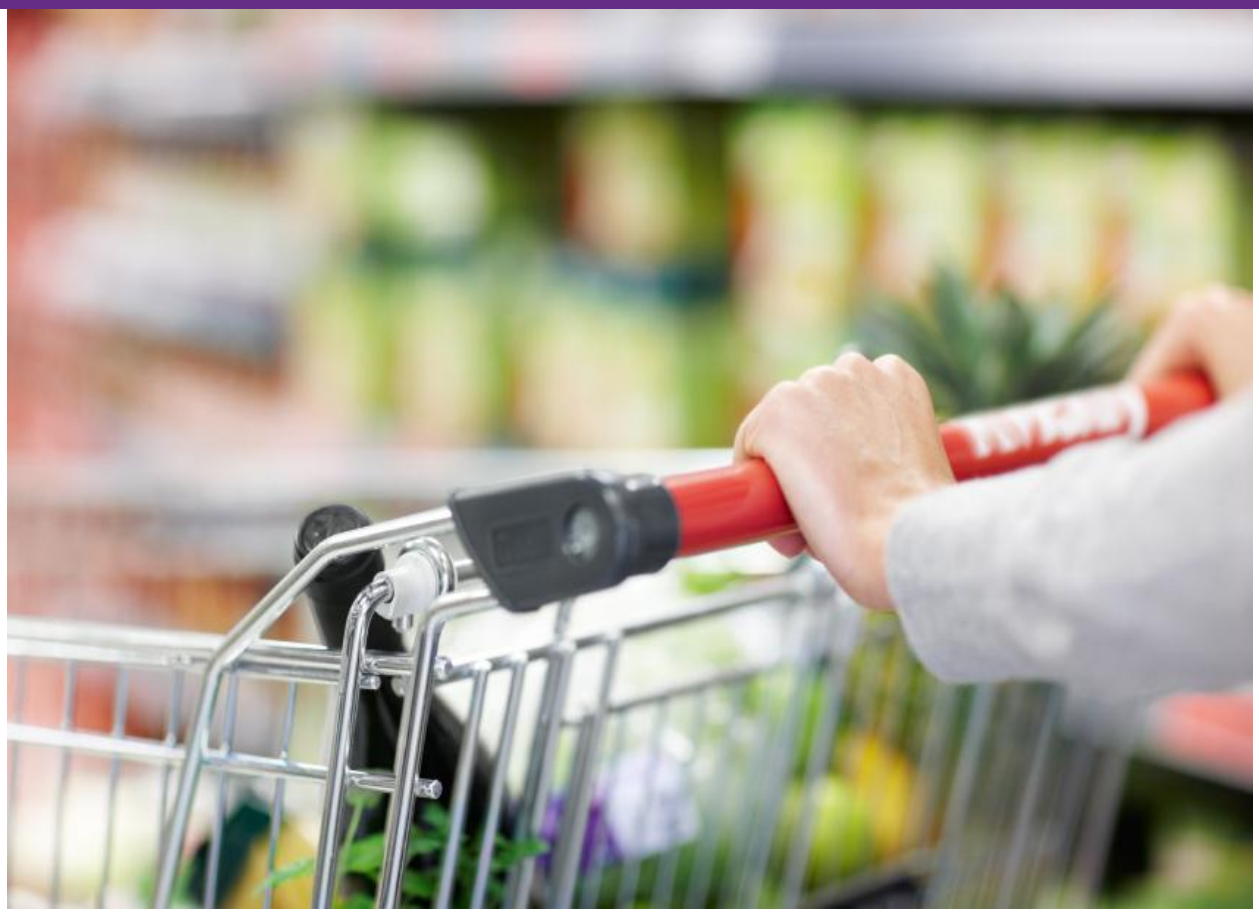
safefood

An Assessment of the Microbiology of Hand Contact Surfaces in the Retail Environment

Environmental Health Service Training Exercise



be safe be healthy be well

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- The staff at the Waterford and Dublin Public Health Laboratories who examined the samples
- The management and staff at the participating retail premises.

