



Food safety in the domestic environment



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ABSTRACT

The main purpose of this work was to evaluate the significance of food safety in domestic environments. In this study, several points in 15 houses (handles of doors, refrigerators and dishwashers, cooking stove knobs, surfaces of preparation of foods, taps and kitchen towels, as well as from domestic animals' feet that usually have access to the kitchen area, and WC knobs and taps) were sampled and tested for detection and quantification of *Enterobacteriaceae*, *Staphylococcus* coagulase-positive, *Escherichia coli*, *Listeria* spp. and *Campylobacter* spp. A questionnaire was also prepared and administered to the person responsible for domestic tasks in order to evaluate their experience of hygienic practices. The results showed a total of 125 *Enterobacteriaceae* spp. isolates, 86 *Staphylococcus* coagulase-positive isolates, 5 *Listeria* spp., 13 *E. coli* isolates and no *Campylobacter* spp. was found. Most of the isolates were found distributed by the entire house, with handles, knobs and domestic animals' feet being the points more contaminated. Also, there was no relation between the answers to the questionnaires administered and the microbiological results obtained. These results revealed the need to develop some education campaigns designed to educate consumers in good hygiene practices at home.

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1. Introduction

According to the World Health Organization, foodborne diseases directly affect millions of people every year in the world (WHO – World Health Organization, 2000, pp. 198). The reduction of these diseases is one of the main goals in national and international food safety programmes.

In the European Union (EU), one third (36.4%) of reported foodborne outbreaks are caused by improper handling of food in households, followed by restaurants, cafes, bars, hotels (20.6%), schools and kindergardens (5.5%) (EFSA, 2011). Home-based outbreaks are not often identified nor reported which then underestimates the real situation (Fischer, Frewer, & Nauta, 2006; Scott, 1996).

Because of its nature, the domestic environment is a multifunctional place and this has a direct impact on the need for food safety improvement. First of all, the domestic environment contains occupants of assorted ages and diverse health status. Particularly, the emergent elderly and immunocompromised populations living at home are often at a higher risk of the acquisition of foodborne diseases as well as for a more severe disease outcome (Jevšnik et al., 2013; Scott, 2003). Inappropriate hand washing, food handling and preparation, short cooking times and long storage in non-

appropriate conditions at home, can all permit proliferation of microorganisms. These are thought to be the cause of a significant amount of foodborne illness, in the domestic environment (Fischer et al. 2006; Scott, 1996). Pathogenic microorganisms are being carried to our homes through people, food, domestic animals, contaminated water and by air. These microorganisms are then disseminated to various surfaces throughout the home by cross-contamination, indicating the need for behavioural changes in our daily life (Gorman, Bloomfield, & Adley, 2002). So, the consumer, as the last link in the food supply chain, plays an important role in the prevention of foodborne diseases and is responsible for proper food handling from purchase to the home food preparation (Jevšnik, Hlebec & Raspor, 2008; Jevšnik, Hoyer & Raspor, 2008; Kennedy et al., 2005; Redmond & Griffith, 2003). Consumers must know and be aware of the need for good hygiene practices at home to prevent the occurrence of infectious diseases (Hillers, Medeiros, Kendall, Chen, & DiMascola, 2003), and then need to be motivated to act on that knowledge as a precondition for behavioural change (Medeiros et al., 2004). One of the biggest problems in achieving these improvements are educating the public and promoting behavioural changes. As demonstrated by Redmond and Griffith (2004) judgements of 'optimistic-bias' and the 'illusion of control', as well as notions of perceived invulnerability to food poisoning from home-prepared foods – "it only happens to others" – are common among consumers.

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Taking this into account, the aim of this study was to evaluate home hygiene taking microbiological samples from different points from 15 private homes and designing a questionnaire, related with their cleaning habits and food safety.

2. Material and methods

2.1. Sampling

In this work, 15 private houses were investigated and swabs were taken from defined points in each home: handles of doors, refrigerators and dishwashers, cooking stove knobs, surfaces used for preparation of foods, taps and kitchen towels, WC knobs and taps and from domestic animals' feet that usually have access to the kitchen area. Swabs from each site were taken after the normal daily cleaning of the house, using one cotton swab moistened with Buffered Peptone Water (BPW, Oxoid) and examined for *Enterobacteriaceae*, *Escherichia coli* and *Staphylococcus*, Bolton Broth (Biokar Diagnostics) for *Campylobacter* spp. and half-Fraser broth (Biokar Diagnostics) for *Listeria* spp. All samples, in total 175, were transported to the laboratory in a refrigerated box and analysed as soon as they arrived in the laboratory (within 24 h).

