

# *Food Safety Knowledge, Microbiology and Refrigeration Temperatures in Restaurant Kitchens on the island of Ireland*





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***A study commissioned by safefood***

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# Summary

A population-based telephone survey conducted in 2002 estimated that there were 3.2 million episodes of acute gastroenteritis on the island of Ireland each year (Scallon et al., 2004). It is often very difficult to definitively identify the source of illness. However, of the respondents in that study suspecting food as the reason for their illness, 74% blamed food consumed from commercial premises such as restaurants, cafés, takeaways, canteens and pubs. Within the food services industry, statistics show a significant level of prosecutions, prohibition and closure orders of restaurants for food hygiene offences.

The Food Safety Authority of Ireland has identified the main contributory factors to foodborne infections to be: cross-contamination, inadequate cooking, inadequate storage, inadequate reheating, delayed serving and infected food handlers (FSAI, 2000). Development of appropriate training and education campaigns to target problem areas requires initial understanding of the current level of food safety knowledge and practices in the food services industry. This study was undertaken to:

1. Establish the areas where food safety knowledge is lacking among head chefs and catering kitchen managers
2. Assess hygiene within restaurant kitchens and to determine the incidence of bacterial contamination in the catering kitchen environment
3. Establish the refrigeration temperature in restaurant refrigerators
4. Identify key areas where restaurants could improve hygiene/food safety

## Methods

A total of 200 restaurants throughout the island of Ireland volunteered to participate in the study. The investigation comprised four elements:

1. The person responsible for food safety (e.g. head chef) was interviewed using a structured questionnaire, in each restaurant
2. Surfaces and equipment were swabbed for microbiological analysis
3. An audit was performed in 50 randomly selected restaurants
4. Refrigeration temperatures were monitored in ten randomly selected restaurants

These data were collected during the years 2001 and 2002.



## Key Findings

- A structured audit of catering establishments showed that, in general, food handling practices were good. However, some important deficiencies were observed. The most frequent shortcomings in the kitchen audit were the potential for cross-contamination with dishcloths, inadequate systems for inspection of deliveries and structural and physical hygiene deficiencies.
- Of the establishments surveyed, less than half (40%) reported using a meat temperature probe to determine that the food was adequately cooked. The majority of establishments used subjective measures, based on visual inspection, to check for adequate cooking.
- Almost all of the establishments surveyed (99%) had a designated handwashing sink(s) with hot water and soap provided.
- Reported knowledge of potential foodborne pathogens by kitchen managers was high with the exception of awareness of *Campylobacter*. Forty-two percent of respondents had heard of this food pathogen and, of those, 14% could associate it with chicken.
- Where applicable to the business activities, a high level of knowledge of correct hot holding procedures for food was recorded. Ninety-two percent (91.8%) knew that the current minimum temperature recommendation for food held in the bain marie was 63°C and 73.8% checked the temperature of the food. However, 14.9% relied on the dial reading and 11.3% monitored the temperature of the water.
- The majority of interviewees (97%) knew the recommended chill storage temperature and 91.5% reported having a thermometer in the refrigerator.
- A temperature survey of a subset of ten restaurants' refrigerators showed that they were all operating within the recommended temperature range.
- Food delivery inspection systems varied considerably (42% of respondents reported checking every delivery and 59% based the audit on a standard developed in-house).
- Considerable familiarity with HACCP was recorded by the kitchen manager questionnaire. The kitchen audit revealed that 64% of establishments had a HACCP plan of 'some description' in place and 56% possessed a hygiene/HACCP prerequisite document.

## **Recommendations**

Restaurants must comply with food safety legislation. Guides to compliance are available in both jurisdictions. This research identifies the following areas requiring particular improvement to meet with legislative requirements. These recommendations are, of necessity, generic and need to be interpreted in the context of a risk assessment of the individual premises and with the professional guidance of an Environmental Health Officer.

- The use of a temperature probe should be adopted as a standard technique for checking that specific meats and poultry are properly cooked in restaurant kitchens.
- The promotion of specific guidelines for cooling cooked food is indicated, with emphasis on the needs of establishments without a blast chill facility.
- The continued emphasis on guidance for structured and operational hygiene practices is justified. Risks associated with cross-contamination merit particular attention.
- Food delivery inspections should be comprehensive and include inspection of vehicles, personnel, 'best before' and 'use by' dates, packaging and temperature of the product.
- The legislative requirements relating to the development, documentation and implementation of HACCP prerequisite and food safety systems should be continually emphasised and supported.
- The positive results of this survey relating to a good level of knowledge of chill and hot-holding measures should be circulated as evidence of progress in good food safety practice.

# 1. Introduction

Foodborne illness is a threat to public health and is the cause of considerable suffering on the island of Ireland. It also represents a major economic loss to the economies of both the Republic of Ireland (ROI) and Northern Ireland (NI) in terms of lost working days and health sector costs. Worldwide there is concern at the economic burden of such illness. In the United States, the annual cost of foodborne illness is estimated to be \$6.7 billion, up to \$100 million in New Zealand and \$123 million in Sweden. Individual outbreaks are also costly. The 1996 *Escherichia coli* O157 outbreak, associated with a school canteen in Japan, cost the equivalent of €7.2 million. A population-based study of acute gastroenteritis on the island of Ireland estimated that 1.5 million working days and 1.3 million school/college days are lost each year due to acute gastroenteritis and losses in earnings alone were estimated at €173.5 million (£114 million) per year (Scallan et al., 2004).

This study of acute gastroenteritis on the island of Ireland also found that of the respondents in the study suspecting food as the reason for their illness, 72% suspected food consumed from restaurants/cafés, takeaways, canteens and pubs (Scallan et al., 2004).

On the island of Ireland, Directive 93/43/EEC of the European Community has been enacted into legislation in both the Republic of Ireland: Hygiene of Food Stuffs Regulations, 2000; and in Northern Ireland: Food Safety (General food hygiene regulation (Northern Ireland), 1995, and Food Safety (Temperature control regulation (Northern Ireland), 1995. Both jurisdictions also have legislative guides to compliance for catering establishments: The National Standards Authority Ireland publication IS. 340: *Hygiene For The Catering Sector* in the Republic of Ireland and the *Industry Guide to Good Hygiene Practice: Catering Guide* in Northern Ireland.

The Food Safety Authority of Ireland has identified the main contributing factors to foodborne infection in the catering sector to be cross-contamination, inadequate cooking, inadequate storage, inadequate reheating, delayed serving and infected food handlers (FSAI, 2000). All of these factors could and should be controlled through education campaigns, training and the development of food safety systems such as hazard analysis and critical control point (HACCP). However, systems such as HACCP require some background information about current food safety knowledge within the food services industry. This enables education campaigns and training to be targeted at areas where important food safety knowledge is lacking. In addition, baseline studies are required within this industry to describe current food safety practices, identify the hazards and levels of contamination that should be targeted by food safety management systems and to evaluate improvements over time.

## **The objectives of this study were as follows:**

1. To establish the areas where food safety knowledge is lacking among head chefs and catering kitchen managers
2. To assess hygiene within restaurant kitchens and to determine the incidence of bacterial contamination in the catering kitchen environment
3. To establish the real refrigeration temperature in restaurant refrigerators
4. To identify key areas where restaurants may improve hygiene/food safety

## 2. Methodology

Four approaches were used to collect data from catering establishments across the island of Ireland during the years 2001 and 2002. A total of 200 establishments volunteered to participate in the study that involved a kitchen manager questionnaire and a microbiological survey, in conjunction with a refrigerator temperature survey and a restaurant kitchen audit, in a subset of the sample.

*Kitchen manager questionnaire:* A total of 200 restaurants were visited throughout the island of Ireland. At each restaurant, the head chef, catering manager or other person responsible for food safety was interviewed and a 'knowledge and food safety practice' questionnaire was completed. The questionnaire included questions on the respondent's profile and that of the restaurant. Other elements investigated staff training, restaurant food safety practices and the respondent's knowledge of food safety issues (Appendix 1).

