monitoring of critical control points (food storage and food processing temperatures, total polar compounds) and microbiological analysis of food-contact and hand-contact surfaces. While general high scores were obtained in the observational survey (73.3% above 36 points), none of the evaluated services had obtained the maximum rate of 48 points. The mayor deficiencies were related to the presence of dirty uniforms, improper hand washing or use of gloves, incorrect disinfection of vegetables and the missing records of stated critical points (temperatures and polar compounds in oil). The performed monitoring activities confirmed the safety of frying oil in all the kitchens, despite the fact that only 33% of them applied scientific methods to measure polar compounds. By contrast, holding temperatures were unsatisfactory in 77% of cold dishes and in 19% of hot meals. Despite the fact that 77% of food contact surfaces were considered acceptable (<4 CFU/cm<sup>2</sup>), high levels of total mesophilic microorganisms and *Enterobacteriaceae* were detected in hand-contact surfaces such as aprons and handles. The periodic visual supervision focusing on hygienic practices and the microbiological surveillance of surfaces of high risk for cross-contamination should provide valuable information for improving the knowledge, attitudes and practices of food handlers regarding food safety.

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### 1. Introduction

Foodborne diseases are still a major concern to the European governments, taking into account that 60% of foodborne outbreaks in Europe occur outside the home and 22% take place in collectivities (EFSA, 2015). Therefore, the impact of catering services on health is determinant, especially when the target population of food supply is made up of vulnerable groups such as users of childcare, schools, hospitals and nursing homes (Albrecht & Nagy-Nero, 2009). In order to protect the health of consumers, the current European regulatory framework requires food business

operators to implement and maintain ongoing procedures based on HACCP principles (EC, 2004).

The first step in achieving an effective HACCP system is to establish solid prerequisite programs (Henroid & Sneed, 2004), considered to be an indispensable tool for successful implementation of a self-control system (Liz Martins & Rocha, 2014). Various documents and guidelines have been developed to facilitate the implementation of prerequisite programs and HACCP in catering services according to the characteristics and needs of small establishments (Mortimore, 2001; Taylor, 2008). However, difficulties in the implementation of these food management systems in small and medium catering establishments have been reported by several authors (Banati & Lakner, 2012; Baş, Yuksel, & Cavusoglu, 2007; Garayoa, Díez-Leturia, Bes-Rastrollo, García-Jalón, & Vitas, 2014; Herath & Henson, 2010). The wide variety of dishes, limited human resources, insufficient knowledge, low motivation of

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employees and inadequate or outdated facilities are some of the reasons for the failure in developing HACCP systems. Consequently, incorrect food preparation practices such as poor hygiene (especially inadequate hand washing), cross-contamination between raw and cooked foods, improper heating and/or storage of food are recurrent problems reported in the catering sector (Baş, Ersun, & Kivanç, 2006a; Herath & Henson, 2010; Liz Martins & Rocha, 2014; Panisello & Quantick, 2001; Tavakkoli et al., 2015) that can contribute to foodborne outbreaks. Thus, the promotion of personal hygiene and good handling practices are postulated as the major preventive actions for pathogen transmission from food handling personnel to the final consumer (Smigic et al., 2016) and in particular, adherence to proper hand hygiene is crucial for reducing foodborne diseases (Pragle, Harding, & Mack, 2007). In addition, microbiological analyses of surfaces have been proposed to assess the effectiveness of cleaning and disinfection operations (Balzaretto & Marzano, 2013; Domenech-Sanchez, Laso, Perez, & Berrocal, 2011).

Therefore, there is a need to develop easy procedures that allow managers to perform effective surveillance programs in catering services to ensure the quality of prepared foods. The main objective of this study was to assess the procedures carried out in catering services located in Navarra (a region of northern Spain) through on-site inspections and different monitoring activities in order to provide useful information based on the observed recurrent deviations that can be used by the managers to improve training in food safety subjects.

## 2. Material and methods

### 2.1. Design of the study

The study was carried out from September 2014 to June 2015 and involved 15 catering services located in the region of Navarra (Spain). All these establishments have implemented the HACCP system and usually prepare 50 to 300 daily meals for schools ( $n = 6$ ), business companies ( $n = 4$ ) and the healthcare sector ( $n = 5$ ). Foodservices offered a daily menu of at least three dishes (including starters and main courses). All meals were prepared, distributed and consumed in the same day.