2.2. Microbiological analyses

The detection of *Campylobacter* spp. and *Listeria* spp. was performed according to International Standard Organization (ISO) 10272-1 and ISO 11290-1 methodology, respectively. Enumeration of coagulase-positive *Staphylococcus* and *E. coli* was performed according to the ISO 6888-1 and ISO 16649-2 methodology, respectively. *Enterobacteriaceae* enumeration and detection were performed according to the ISO 21528-2 methodology.

2.3. Questionnaire

A questionnaire was designed with questions related to food safety and cleaning habits, and was administered to the responsible persons in each house, without any supervision.

This questionnaire included the following questions:

- Is there any domestic animal in your house?
- When you use WC do you wash your hands always, most of times, rarely or never?
- In the kitchen area do you usually wash your hands when you go to WC, handle raw, cooked or ready to eat food?
- How often do you usually clean knobs (doors, refrigerator, dishwasher)?
- How often do you usually clean taps?
- How often do you usually clean the kitchen counter and stove buttons?
- Do you use kitchen cloths?
- Do you have different cutting boards for vegetables, meat, fish, cooked and raw food?
- Do you have any kind of doubt about proper food safety behaviours?

All the data was only evaluated in order to find if reported behaviours are reflected in microbiological results.

3. Results and discussion

The 2003 World Health Organization (WHO) report concluded that about 40% of reported food-borne outbreaks in the WHO European Region occur in private homes (reviewed by Bloomfield, Exner, Fara, & Scott, 2008). Therefore it is important to know how to prevent contamination and to know where the contamination occurs.

Fig. 1 shows *Enterobacteriaceae* counts by locality and there was a variation in results, with a high percentage of no counts and $<10^2$ CFU/swab and some places with high isolation rates ($>10^2$ CFU/swab). Localities such as domestic animals' feet, kitchen tap, and kitchen counter, cooking stove knobs, refrigerator and dishwasher handle or kitchen cloth, showed levels of contamination $>10^5$ CFU/swab. It is clear that *Enterobacteriaceae* are distributed all around the house, which is in agreement with results obtained by Curtis et al. (2003) that proved that faecal contamination of the domestic environment does occur, since faecal coliforms were found at a number of sites, not only in toilets and bathrooms but also in kitchens and on a variety of objects. Also,

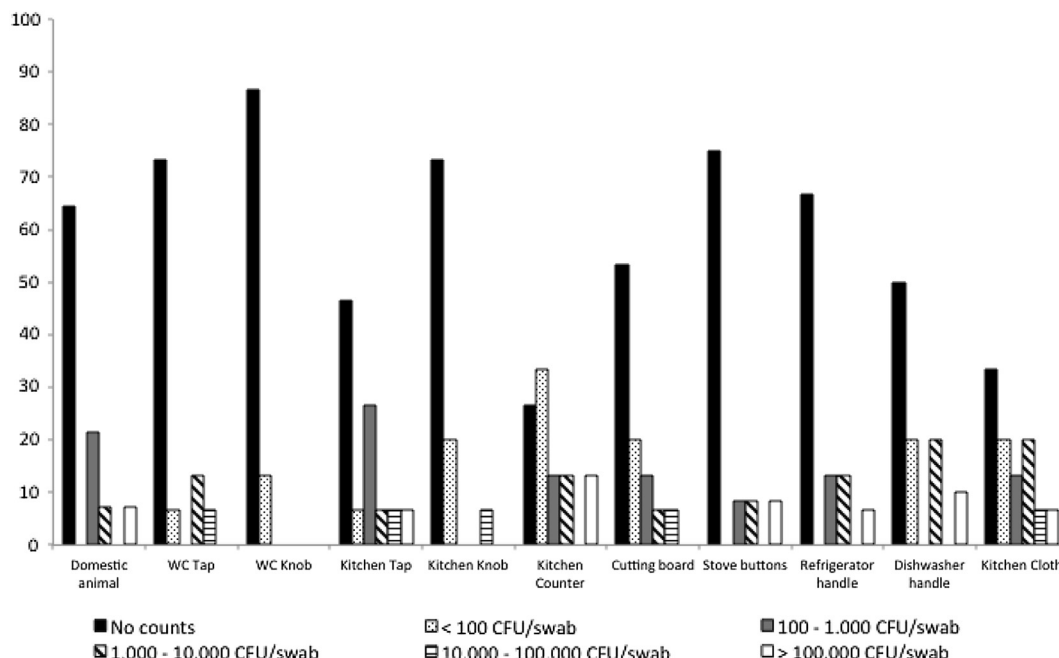


Fig. 1. Percentage (%) of several points in the domestic environment with counts of *Enterobacteriaceae* within given ranges.

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