*Microbiological survey:* At each of the 200 catering establishments, the refrigerator, worktop, cleaned cutting boards and cleaned knives were swabbed and the dishcloth sampled. Total viable counts (TVC), total coliform counts (TCC), and the presence or absence of *Escherichia coli*, *Salmonella* spp., *Campylobacter* spp., *Listeria monocytogenes*, *Yersinia enterocolitica*, *Staphylococcus aureus* and *Escherichia coli* O157 were determined, using standard ISO microbiological methods as described by Kennedy et al. (2005).

*Refrigeration temperature survey:* The temperature in refrigerators in ten randomly selected restaurants was monitored by leaving temperature data loggers, programmed to record the air temperature every 30 minutes, in the catering refrigerator for a period of 94 hours.

*Kitchen audit:* The kitchens of 50 randomly selected restaurants were audited using the audit checklist provided in I.S. 340: *Hygiene in the Catering Sector*, published by the National Standards Association of Ireland (NSAI, 1994). The audit questionnaire is included in Appendix 2. All audits were conducted by the same trained auditor and involved a visual inspection of the premises, equipment and documentation. The audit also included a number of questions for the kitchen manager about routine practices (Appendix 2).

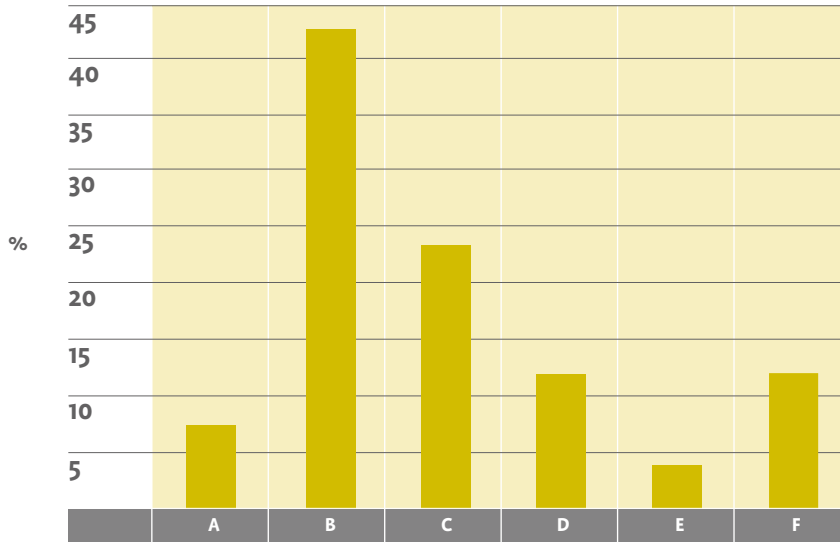
## 3. Results

### 3.1. Kitchen Manager Questionnaire

#### 3.1.1. Demographics

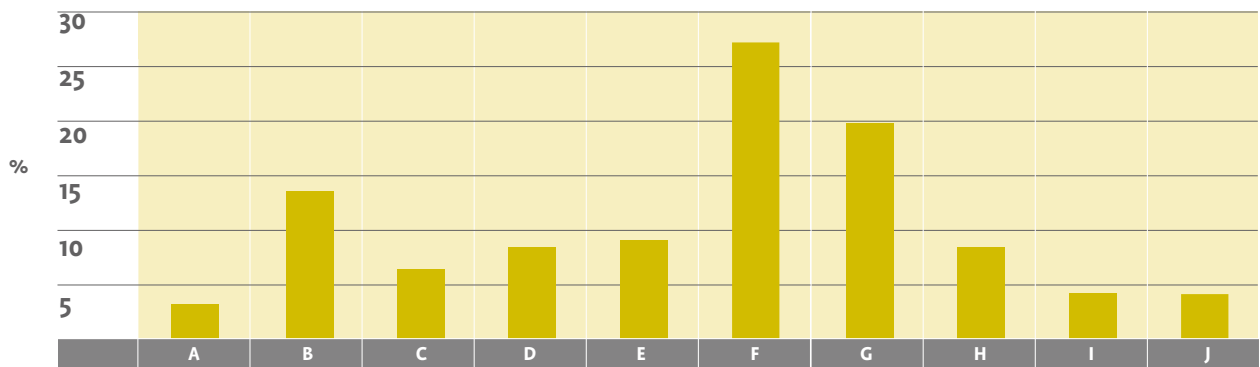
- The majority of interviewees were male (70%) versus female (30%), and most were in the age range 25-34 years (Figure 1).

**Fig 1: The age profile of interviewees (A = 19-24 years; B = 25-34 years; C = 35-44 years; D = 45-54 years; E = 55-64 years; F = declined to answer)**



- Of those interviewed, 28.5% had a certificate in food preparation, 15% had a diploma, 5% had a degree, 25% had attended a City and Guilds course, 6.5% had completed a CERT course and 20% had no formal, only on-the-job, training.
- The average number of customers in a typical week at the restaurants surveyed varied from under 100 to over 4,000 (Figure 2).

**Fig 2: The average number of customers per week (A = 20-99; B = 100-199; C = 200-299; D = 300-399; E = 400-499; F = 500-999; G = 1000-1999; H = 2000-2999; I = 3000-3999; J = 4000 or more)**

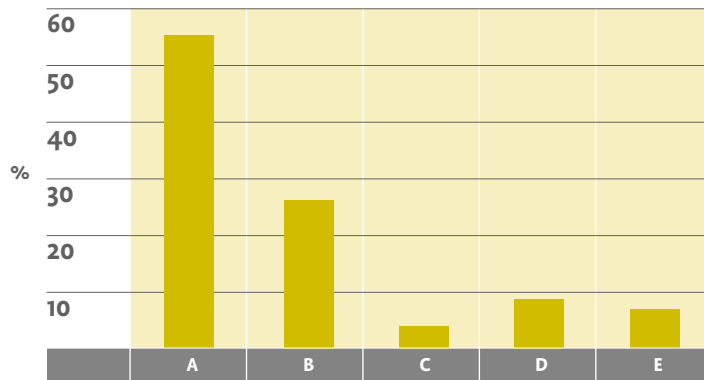


- Most restaurants (83.5%) employed 1-10 people in food handling operations, with fewer establishments employing greater numbers of staff: 11-20 people (12.5%), 21-30 (2.5%) and more than 30 people (1.5%).

### 3.1.2. Training

- The legislation clearly defines that “the proprietor of a food business shall ensure that food handlers engaged in the food business are supervised and instructed and/or trained in food hygiene matters commensurate with their work activities”. However, the number of employees per establishment influenced the percentage of staff with food safety training. In small restaurants with fewer than ten employees over half typically had training. However, this percentage dropped as employee number per establishment increased (Figure 3).

**Fig 3: The percentage of food handlers with food hygiene training as a function of employee number (A = 1-10; B = 11-20; C = 21-30; D = >30; E = other)**

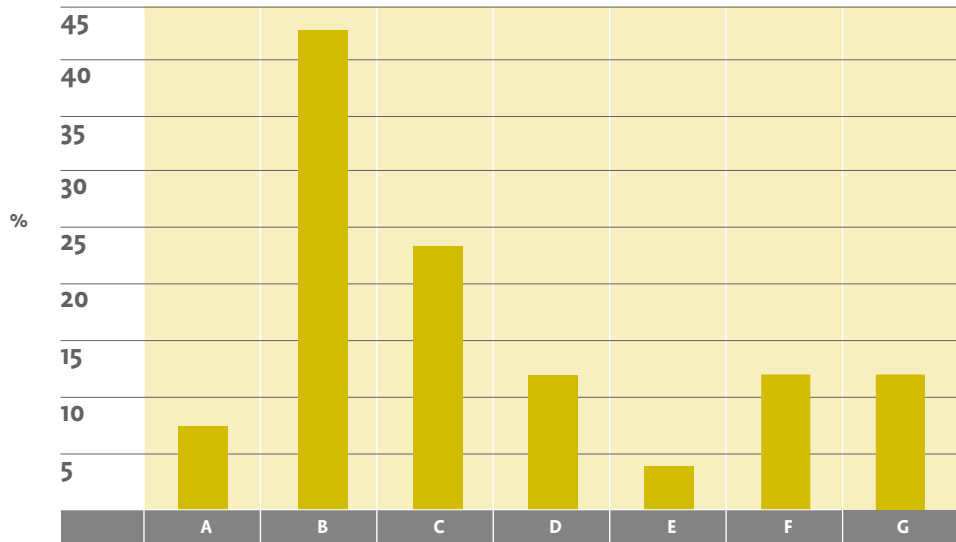


- Of those who reported that some or all of their staff had received hygiene training, the majority (30.5%) claimed this training had been certified by the regional health board, 15% by the Chartered Institute of Environmental Health, 10% through college courses, 8.5% by CERT, 3.5% by consultants, 2% by the National Vocational Qualification, 1.5% by the Royal Society of Health, 1% by the Food Safety Authority of Ireland, 1% by Royal Institute of Public Health and Hygiene with ‘other’ and ‘don’t knows’ accounting for 7% and 20%, respectively.
- Of the head chefs, catering managers or other persons responsible for food safety in the catering kitchens surveyed, 78% were unaware of the current legislation relating to catering food safety.
- HACCP meant different things to different caterers. Responses included: food safety system (10%); process control system (5.5%); temperature control system (8%); documentation procedures (4.5%); with 60.5% outlining hazard analysis and critical control point. Other answers accounted for 3.5% while 8% did not know about HACCP.