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1 Summary

This study aimed to assess the microbiology of food and hand contact surfaces in the retail environment and the potential for these surfaces to act as vehicles for the spread of foodborne pathogens. During the survey, 10 stores in the Republic of Ireland (ROI) were visited by student Environmental Health Officers (EHOs) who took swab samples from four surfaces: conveyor belts, long-life shopping bags, shopping trolley handles and keypads on card payment units. The swab samples were examined for the presence of the pathogens *Salmonella, Campylobacter* and *Listeria*. The Aerobic Colony Counts, as well as the levels of *E. coli* and Enterobacteriaceae, were also determined. In addition, structured questionnaires were used with retailers to establish the stores' regimes for the cleaning of conveyor belts. Similarly, shoppers donating their long-life shopping bags for sampling were questioned about how they normally use these bags, and the results were compared with those from the microbiological survey. The results indicated that the hygiene of the surfaces sampled was good, with *Salmonella, Campylobacter* and *Listeria* not detected in any of the samples, and levels of both Enterobacteriaceae and *E. coli* were below the limits of detection in all but one sample. Aerobic Colony Counts varied but none of the results obtained would be deemed 'unacceptable' or 'unsatisfactory' under guidelines for ready-to-eat foods. The responses to the hygiene questionnaires showed good hygiene practices in place in the supermarkets visited, with all conveyor belts reportedly cleaned at least once a day. Overall, this short survey of 10 supermarkets did not highlight any cause for concern or potential for transfer of foodborne pathogens from the surfaces sampled to foods or to customers' hands.

2 Introduction

Over the years, food retail outlets have implemented improved systems for microbiological food safety. In most cases, this required the application of Hazard Analysis and Critical Control Point (HACCP) systems[1] for food prepared on the premises. HACCP is a systematic approach to identifying and putting in place controls for all potential food safety hazards, and would include the implementation of practices to ensure the separation of raw and cooked food items. As the source of food poisoning is frequently unknown, it is vital that measures are in place to ensure the safety of our food at every stage of the food chain, from production, storage and distribution, through to sale to the final consumer.

The foods purchased by consumers often come into contact with a number of surfaces that may not be considered food contact surfaces in the traditional sense. These surfaces include the conveyor belts at cash registers and long-life shopping bags. Hand contact surfaces such as money, shopping trolley handles and the drawers of cash registers may also be a source of microbial contamination. The purpose of this study was to investigate the potential for food contamination due to surface contacts encountered while shopping. These surfaces included the conveyor belts at cash registers, long-life shopping bags, shopping trolley handles and keypads on card payment units. A previous study[2] in UK butcher shops in 2002 showed the potential for contamination from raw to cooked food, even when cleaning regimes were in place. Another study[3] of currency in Nigeria in 2007 found high rates of microbial contamination of paper currency, which the authors concluded, represented an infection hazard for consumers, and additionally emphasised the importance of adequate hand-hygiene and hand-washing protocols. The intention of this study was to fill a knowledge gap concerning the microbiological status of the surfaces described above, and to use the data to highlight the importance of hand-washing in limiting the transmission of foodborne disease, thus providing retailers with useful information regarding hygiene regimes and adequate cleaning of these surfaces to prevent cross-contamination.

3 Methodology

The survey was conducted during June and July 2011. In total, 10 stores were visited by student EHOs in the Republic of Ireland, following a defined protocol. In each store the store manager, or designated staff member, as well as three customers, were interviewed and hygiene questionnaires completed (Appendix 2). During the visit, swab samples were taken from the four surfaces under investigation - conveyor belts, long-life shopping bags, shopping trolley handles and keypads on card payment units – with a total of 63 samples taken in each premises.

These samples were analysed for a number of microbiological parameters in order to assess the potential for transmission of foodborne illness through contact with these surfaces. The conveyor belts, long-life shopping bags and the shopping trolley handles were swabbed and subsequently analysed to determine the Aerobic Colony Count and the levels of *E. coli* and Enterobacteriaceae, indicator organisms which do not cause illness but whose presence may indicate poor hygiene and faecal contamination.

The surfaces were also tested for the presence of the pathogens *Salmonella, Campylobacter* and *Listeria*.

The keypads for card payment units were swabbed and tested for Aerobic Colony Counts and the presence of *E. coli* and Enterobacteriaceae.