The same trained person visited each foodservice once during the study. Food handlers were unaware of the date of the visit and the inspections were carried out while the food handlers were doing their routine activities. The on-site inspection consisted of data collection using a checklist, monitoring of temperatures, control of polar compounds in frying oil, and sample collection of surfaces for microbiological analyses.

### 2.2. Observational survey (checklist)

A specific checklist was developed, including 54 items for assessing the prerequisites and activities related with the implementation of HACCP, according to Spanish Legislation (BOE, 1989; BOE, 2001). It was divided into the following categories: general information (number of meals, characteristics of the establishment), food handlers hygiene (staff uniform, hand washing, absence of jewelry, etc.), food handling activities (defrosting, use of utensils for different activities, cross-contamination of food, etc.), equipment and facilities (thermometers, presence of kitchen towels, clean surfaces, cleaning records, etc.), frying oil (oil type, method to control polar compounds, control records) and storage conditions (temperatures, organization, absence of expired products, absence of products on the floor, etc.).

With the exception of questions related to general information (answered by the person in charge of foodservices), all of the items

were completed through on-site observation. They were based on yes/no answers (score 1/0, depending on the compliance or noncompliance of the observed item) and measured as frequencies (occurrence of observed attribute). All of the checked items had the same point value, so each kitchen could achieve a maximum overall score of 48.

### 2.3. Monitoring of temperatures and polar compounds

In addition to recording the temperature of refrigerators and freezers shown in the display of each chamber, we measured the temperatures of products stored in three different areas of the chamber using an infrared thermometer RayTemp 3 (ETI Ltd, Easting Close, United Kingdom). In order to assess storing temperature compliance, we used the following criteria:  $\leq 4$  °C for products under refrigeration (some establishments only had one storage chamber for raw and cooked meals) and  $\leq -18$  °C for freezing products.

We checked the temperature of prepared meals in the center of the product using a calibrated thermometer (Checktemp 1, Hanna Instruments, Spain). According to Spanish legislation (BOE, 2001), the following criteria were established: hot meals:  $\geq 65$  °C until the time of consumption, and chilled meals:  $\leq 8$  °C (consumption was performed in all cases in less than 24 h).

Food handlers were asked to heat the oil until it reached the range of 160 °C to 180 °C. Once heated, the measuring instrument FOM 320 (Ebro-electronic, Ingolstadt, Germany) was dipped into the oil and stirred in order to measure the percentage of total polar compounds. The maximum limit allowed is 25% (BOE, 1989).

### 2.4. Surfaces: sample collection and microbial analysis

We collected a total of 93 samples, including food contact surfaces ( $n = 30$ ; serving trays and cutting boards) and hand-contact surfaces ( $n = 63$ ; aprons and door handles).

The food contact surfaces were sampled with the premise that they were clean and ready to use at the time of sampling. These samples were collected by using Rodac contact plates containing Plate Count Agar (PCA; Scharlau, Sentmenat, Spain) and were incubated at  $30 \pm 1$  °C for  $72 \pm 3$  h for the enumeration of total mesophilic aerobic microorganisms. The hand-contact surfaces were sampled during daily activity and therefore, they had previously been handled or touched by workers. Each surface was swabbed using a 5 cm  $\times$  5 cm sterile template (Evancho, Sveum, Moberg, & Frank, 2001). The swab head was immersed into 3 ml of peptone saline solution and ten-fold serial dilutions were carried out for the enumeration of microorganisms in the following conditions: total mesophilic aerobic microorganisms in PCA (Scharlau) at  $30 \pm 1$  °C for 72 h and *Enterobacteriaceae* in Violet Red Bilis Glucose Agar (VRBG, Scharlau) at  $37 \pm 1$  °C for 24 h. Results were expressed as CFU/cm<sup>2</sup>.

According to internal criteria previously established (Garayoa et al., 2014), a limit of 1 CFU/cm<sup>2</sup> for utensils and equipment in direct contact with the prepared meals (serving trays) and a limit of 4 CFU/cm<sup>2</sup> for work surfaces and utensils in contact with raw food (cutting boards) were established. However, for hand-contact surfaces, a maximum criterion of 100 CFU/cm<sup>2</sup> was established due to the lack of agreement between different authors (Domenech-Sanchez et al., 2011; Forsythe, Hayes, & Sanz Pérez, 2002; MAPAQ, 2009; de Oliveira et al., 2014).

### 2.5. Statistical analysis

All statistical analyses were implemented in STATA version 12.1 (StataCorp LP, College Station, Texas). The means, percentages and

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