### 3.1.3. Food Delivery and Storage

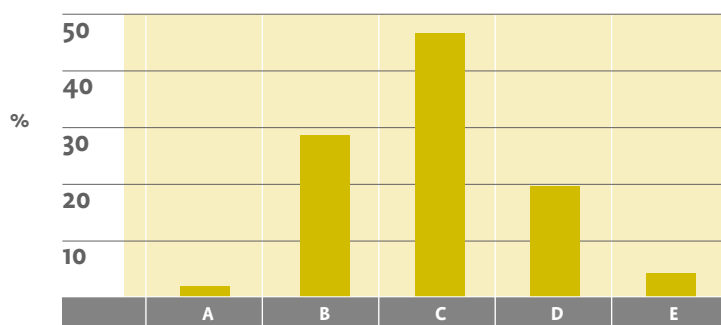
- In 70% of catering establishments, suppliers were audited by the head chef. This task was undertaken by the catering manager in 14% of restaurants, by another member of staff in 10.5%, by an external auditor/consultant in 2%, while the health board was mentioned in 2.5% of cases. Other responses accounted for 1%.
- Supplier audits were conducted at varying frequencies. Most occurred with every delivery (Figure 4) but in many cases the audit was conducted only weekly, or even yearly, despite legislation which clearly states that all deliveries should be visually inspected.

**Fig 4: The frequency of supplier audits (A = spot checks; B = every delivery; C = daily; D = weekly; E = monthly; F = yearly; G = other)**



- When asked what standards were used to audit suppliers, 59% of establishments based the audit on a standard developed in-house and 8% cited ISO standards. Others sought guidance from other sources including environmental health officers (7%), regional health boards (5.5%) or the Food Safety Authority of Ireland guide (5%). Others were unsure (12.5%) or cited other standards (3%).
- In 97% of establishments, the interviewee knew the recommended refrigeration temperature. Most claimed to have a thermometer in refrigeration unit(s) (91.5%), chill room(s) (68.5%) and freezer unit(s) (79.5%).
- In 20% of establishments, the thermometer in the low temperature unit (refrigerator, chill room or freezer) was used as the sole source of temperature readings and the temperature of the foods stored in these units was never checked.
- Most raw meat was stored in a separate fridge, on the bottom shelf or in a cold room (Figure 5).

**Fig 5: The areas in the refrigeration system where raw meat is stored**  
(A = middle shelf; B = bottom shelf; C = separate fridge; D = cold room; E = not applicable)



- Of those questioned about hot holding, 26.5% cited the question as not applicable to their operation. But where it was applicable, 91.8% knew that the current minimum temperature recommendation for food held in the bain marie was 63°C and 73.8% checked the temperature of the food, while 14.9% relied on the dial reading and 11.3% monitored the temperature of the water.

### 3.1.4. Food Handling

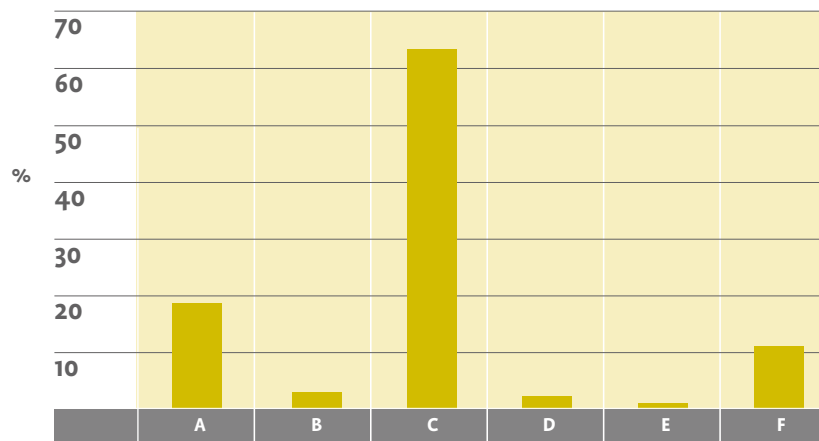
- When asked about practices to ensure that knives used to cut raw food were not subsequently used on cooked foods, 35.5% of respondents claimed they used a two-knife system, 27.5% always washed the knife immediately after use, 25% used colour-coded knives, while 12% cited other practices. All respondents (100%) washed the knives with hot water and detergent or mild bleach, either manually or using a dishwasher.
- When asked the same question about cutting boards, 82.5% of respondents used a colour-coded system, 8% washed the board with hot water, a detergent and mild bleach or sanitiser, 7.5% washed the board with hot water and detergent, 1.5% used the dishwasher, and 0.5% rinsed the cutting board using cold water. The vast majority (97.5%) of cutting boards were made from plastic, with 1.5% of establishments using wooden boards and 1% citing other materials, such as glass.
- Almost all (99.5%) catering establishments had a designated sink(s) for washing hands and the majority (99%) provided hot water and soap and 7.5% provided a scrubbing brush. When asked about cleaning hands after handling raw meat, the majority washed their hands with bactericidal soap (92%) or ordinary soap (2%), while one respondent (0.5%) wiped his/her hands with a cloth instead of washing.
- In 65% of establishments, a sanitiser was used to clean the refrigerator while 27% used a detergent, 6% washing-up liquid and 2% applied a baking soda solution.
- A sanitiser was also usually used (78.5% of establishments) when cleaning worktops. Detergent and washing-up liquid were used in 19.5% and 2% of establishments, respectively.
- Most establishments (45.5%) used a dishcloth to clean the refrigerator and worktop, with J-cloths being used in 26%, disposable paper roll or paper towels in 22% and a sponge in 6.5% of establishments.



### 3.1.5. Food Preparation

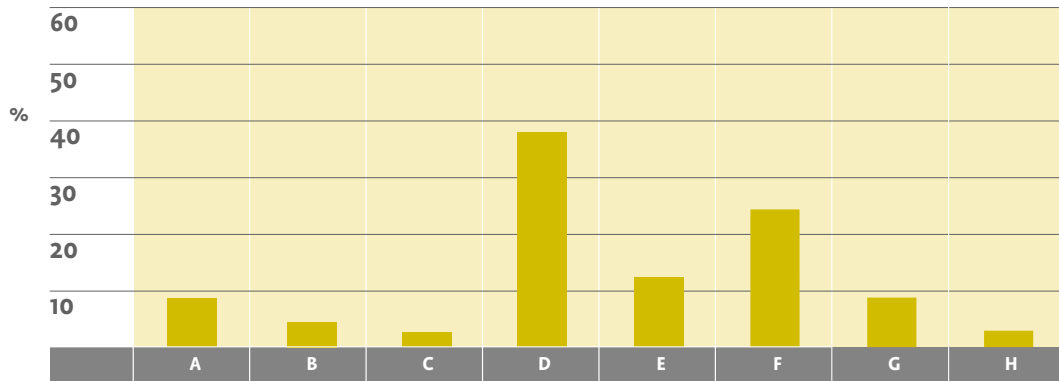
- Most establishments (around 60%) defrosted frozen meat in a refrigerator (Figure 6), with almost 20% defrosting at room temperature.