The EHOs completed a hygiene questionnaire in each store, which recorded the visual appearance of the conveyor belts sampled. Details of the protocols used for their cleaning and the frequency of cleaning were also recorded, through a structured interview with the store manager or other designated staff member.

To obtain samples from long-life shopping bags, three customers in each store were offered two ***safe***food long-life shopping bags in exchange for their own bag, which was then tested by swabbing. A questionnaire was used with customers to establish their usage of long-life shopping bags and other relevant information. The swab samples were dispatched to the Waterford and Dublin Public Health Laboratories for analysis and the results, along with the completed questionnaires, were returned to ***safe***food by the student EHOs. The results were then analysed and the questionnaire responses collated.

4 Results and discussion

The results of the samples tested showed that none of the pathogens *Salmonella, Campylobacter* and *Listeria monocytogenes* was detected in any sample. *Salmonella* and *Campylobacter* are the two main causes of bacterial foodborne illness. *Listeria* is a pathogen which rarely causes illness in healthy populations, but can be dangerous for certain groups, including pregnant women, those who are immune-compromised and the elderly.

Results also showed that the indicator organisms, *E. coli* and Enterobacteriaceae were not detected (<1 cfu/cm^2), except for one customer's canvas shopping bag, which gave a result for Enterobacteriaceae of 3 cfu/cm^2. Results of all samples for Aerobic Colony Counts ranged from < 1 to 4,900 cfu/cm^2. Aerobic colony counts of between <10 and < 10^6 cfu/gram, depending on the food type, and Enterobacteriaceae counts of <10^2 cfu/g are considered satisfactory for ready-to-eat foods.

The absence of any of the three pathogens is reassuring, and indicates that this aspect of food retailing represents a low risk of exposure to foodborne illness caused by these organisms. Similarly, the levels of the indicator organisms, *E. coli* and Enterobacteriaceae, below the limits of detection of 1 cfu/cm^2, suggests that the microbiology of these surfaces is not a cause for concern, as the presence of these organisms would indicate possible faecal contamination. The Aerobic Colony Count gives an estimate of the total number of recoverable bacteria present on the surfaces. The results show that of the 118 samples tested, 28 were below the limits of detection with counts of < 1 cfu/cm^2.

The other samples had counts ranging from 1 cfu/cm^2 to 4,900 cfu/cm^2.

Only four samples had counts exceeding 1,000 cfu/cm^2 and 80 samples had counts of <100 cfu/cm^2, see **Chart 1**.

The highest counts for the four sampling points were:

- 460 cfu/cm^2 on key pads on card payment units
- 1,000 cfu/cm^2 on shopping trolley handles
- 150 cfu/cm^2 on conveyor belts
- 4,900 cfu/cm^2 from shopping bags.

Even the highest count overall, from a sample taken from a customer's plastic shopping bag, is not a cause for concern as this level would not be considered unsatisfactory in 1 gram of a ready-to-eat

food. Unfortunately, there was no customer questionnaire information available from the owner of the bag from which an Enterobacteriaceae count of 3 cfu/cm^2 was detected, but of the other customers surveyed, eight did indicate that they also used their shopping bags to carry items such as shoes, which could be a vehicle for faecal contamination, Table 1. Only two customers reported any washing of their shopping bags, and there was no significant difference in results regardless of whether raw meat was packed separately or not.