**Fig 6: Meat defrosting practices in catering establishments (A = at room temperature; B = microwave; C = refrigerator/cold room; D = cold water; E = cook meat frozen; F = not applicable)**

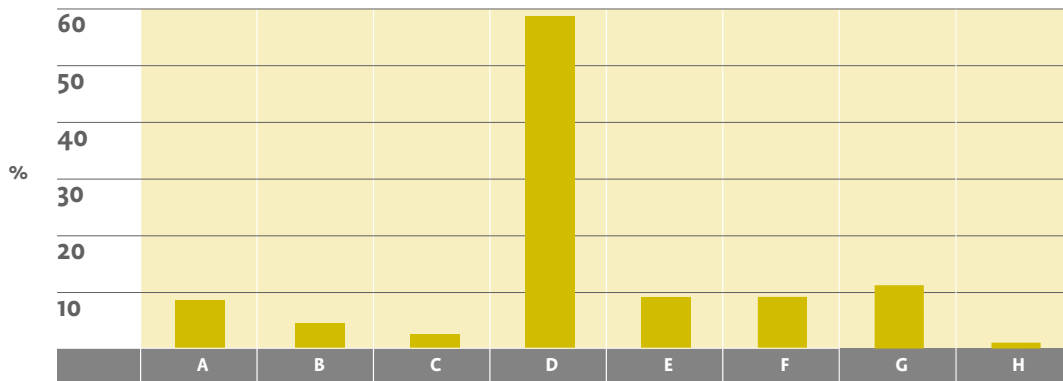


- A variety of tests were used to check that red meat (Figure 7) and poultry (Figure 8) were fully cooked. Although many of the establishments used a temperature probe reading (40%), a significant number relied on cooking time, touch or experience (Figures 7 and 8).
- However, the legislative compliance guides clearly indicate minimum core temperatures that must be achieved and recommend the use of a temperature probe for cooking pork, poultry, minced or chopped meat and rolled joints. This is essential to ensure that food pathogens are killed.

**Fig 7: Practices to check that red meats are fully cooked (A = juice runs clear; B = visual inspection; C = brown & crisp outer coating; D = probe reading; E = when in the oven for the stated time; F = touch; G = experience; H = other)**



**Fig 8: Practices to check that poultry is fully cooked (A = juice runs clear; B = visual inspection; C = brown & crisp outer coating; D = probe reading; E = when in the oven for the stated time; F = touch; G = experience; H = other)**



- Food that was cooked but not eaten was usually (in 72.5% of establishments) allowed to cool at room temperature and then placed in chilled storage. In other cases, uneaten food was discarded (9%), allowed to cool at room temperature and placed in frozen storage (1.5%) or left out indefinitely on the counter top at room temperature (0.5%). Some respondents (6%) suggested other practices and 10.5% stated that the question was not applicable.
- On the question of reheating of food, this was not applicable to 26% of establishments, 29.5% served food cold, while for the remainder, where this operation was performed, 99% reported reheating food to above 70°C.

### 3.1.6. Microbial Knowledge

- The level of knowledge of microbial pathogens is summarised in Table 1. *Salmonella* (100%), *Escherichia coli* O157 (97.5%), *Listeria monocytogenes* (84%) and *Staphylococcus aureus* (78%) were familiar to most interviewees, although the source of these bacteria was less well known.

Pathogen	Had heard of pathogen	Associated pathogen with relevant source*		
<b>Salmonella</b>	100%	Poultry 72%	Pork 6.5%	Eggs 56%
<b>Listeria monocytogenes</b>	84%	Beef 3.5%	Soft cheese 39%	Vegetables 9%
<b>Shigella</b>	13%	Meat 2%	Water 4%	Salads 2%
<b>Escherichia coli O157</b>	98%	Beef 43%	Raw milk 5%	Burgers 45%
<b>Campylobacter</b>	42%	Poultry 14%	Pork 3%	Eggs 2%
<b>Bacillus cereus</b>	48%	Rice 25%	Cream/milk 2%	Soup 5%
<b>Staphylococcus aureus</b>	78%	Milk 3.5%	Eggs 1%	People 59%
<b>Clostridium perfringens</b>	42%	Meat 11%	Spices 5%	
<b>Clostridium botulinum</b>	71%	Canned foods 44%	Meat 6%	
<b>Yersinia enterocolitica</b>	7%	Pork 6%		

\* expressed as % of those who had heard of the pathogen

### 3.2. Microbiological Survey

- The results of the microbiological survey of 200 restaurant kitchens throughout the island of Ireland are shown in Table 2. The total viable counts (TVC) ranged from 94,904 bacteria per cm<sup>2</sup> on the worktops to 3,235,937 bacteria per ml in the dishcloth. The total coliform counts (TCC) ranged from 170 coliform bacteria per cm<sup>2</sup> in the refrigerator to 18,621 coliform bacteria per ml in the dishcloth. *Staphylococcus aureus* was the most prevalent bacterium while *E. coli* O157 was not detected at any stage. Generic *E. coli*, *Salmonella*, *Campylobacter*, *L. monocytogenes* and *Y. enterocolitica* were detected in a low percentage of restaurant kitchens.

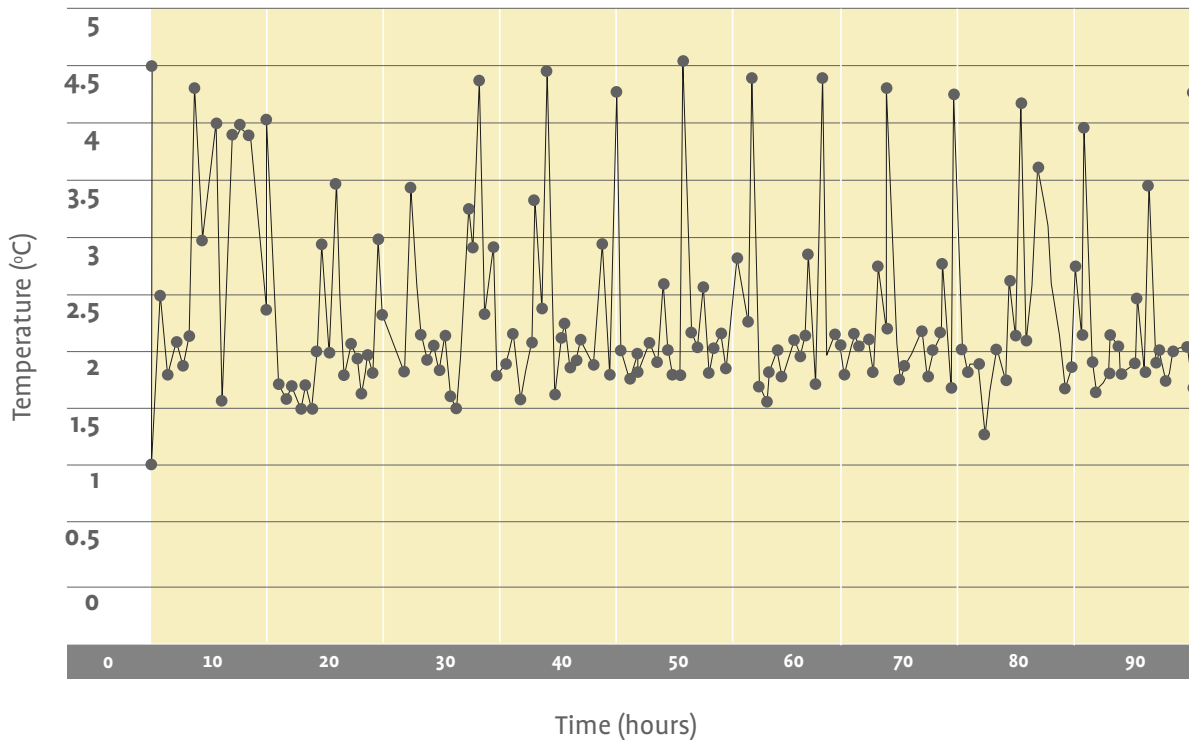
Table 2. Comparison of the numbers and types of bacteria

Analysis	Fridge	Worktop	Cutting boards (clean)	Knives (clean)	Dishcloths
<b>Mean no. of bacteria present/cm<sup>2</sup></b>					
Total viable count	119,526	94,406	602,559	109,648	3,235,937 <sup>a</sup>
Total coliform count	170	473	977	257	18,621 <sup>a</sup>
<b>% prevalence</b>					
<i>E. coli</i>	4	2	3	1	8
<i>Salmonella</i>	6	2	9	3	9
<i>Campylobacter</i>	1	0	1	0	2
<i>L. monocytogenes</i>	3	0	2	1	2
<i>Y. enterocolitica</i>	1	0	1	0	1
<i>S. aureus</i>	24	25	23	13	28
<i>E. coli</i> O157	0	0	0	0	0
<sup>a</sup> count expressed per ml of diluent for dishcloths.					

### 3.3. Refrigerator Temperature Survey

- The average temperature profile of restaurant refrigerators is shown in Figure 9. The air temperature was sampled every 30 minutes for 94 hours. The overall results of the temperature survey indicate that the ten restaurant refrigerators tested were operating within the recommended temperature range of 1 to 5°C.

**Fig 9: The average temperature profile of restaurant refrigerators**

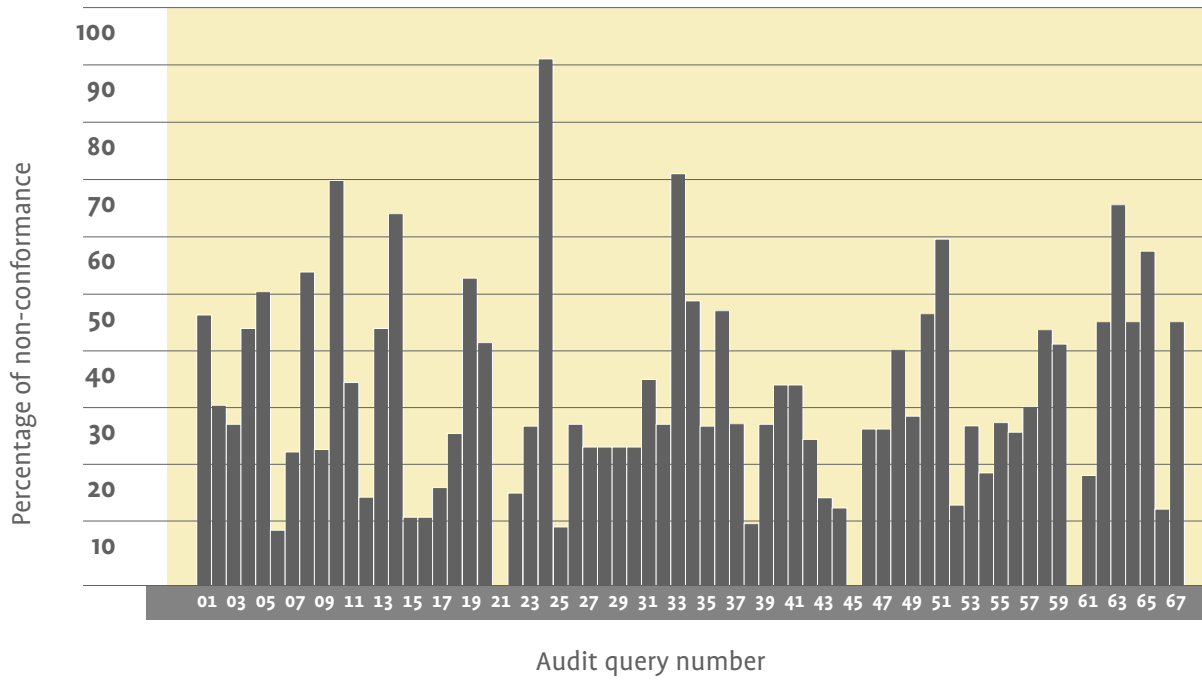


### 3.4. Restaurant Kitchen Audit

The results of the restaurant food safety inspection are shown in Figure 10, which shows the percentage of restaurant kitchens that failed each inspection query. The highest non-conformance rate was for query number 24: “Are dishcloths a potential vehicle for cross-contamination?” The top eight non-conformances from the audit checklist are indicated below, where deficiencies were evident in at least 50% of restaurants for the following audit queries:

1. Are dishcloths a potential vehicle for cross-contamination?
2. Is there air flow from clean to contaminated areas?
3. Does the layout protect against the accumulation of dirt?
4. Are ceilings and overhead fixtures designed and finished to prevent the accumulation of dirt, to prevent condensation, to prevent the growth of moulds and the shedding of particles?
5. If you have checklists for inspections of deliveries do these include inspection of the hygiene of the delivery person?
6. If you have a hygiene/HACCP prerequisite manual does this include hygiene training and job description?
7. If you have checklists for inspection of deliveries do these include inspection of packaging?
8. Are there washing procedures for knives and other tools or designated knives to protect against cross-contamination?

**Fig 10: The results of restaurant kitchen food safety hygiene audit**



## 4. Conclusions and Recommendations

The Food Safety Authority of Ireland has identified six key contributory factors to food poisoning: (1) inadequate cooking, (2) cross-contamination, (3) infected food handlers, (4) inadequate reheating, (5) inadequate storage and (6) delayed serving (FSAI, 2000). The WHO Surveillance Programme for Control of Foodborne Infections and Intoxications in Europe (7th Report) (WHO 2000) groups 'inadequate cooking' with 'inadequate reheating' and puts a contributing percentage on each for the Republic of Ireland as follows:

1. Inadequate cooking/reheating (25.6%);
2. Cross-contamination (23.1%);
3. Infected food handler (17.9%);
4. Food prepared too far in advance (17.1%);
5. Improper storage (15.4%).

Each of these activities will now be examined as potential contributory factors to foodborne illness in restaurants on the island of Ireland using the results of the research reported above.

### **Inadequate cooking/reheating**

When asked about the various techniques used to check that meat and poultry were adequately cooked, a variety of answers were offered. Only 40% reported using a meat temperature probe. Some of these techniques are quite subjective and could result in inadequately cooked meat being served to customers. However, the legislative compliance guides indicate minimum core temperatures that must be achieved, which can only be measured with the use of a temperature probe. Pork, poultry, minced or chopped meat must reach minimum critical cooking temperatures to ensure that food pathogens are killed.

- **Recommendation:** The use of a temperature probe should be adopted as a standard technique for checking that specific meats and poultry are properly cooked in restaurant kitchens.

If foods are properly cooked and leftovers are hygienically packaged and stored at chilled temperature, reheating is for culinary and not food safety reasons. Of those interviewed, 74% left cooked food out at room temperature to cool before placing in chilled/frozen storage.

The legislation does not specify any time or temperature limits for cooling cooked food but specifies that caterers 'shall cool that food as quickly as possible'. In the Republic of Ireland I.S. 340 recommends that 'cooled food shall be placed under refrigerated conditions within 90 minutes after cooking and shall reach a temperature of less than 10°C within 150 minutes after cooling has commenced'. This is generally unachievable without a blast chiller. If a blast chiller is unavailable, restaurants should avoid advance cooking and should cook foods on the day they will be served. In Northern Ireland the guide to compliance does not specify a specific time limit for the cooling of foods. However, while blast chilling is preferable, at a minimum, cooked food should be portioned to speed up cooling and should be refrigerated as soon as possible.

- **Recommendation:** The promotion of specific guidelines for cooling cooked food is indicated, with emphasis on the needs of establishments without a blast chill facility.

## Cross-contamination

Potential vehicles for cross-contamination were identified by the microbiological survey. Additional evidence to support these findings may be identified from the outcomes of the structured kitchen audit undertaken in the subset of the restaurants. From this, in almost 90% of kitchens, concern was expressed about the use of dishcloths and in up to 70% of cases there were reservations about structural aspects of the kitchen. Various systems for the separation of knives and cutting boards were cited in the kitchen manager questionnaire survey, with concern being highlighted about their implementation in the kitchen audit.

It is strongly recommended that those responsible for food safety in restaurants conduct a review of their premises and procedures based on the information in I.S. 340: 'Hygiene for the Catering Sector' for caterers in ROI or 'Safe Catering, Your Guide to HACCP' for caterers in NI. This should include a review of equipment cleaning procedures, and training should be provided for all kitchen personnel on how to clean counter tops, knives, cutting boards, etc. Dishcloths should be removed from restaurants and replaced with disposable pull-wipes, paper towels etc, or used only in conjunction with effective and frequent dishcloth disinfection procedures.