Chart 1. Aerobic Colony Counts for all samples

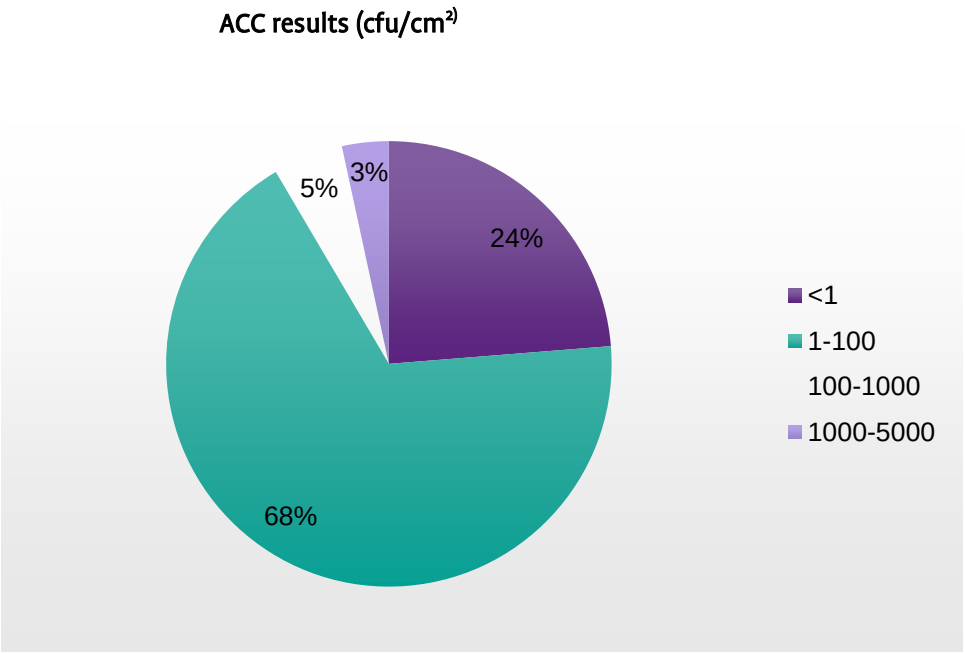

Table 1. Responses to customer hygiene questionnaire

	Yes	No
Do you ever clean or wash your bags?	2	16
Do you use your bags for items other than food?	8	10
Do you pack raw meat separately from other foods?	10	8

5 Conclusion

The results from this survey are reassuring for consumers and retailers, as none of the surfaces sampled yielded results which would indicate a food safety risk. Using the criteria for assessing the microbiological quality of ready-to-eat foods[4] as a useful way to interpret the data, these results would all be deemed 'acceptable', indicating that the risk of transmission of foodborne illness from this part of the food chain is low. The result from the retailer questionnaires showed a good awareness of the need for hygiene, as all questioned reported at least once daily cleaning of the checkout conveyor belts with a sanitiser. One outlet cleaned the belts twice daily, while another claimed it was done three to four times daily. Only four of the 30 conveyor belts examined were observed to be visually dirty.

The results from the key pads on card payment machines were not a cause for concern, as most had very low Aerobic Colony Counts. Even the customers' long-life shopping bags, which could be considered a risk due to their use for items other than shopping, did not yield any unsatisfactory results. Since the introduction of a levy on disposable shopping bags was introduced in ROI in March 2002, most shoppers use their own long-life bags. This survey shows that there is no indication that the use of these bags poses a food safety risk. Likewise, the move to cashless shopping with the wider use of card payment units with keypads, which are handled by both customers and retail staff, does not appear to increase the risk of transfer of pathogens to customers hands, and then potentially to food.

The results from the hygiene questionnaires indicate that good hygiene practices are in place in supermarkets, with regard to conveyor belts at checkouts. However, we know from a previous FSAI survey[5] that *Campylobacter* can be found on the outside surface of poultry packaging as well as on retail display chill cabinets, and therefore it is important that retailers implement and maintain appropriate hygiene regimes for surfaces that may come into contact with packaged poultry or other raw meat products.

The responses from the customers in the questionnaires show good awareness of the need for hygiene. However, given that just under half of the customers questioned reported that they do not pack raw meat separately from other foods, further guidance to consumers on measures to avoid cross-contamination may be useful. It may also be beneficial for retailers to ensure that bag packers (e.g. charity collectors) have received some training or guidance on how to pack foods appropriately.

Overall, the results of the survey are encouraging, although the importance of good food hygiene practices should continue to be promoted amongst retailers as well as consumers.

6 References

[1] Guidance Note No. 23 Development and Assessment of Recognised National Voluntary Guides to Good Hygiene Practice and the Application of HACCP Principle. (2007). FSAI.

[2] Worsfold, D and Griffith, C.J. (2002). An assessment of cleaning regimes and standards in butchers' shops. Int. J. Environ. Health Res., 11(3), 245 – 256.

[3] Umeh, E.U., Juluku, J.U. and Ichor, T. (2007). Microbial contamination of 'Naira' (Nigerian currency) notes in circulation. Res. J. Env. Sc., 1(6), 336 –339.

[4] Health Protection Agency. (November 2009). Guidelines for assessing the microbiological safety of ready-to-eat foods. London: Health Protection Agency.