- **Recommendation:** The continued emphasis on guidance for structured and operational hygiene practices is justified. Risks associated with cross-contamination merit particular attention.

## Infected Food Handler

Personal hygiene training should be provided to all food handling personnel, including information on how they may act as a potential source of pathogenic bacteria. The high level of good handwashing facilities identified is reassuring. The presence of *Staphylococcus aureus* on surfaces and dishcloths indicates unhygienic handling and acts as a reminder of the need for good hygiene practices in the kitchen. Restaurants scored well in the audit in the area of employee health and the prevention of ill/infected staff from working in the food preparation environment.

## Food prepared too far in advance

Although neither the kitchen manager questionnaire nor the audit surveys specifically addressed the issue of preparing food too far in advance, there was no evidence that a delay in serving food was a problem in the surveyed restaurants. Furthermore, as the next section on 'improper storage' reveals, both the questionnaire and audit suggested that chefs have a good knowledge of chilled storage and hot holding.

## Improper storage

The majority of interviewees (97%) knew the recommended chilled storage temperature, and 91.5% claimed to have a thermometer in the refrigerators with 68.5% having a thermometer in the chill room. Furthermore, approximately 80%, scored well in the chilled storage section of the inspection (queries 53 to 55) and 78% of the refrigerators and chilled rooms checked during the audit were operating at the recommended temperatures.

Of those questioned about hot holding, 26.5% cited the question as not applicable while 91.8% of the remainder knew the recommended hot holding temperature and 73.8% checked the temperature of the food in the bain marie. This was also reflected in the inspection, with the majority of establishments scoring well on hot holding queries.



- **Recommendation:** The positive results of this survey relating to a good level of knowledge of chill and hot-holding measures should be circulated as evidence of progress in good food safety practice.

### **Other Food Safety Concerns**

In addition to the activities mentioned above, the research survey results presented in this report identify 'delivery inspection' and 'food safety systems and documentation' as other key areas where food safety knowledge and practices are lacking within the catering industry on the island of Ireland.

### **Delivery inspections**

In the knowledge survey, only 42% of those interviewed claimed that every delivery was inspected. Furthermore, the audit revealed that many establishments had inspection procedures that did not include the suitability of the vehicle (42%), the hygiene of the delivery person (64%), 'best before' and 'use by' dates (42%) and inspection of the packaging (56%). This may be explained by the fact that 59% of those interviewed in the knowledge survey claimed that their delivery inspections were based on standards developed in-house.

- **Recommendation:** Food delivery inspections should be comprehensive and include inspection of vehicles, personnel, 'best before' and 'use by' dates, packaging and temperature of the product.

### **Food safety systems and documentation**

Although the vast majority of interviewees in the knowledge survey had some idea of what HACCP was, a significant percentage (36%) did not have a HACCP plan of any description, while 44% had no hygiene/HACCP prerequisite document. Without written procedures, it is difficult to implement hygiene and food safety controls on a consistent basis over time and impossible to demonstrate that hygiene and food safety are under control. The available guidelines I.S. 340: Hygiene for Catering Sector (NSAI 1994 – ROI caterers) and Safe Catering, Your Guide to HACCP' (2003 – NI caterers) are available resources.

- **Recommendation:** The legislative requirements relating to the development, documentation and implementation of HACCP prerequisite and food safety systems should be continually emphasised and supported.

## 5. Summary of Key Findings

- A structured audit of catering establishments showed that, in general food handling practices were good but some important deficiencies were observed. The most frequent shortcomings in the kitchen audit were the potential for cross-contamination with dishcloths, inadequate systems for inspection of deliveries and structural and physical hygiene deficiencies.
- Considerable familiarity with HACCP was recorded by the kitchen manager questionnaire. The kitchen audit revealed that 64% of establishments had a HACCP plan of 'some description' in place and 56% possessed a hygiene/HACCP prerequisite document.
- Of the establishments surveyed, less than half (40%) reported using a meat temperature probe to determine that the food was adequately cooked. The majority of establishments used subjective measures, based on visual inspection, to check for adequate cooking,
- Almost all of the establishments surveyed (99%) had a designated hand washing sink(s) with hot water and soap provided.
- Reported knowledge of potential foodborne pathogens by kitchen managers was high with the exception of awareness of *Campylobacter*. Forty-two percent of respondents had heard of this food pathogen and of those, 14% could associate it with chicken.
- Where applicable to the business activities, a high level of knowledge of correct hot holding procedures for food was recorded. Ninety two percent knew that the current minimum temperature recommendation for food held in the bain marie was 63°C and 73.8% checked the temperature of the food. However, 14.9% relied on the dial reading and 11.3% monitored the temperature of the water.
- The majority of interviewees (97%) knew the recommended chill storage temperature and 91.5% reported having a thermometer in the refrigerator.
- A temperature survey of a subset of ten restaurants' refrigerators showed that they were all operating within the recommended temperature range.
- Food delivery inspection systems varied considerably (42% of respondents reported checking every delivery and 59% based the audit on a standard developed in-house).

## 6. References

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**Scallan, E., Fitzgerald, M., Collins, C., Crowley, D., Daly, L., Devine, M., Igoe, D., Quigley, T., Robinson, T. and Smyth, B. (2004)**

*Acute Gastroenteritis in Northern Ireland and the Republic of Ireland: a Telephone Survey*

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**World Health Organisation (2000)**

*WHO Surveillance Programme for Control of Foodborne Infections and Intoxications in Europe, 7th Report, 1993-1998.*

# Appendix 1 - Food Safety Questionnaire

Date: \_\_\_\_\_

Restaurant: \_\_\_\_\_

Chef name: \_\_\_\_\_

Type of restaurant: \_\_\_\_\_

Dear participant,

Thank you for agreeing to complete this questionnaire. It should take no longer than 10 minutes to complete. This survey is being undertaken within 300 catering establishments throughout the country. Your answers to this survey are voluntary and will be kept confidential. No identifying information will appear on any aspect of this study.

## Section 1: Demographics

### 1. Note gender

- 1. Male
- 2. Female

### 2. Which of these is your age group?

- 1. Under 18
- 2. 19-24
- 3. 25-34
- 4. 35-44
- 5. 45-54
- 6. 55-64
- 7. 65-75

### 3. What qualifications have you achieved through your training?

- Qualification:
- 1. Certificate
  - 2. Diploma
  - 3. BSc
  - 4. None

5. Please specify if other \_\_\_\_\_

**4. In your estimation, what is the average number of customers, who eat here, in a typical week?**

- 1. Lunch time:
- 2. Dinner time:

Total per week: \_\_\_\_\_

**5. On average, could you tell me, how many people work in your kitchen?**

- 1. 1 to 10
- 2. 11 to 20
- 3. 21 to 30

4. Please specify if other \_\_\_\_\_

**Section 2: Training:**

**1. How many of the people in your kitchen have a certificate in food hygiene?**

- 1. 1 to 5
- 2. 5 to 10

3. Please specify if other \_\_\_\_\_

**2. Who was the certification body?**

\_\_\_\_\_

**3. How do you ensure that non-English speaking people are aware of the issues involved in food safety?**

\_\_\_\_\_

**4. What piece of legislation covers hygiene in catering?**

- 1. General Hygiene Directive (93/43 EC)
- 2. Irish law (SI 165 of 2000)
- 3. Don't know

4. Please specify if other \_\_\_\_\_

**5. Could you please tell me what you understand by HACCP?**

- Food Safety System
- Process Control
- Hazard Analysis and Critical Control Point

Please specify if other \_\_\_\_\_

**Section 3: Food Storage and delivery**

**1. Who audits/inspects your suppliers?**

- 1. Catering manager
- 2. Head chef
- 3. Another member of staff

4. Please specify if other \_\_\_\_\_

**2. How often?**

- 1. Every time there is a delivery
- 2. Once a day
- 3. Once a week

4. Please specify if other \_\_\_\_\_

**3. To which standard do you audit/inspect your suppliers?**

- 1. ISO
- 2. FSAI guide 2001
- 3. Developed your own
- 4. Unsure

5. Please specify if other \_\_\_\_\_

**4. At what temperature do you think your refrigerator should be kept?**

- 1. Less than 1°C
- 2. 1 to 5°C
- 3. 6 to 10°C
- 4. More than 10°C
- 5. Unsure

**5. Do you have a thermometer in your;**

- |    |              |     |                          |    |                          |        |                          |
|----|--------------|-----|--------------------------|----|--------------------------|--------|--------------------------|
| A. | Refrigerator | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Unsure | <input type="checkbox"/> |
| B. | Freeze       | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Unsure | <input type="checkbox"/> |
| C. | Cold room    | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> | Unsure | <input type="checkbox"/> |

If no, how do you monitor the temperature of the above? \_\_\_\_\_

**6. When raw meat is refrigerated, where is it stored?**

- |    |                               |                          |
|----|-------------------------------|--------------------------|
| 1. | Top shelf of refrigerator     | <input type="checkbox"/> |
| 2. | Middle shelf of refrigerator  | <input type="checkbox"/> |
| 3. | Bottom shelf of refrigerator  | <input type="checkbox"/> |
| 4. | Bottom drawer                 | <input type="checkbox"/> |
| 5. | Any shelf that there is space | <input type="checkbox"/> |
| 6. | Separate fridge               | <input type="checkbox"/> |
| 7. | Cold room                     | <input type="checkbox"/> |

**7. What temperature is the food in the Bain Marie? \_\_\_\_\_**

**8. How do you know the food is at that temperature?**

- |    |                               |                          |
|----|-------------------------------|--------------------------|
| 1. | Temperature probe             | <input type="checkbox"/> |
| 2. | Read the dial                 | <input type="checkbox"/> |
| 3. | Read digital display          | <input type="checkbox"/> |
| 4. | Please specify if other _____ |                          |

## **Section 4: Handling**

**1. How do you ensure knives used to cut raw foods are not subsequently used on foods that won't be cooked?**

- |    |                               |                          |
|----|-------------------------------|--------------------------|
| 1. | Two knife system              | <input type="checkbox"/> |
| 2. | Colour coded                  | <input type="checkbox"/> |
| 3. | Please specify if other _____ |                          |

**2. How is the dirty/used knife cleaned?**

- 1. Re-use the knife as is
- 2. Rinse the knife under cold water
- 3. Wipe the knife with a damp cloth
- 4. Wash the knife with detergent and hot water
- 5. Wash the knife with detergent, hot water and wipe it over with mild bleach
- 6. Dish washer or other equivalent machine

**3. How do you ensure your cutting board after cutting raw foods is subsequently used on foods that won't be cooked?**

- 1. Re-use the cutting board as is
- 2. Rinse it under cold water
- 3. Wipe it with a damp cloth
- 4. Wash it with detergent and hot water
- 5. Wash it with detergent, hot water and wipe it over with mild bleach
- 6. Colour coded

**4. What material is your cutting boards made of ?**

- 1. Wooden
- 2. Plastic
- 3. Please specify if other \_\_\_\_\_

**Section 4: Personal hygiene/cleaning.**

**1. How do you wipe your hands after handling raw meat?**

- 1. Wipe them on a tea-towel, dish cloth, J-cloth
- 2. Rinse them under cold water
- 3. Rinse them under warm/hot water
- 4. Wash them with ordinary soap and warm/hot water
- 5. Wash them with antibacterial soap and warm/hot water
- 6. Don't handle raw meat

7. Please specify if other \_\_\_\_\_

2. **Do you have a designated sink for cleaning your hands?** Yes  No

3. **Does this/other sink have hot water, soap and a scrubbing brush?** Yes  No



**4. How do you clean your fridge/freezer?**

<b>Washing Agent</b>	Tick one box
Detergent	<input type="checkbox"/>
Washing up liquid	<input type="checkbox"/>
Baking Soda	<input type="checkbox"/>
Sanitizer	<input type="checkbox"/>
Nothing	<input type="checkbox"/>

<b>Water Temperature</b>	Tick one box
Hot	<input type="checkbox"/>
Warm	<input type="checkbox"/>
Luke Warm	<input type="checkbox"/>
Cold	<input type="checkbox"/>

**5. How do you clean your work tops?**

<b>Washing Agent</b>	Tick one box
Detergent	<input type="checkbox"/>
Baking soda	<input type="checkbox"/>
Sanitizer	<input type="checkbox"/>
Nothing	<input type="checkbox"/>

<b>Water Temperature</b>	Tick one box
Hot	<input type="checkbox"/>
Warm	<input type="checkbox"/>
Luke Warm	<input type="checkbox"/>
Cold	<input type="checkbox"/>

<b>Physical Action</b>	Tick one box
Sponge/wash	<input type="checkbox"/>
Wipe	<input type="checkbox"/>
Spray	<input type="checkbox"/>

**6. What do you clean your fridge/worktops with?**

1. J-cloth or similar type of disposable cloth	<input type="checkbox"/>
2. Sponge	<input type="checkbox"/>
3. Dish cloth	<input type="checkbox"/>
4. Blue roll	<input type="checkbox"/>
5. Please specify if other _____	

**Section 5: Food Preparation**

**1. How do you usually defrost frozen meat? (Do not show options)**

1. Leave it out at room temperature	<input type="checkbox"/>
2. Defrost cycle in the microwave	<input type="checkbox"/>
3. In the refrigerator/cold room	<input type="checkbox"/>
4. In a basin of cold water	<input type="checkbox"/>
5. Cook meat frozen	<input type="checkbox"/>
6. Not applicable	<input type="checkbox"/>
7. Please specify if other _____	

**2. How do you know red meat is sufficiently cooked?** (Do not show options)

- |    |   |                          |
|----|---|--------------------------|
| 1. | When the juice runs clear                                   | <input type="checkbox"/> |
| 2. | When it tastes cooked                                       | <input type="checkbox"/> |
| 3. | When the meat looks cooked on the inside                    | <input type="checkbox"/> |
| 4. | When the meat falls away from the bone                      | <input type="checkbox"/> |
| 5. | When it has a brown and crisp outer coating                 | <input type="checkbox"/> |
| 6. | When it has the correct thermometer/probe reading           | <input type="checkbox"/> |
| 7. | When it has been in the cooker for the stated required time | <input type="checkbox"/> |
| 8. | Touch   | <input type="checkbox"/> |
| 9. | Please specify if other _____                               |                          |

**3. How do you know poultry and pork is sufficiently cooked?**

- |    | Poultry                       | Pork                     |
|----|-------------------------------|--------------------------|
| 1. | <input type="checkbox"/>      | <input type="checkbox"/> |
| 2. | <input type="checkbox"/>      | <input type="checkbox"/> |
| 3. | <input type="checkbox"/>      | <input type="checkbox"/> |
| 4. | <input type="checkbox"/>      | <input type="checkbox"/> |
| 5. | <input type="checkbox"/>      | <input type="checkbox"/> |
| 6. | <input type="checkbox"/>      | <input type="checkbox"/> |
| 7. | <input type="checkbox"/>      | <input type="checkbox"/> |
| 8. | <input type="checkbox"/>      | <input type="checkbox"/> |
| 9. | Please specify if other _____ |                          |

**4. In your estimation, what percentage of customers prefer their meat rare?** \_\_\_\_\_

**5. How do you store food that is cooked /uneaten?**

- |    |  |                          |
|----|--|--------------------------|
| 1. | Left on counter top                              | <input type="checkbox"/> |
| 2. | Allowed to cool, then placed in the refrigerator | <input type="checkbox"/> |
| 3. | Allowed to cool, then refrozen                   | <input type="checkbox"/> |
| 4. | Discarded  | <input type="checkbox"/> |
| 5. | N/A  | <input type="checkbox"/> |
| 6. | Please specify if other _____                    |                          |

**6. What temperature do you reheat this food to?**

- |    |               |                          |
|----|---------------|--------------------------|
| 1. | Serve it cold | <input type="checkbox"/> |
| 2. | Warm <63°C    | <input type="checkbox"/> |
| 3. | Hot >63°C     | <input type="checkbox"/> |

## Section 6: Bacteria Knowledge

6. I am going to name some of the major food pathogens, which cause food poisoning. I would be grateful if you could tell me if you have heard of them and which foods, if any, you associate them with.