[5] Prevalence of *Campylobacter* spp. on Chicken Packaging and Retail Display Cabinets (June 2010) Food Safety Authority of Ireland.

7 Appendix 1

Protocol for an Assessment of the Microbiology of Hand Contact Surfaces in the Retail Environment

Sampling

At each premises, the following points will be sampled:

- 3 x conveyor belts – a 10cm x 10cm area, using templates
- 3 x chip and PIN machines (i.e. PIN entry pads)
- 3 x shopping trolley handles
- 3 x long-life shopping bags - a 10cm x 10cm area, using templates

Total no. of sampling sites per store: 12

(4 swabs to be taken at 9 sampling sites)

(1 swab only to be taken at each of the 3 Chip and PIN pads sampling sites)

(a) For the conveyor belts, shopping trolley handles and long-life shopping bags (3 of each to be sampled):

At each sampling point **4** swab samples to be taken:

- 1 for aerobic colony count, enumeration of *E. coli* and Enterobacteriaceae (test tube swab)
- 1 for detection of *Salmonella* spp. (sponge swab)
- 1 for detection of *Listeria monocytogenes* (sponge swab)
- 1 for detection of *Campylobacter* spp. (sponge swab)

This means you will have

- 12 samples from conveyor belts
- 12 samples from long-life shopping bags
- 12 samples from shopping trolley handles

from each store. i.e. **36 swabs**

(b) For chip input pads:

- 1 test tube swab only to be taken at each sampling point, for aerobic colony count, enumeration of *E. coli* and Enterobacteriaceae

i.e. **3 swabs** from chip input pads per store

Total no. of swabs per store: 39

Questionnaires and handling of samples

- Hygiene questionnaire – One hygiene questionnaire should be completed for each store visited.
- Long-life shopping bags – Customers should be offered two new bags in place of the bag to be sampled.
- Transport and storage of samples: All swab samples should be stored and transported to the laboratory according to the FSAI–HSE Guidance on Sampling of Food for Microbiological testing.

8 Appendix 2

Hygiene questionnaire

Date _____

Premises _____

Address_____

_____

Staff member interviewed: Name_____

Position_____

Does the store have a cleaning regime for conveyor belts at checkouts?

yes/no

If yes, please give details including frequency of cleaning and type of detergent/sanitiser used _____

_____

Conveyor belt 1:

1. Visual appearance (clean/dirty) _____

2. Date and time when this surface was last cleaned_____

3. Details of cleaning carried out_____

Conveyor belt 2:

1. Visual appearance (clean/dirty) _____

2. Date and time when this surface was last cleaned_____

3. Details of cleaning carried out_____

Conveyor belt 3:

1. Visual appearance (clean/dirty) _____

2. Date and time when this surface was last cleaned_____

3. Details of cleaning carried out_____

Customer questionnaire

[Customers should be reassured that we don't require names or contact details, each customer should be offered two new bags in exchange for their own bag]

Customer 1

1. Type of long-life bag: plastic / canvas / fabric / other
If other, please specify_____

2. Do you ever clean or wash your bag? yes / no
If yes, indicate frequency and method of cleaning _____
_____

3. Do you ever use your bag for carrying items other than food? yes / no
If yes, please specify_____

4. Do you pack items such as raw meat separately from other foods? yes / no
If yes, is a specific bag used for this purpose? yes / no

Customer 2

1. Type of long-life bag: plastic / canvas / fabric / other
If other, please specify_____

2. Do you ever clean or wash your bag? yes / no
If yes, indicate frequency and method of cleaning _____
_____

3. Do you ever use your bag for carrying items other than food? yes / no
If yes, please specify_____

4. Do you pack items such as raw meat separately from other foods? yes / no
If yes, is a specific bag used for this purpose? yes / no

Customer 3

1. Type of long-life bag: plastic / canvas / fabric / other
If other, please specify_____

2. Do you ever clean or wash your bag? yes / no
If yes, indicate frequency and method of cleaning _____
_____

3. Do you ever use your bag for carrying items other than food? yes / no
If yes, please specify_____

4. Do you pack items such as raw meat separately from other foods? yes / no
If yes, is a specific bag used for this purpose? yes / no

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