- |     |   |  |   |   |
|-----|---|--|---|---|
| 1.  | <i>Salmonella:</i><br>If 'Yes' what foods would you associate with it?              | Yes <input type="checkbox"/><br>Poultry <input type="checkbox"/>     | No <input type="checkbox"/><br>Pork <input type="checkbox"/>        | Unsure/DK <input type="checkbox"/><br>Eggs <input type="checkbox"/>                       |
| 2.  | <i>Listeria:</i><br>If 'Yes' what foods would you associate with it?                | Yes <input type="checkbox"/><br>Beef <input type="checkbox"/>        | No <input type="checkbox"/><br>Soft Cheese <input type="checkbox"/> | Unsure/DK <input type="checkbox"/><br>Vegetables <input type="checkbox"/>                 |
| 3.  | <i>Shigella:</i><br>If 'Yes' what foods would you associate with it?                | Yes <input type="checkbox"/><br>Meat <input type="checkbox"/>        | No <input type="checkbox"/><br>Water <input type="checkbox"/>       | Unsure/DK <input type="checkbox"/><br>Salads <input type="checkbox"/>                     |
| 4.  | <i>E.coli: 0157:</i><br>If 'Yes' what foods would you associate with it?            | Yes <input type="checkbox"/><br>Beef <input type="checkbox"/>        | No <input type="checkbox"/><br>Raw milk <input type="checkbox"/>    | Unsure/DK <input type="checkbox"/><br>Burgers <input type="checkbox"/>                    |
| 5.  | <i>Campylobacter:</i><br>If 'Yes' what foods would you associate with it?           | Yes <input type="checkbox"/><br>Poultry <input type="checkbox"/>     | No <input type="checkbox"/><br>Pork <input type="checkbox"/>        | Unsure/DK <input type="checkbox"/><br>Eggs <input type="checkbox"/>                       |
| 6.  | <i>Bacillus cereus:</i><br>If 'Yes' what foods would you associate with it?         | Yes <input type="checkbox"/><br>Rice <input type="checkbox"/>        | No <input type="checkbox"/><br>Cream/Milk <input type="checkbox"/>  | Unsure/DK <input type="checkbox"/><br>Soup <input type="checkbox"/>                       |
| 7.  | <i>Staphylococcus Aureus:</i><br>If 'Yes' what foods would you associate with it?   | Yes <input type="checkbox"/><br>Milk <input type="checkbox"/>        | No <input type="checkbox"/><br>Eggs <input type="checkbox"/>        | Unsure/DK <input type="checkbox"/><br>Any food handled by people <input type="checkbox"/> |
| 8.  | <i>Clostridium perfringens:</i><br>If 'Yes' what foods would you associate with it? | Yes <input type="checkbox"/><br>Meat <input type="checkbox"/>        | No <input type="checkbox"/><br>Spices <input type="checkbox"/>      | Unsure/DK <input type="checkbox"/><br><input type="checkbox"/>                            |
| 9.  | <i>Clostridium botulinum:</i><br>If 'Yes' what foods would you associate with it?   | Yes <input type="checkbox"/><br>Canned Food <input type="checkbox"/> | No <input type="checkbox"/><br>Raw meat <input type="checkbox"/>    | Unsure/DK <input type="checkbox"/><br><input type="checkbox"/>                            |
| 10. | <i>Yersinia:</i><br>If 'Yes' what foods would you associate with it?                | Yes <input type="checkbox"/><br>Pork <input type="checkbox"/>        | No <input type="checkbox"/><br><input type="checkbox"/>             | Unsure/DK <input type="checkbox"/><br><input type="checkbox"/>                            |

## Section 7: Pests:

### 1. Who is your pest control?

1. Rentokil

2. Pest guard

3. Please specify if other \_\_\_\_\_

### 2. Have they successfully dealt with a particular pest problem in the recent past?

Yes

No

N/A

## Appendix 2 - Kitchen Audit

1. Were the floors in good repair and condition?
2. Were the counter/tables in good repair and condition?
3. Were the walls in good repair and condition?
4. Were the ceilings in good repair and condition?
5. Were the doors in good repair and condition?
6. Were the sinks in good repair and condition?
7. Were window and door openings to the outside fitted with a fly screen or equivalent protection?
8. Have horizontal sills and ledges been avoided?
9. Does the layout permit adequate cleaning and sanitation?
10. Does the layout protect against the accumulation of dirt?
11. Does the layout protect against condensation?
12. Does the layout protect against food contact with toxic materials?
13. Does the layout protect against the formation of moulds?
14. Are ceilings and overhead fixtures designed and finished to prevent the accumulation of dirt, to prevent condensation, to prevent the growth of moulds and the shedding of particles?
15. Are surfaces that come in contact with food easy to clean and sanitise?
16. Is there adequate provision for washing tools?
17. Is there adequate provision for the washing of food?
18. Are colour coded cutting boards used to protect against cross-contamination?
19. Are there washing procedures for knives and other tools or designated knives to protect against cross-contamination?
20. Is there correct storage of raw meat to protect against cross-contamination?
21. Are there designated sinks for washing food to protect against cross-contamination?
22. Is all equipment in good working order and easily cleaned?
23. Are food transport containers clean to protect against cross-contamination?
24. Are dishcloths a potential vehicle for cross-contamination?
25. Are there an adequate number of designated wash hand basins?
26. Do designated wash hand basins have hot and cold water?
27. Do designated wash hand basins have soap / antibacterial soap?
28. Do designated wash hand basins have hygienic drying facilities?
29. Are there an adequate number of designated staff toilets?
30. Does the layout ensure toilets do not open directly in to the food preparation area?
31. Is there adequate ventilation in the toilets?
32. Are there adequate changing facilities for personnel?
33. Is there air flow from clean to contaminated areas?
34. Is the drainage system a potential source of bacterial pathogens?
35. Is there food / other waste in the food preparation area?
36. Are food waste containers easily cleaned, closed and located in a self-draining area?
37. Does the waste bin area exclude pests?
38. Is the water used potable?
39. Are all personnel wearing suitable, clean protective clothing?
40. Have staff received food safety training?
41. Have staff received training in personal hygiene?
42. Do you ensure that employees suffering from food poisoning, diarrhoea or other illness are not permitted to work in the food preparation area by requiring them to complete a medical questionnaire before the commencement of employment?
43. Do you ensure that employees suffering from food poisoning, diarrhoea or other illness are aware they

- should not work in the food preparation area by covering this in a training course?
44. If an employee is out of work as a result of illness for more than 3 days are they required to produce a certificate of fitness to return to work signed by a doctor?
  45. Do you ensure that employees suffering from cuts, boils and sores cover them with a suitable dressing?
  46. Do you use electrocuters to control flying insects?
  47. Are there suitable screens to prevent insects gaining access to the food preparation area?
  48. Do you have a HACCP plan of some description?
  49. If you have a HACCP plan, are cooking and chilling considered to be CCPs?
  50. Do you have a hygiene/HACCP prerequisite manual?
  51. If you have a hygiene/HACCP prerequisite manual, does this include hygiene training and job description?
  52. If you have a hygiene/HACCP prerequisite manual, does this include cleaning and maintenance schedules?
  53. Is the temperature of the refrigerator/chill room between 1°C and 5°C?
  54. Is the temperature of the refrigerator/chill room monitored?
  55. Are there records of refrigerator/chill room temperatures?
  56. Is the temperature of the bain marie monitored?
  57. Are there records of bain marie temperatures?
  58. Do you have a hygiene policy and are you able to produce the same for inspection?
  59. Do you have an audit checklist for self-auditing and are you able to produce these for inspection?
  60. Do you have a list of approved suppliers and are you able to produce these for inspection?
  61. Do you have checklists for inspection of deliveries and are able to produce these for inspection?
  62. If you have checklists for inspection of deliveries, do these include inspection of the suitability of the vehicle?
  63. If you have checklists for inspection of deliveries, do these include inspection of the hygiene of the delivery person?
  64. If you have checklists for inspection of deliveries, do these include inspection of the 'best before' or 'use by' dates?
  65. If you have checklists for inspection of deliveries, do these include inspection of packaging?
  66. If you have checklists for inspection of deliveries, do these include a check of the temperature of the food?
  67. Do you have a copy of the Irish Standard 'Hygiene in the Catering Sector'?



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