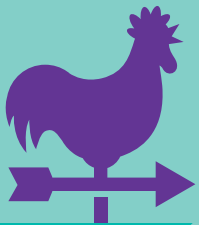


Consumer Focused Review *of the Chicken Food Chain* 2012



Consumer focused review of the chicken food chain

ISBN:

Publication date:

Table of contents

ACKNOWLEDGEMENTS.....	6
MEMBERS OF THE EXTERNAL ADVISORY GROUP	7
ABBREVIATIONS	8
LIST OF TABLES.....	11
LIST OF FIGURES.....	12
EXECUTIVE SUMMARY	13
1 INTRODUCTION	21
1.1 Background to safe food	22
1.2 Objective and terms of reference of the review.....	22
1.3 Consumer focused review of chicken	23
1.3.1 From the consumer perspective.....	23
1.3.1.1 Quantitative research	23
1.3.1.2 Qualitative research.....	26
1.4 Conclusions	28
2 THE CHICKEN MEAT SUPPLY CHAIN.....	29
2.1 Profile of the chicken industry	30
2.1.1 Island of Ireland.....	30
2.1.1.1 Employment	31
2.1.1.2 Consumption.....	31
2.1.1.3 Imports.....	31
2.1.1.4 Exports	32
2.1.1.5 Expenditure.....	32
2.1.2 European perspective.....	32
2.1.3 Global perspective.....	32
2.2 Outline of the chicken food chain	34
2.2.1 Poultry production systems	34
2.2.1.1 Conventional	34
2.2.1.2 Free Range.....	35
2.2.1.3 Organic.....	35
2.2.2 Broiler breeding	35
2.2.3 Broiler rearing.....	36
2.2.4 Slaughter and primary processing.....	37
2.3 Conclusions	40
3 FOOD SAFETY ISSUES.....	41
3.1 Microbiological issues	43
3.1.1 Introduction.....	43
3.1.2 Chicken related foodborne illness on IOI	44
3.1.2.1 Campylobacteriosis.....	44
3.1.2.2 Salmonellosis.....	47
3.1.3. Microbiological risks along the food chain	49
3.1.3.1 At farm level	49
3.1.3.2 Transport from farm to slaughterhouse.....	55
3.1.3.3 Primary processing.....	56

3.1.3.4	Storage and distribution.....	59
3.1.3.5	Retail and catering	59
3.1.3.6	The home	63
3.1.4	Other microbiological risks	64
3.1.4.1	Staphylococcus aureus	64
3.1.4.2	Listeria monocytogenes.....	64
3.1.5	Antimicrobial resistance and cross-resistance	65
3.1.6	Antimicrobial treatment (decontamination) of poultrymeat.....	67
3.1.7	International recommendations.....	69
3.2	Chemical safety issues.....	69
3.2.1	Broiler feed formulation	70
3.2.1.1	Control systems for broiler feed on IOI	70
3.2.2	Compounds classified as additives for use in animal feedingstuffs.....	72
3.2.2.1	Legislation concerning the authorisation of feed additives and bioproteins on IOI.....	73
3.2.2.2	Coccidiosis	73
3.2.3	Compounds classified as contaminants in animal feedingstuffs.....	76
3.2.3.1	Legislation concerning the analysis of animal feedingstuffs and feed additives for contaminants	76
3.2.3.2	Mycotoxins	76
3.2.3.4	Nitrofurans	79
3.2.4	Compounds classified as veterinary medicinal products for use in animal health	80
3.2.5	Surveillance programmes	81
3.2.5.1	Surveillance results for coccidiostat residues on IOI	82
3.2.5.2	Surveillance results for chemical and drug residues	82
3.3	Third Country import controls	83
3.3.1	European Union Food and Veterinary Office.....	84
3.3.2	Border inspection posts	84
3.4	Product traceability and recall	86
3.4.1	Product traceability.....	86
3.4.2	Product recall.....	87
3.5	Animal diseases.....	88
3.5.1	Avian influenza.....	88
3.5.2	Newcastle disease	89
3.6	Conclusions	90
4	NUTRITION AND HEALTH.....	92
4.1	Introduction.....	94
4.2	Nutritional composition of chicken meat.....	94
4.2.1	General	94
4.2.2	Effect of processing and cooking on the nutritional composition of chicken.....	96
4.2.2.1	Nutritional composition of chicken as part of composite dishes	100
4.3	Current consumption patterns	102
4.3.1	Consumption based on market data	102
4.3.2	Consumption based on dietary surveys	103
4.3.2.1	Adults	103
4.3.2.2	Children and adolescents	106
4.3.3	Contribution of chicken to nutrient intakes.....	106
4.4	Chicken and health	108

4.4.1	Chicken and iron status	108
4.4.2	Chicken and cancer	109
4.5	Conclusions	109
5	LABELLING, LEGISLATION AND OTHER ISSUES	111
5.1	Introduction.....	112
5.2	Labelling.....	112
5.2.1	General food labelling requirements	112
5.2.2	Specific meat labelling requirements.....	112
5.2.3	Specific poultrymeat labelling requirements.....	113
5.2.4	Health marking.....	115
5.2.5	Country of origin	116
5.2.6	Nutrition labelling.....	116
5.2.7	Labelling of organic chicken.....	117
5.2.8	Re-labelling	117
5.2.9	Adulteration.....	118
5.3	Animal welfare.....	119
5.4	Training	120
5.4.1	On the island of Ireland	121
5.4.2	At European level.....	122
5.5	Quality assurance schemes	122
5.5.1	Red Tractor Farm Assurance Poultry Scheme.....	123
5.5.2	Bord Bia Chicken Quality Assurance Scheme.....	123
5.6	Conclusions	126
6	SUMMARY & CONCLUSIONS.....	127
6.1	Conclusions	129
6.1.1	At farm level	129
6.1.2	Transport from farm to slaughterhouse.....	130
6.1.3	Primary processing.....	130
6.1.4	Retail and catering	131
6.1.5	In the home	132
6.1.6	Surveillance and controls	133
	References.....	134
	Appendix A.....	143
	Appendix B.....	147
	Appendix C.....	148
	Appendix D.....	149
	Appendix E	150
	Appendix F	151
	Appendix G.....	152
	Appendix H.....	153
	Appendix I.....	156
	USEFUL LINKS	158
	GLOSSARY	159

ACKNOWLEDGEMENTS

Central Statistics Office

Communicable Disease Surveillance Centre, Northern Ireland

The Food Safety Authority of Ireland

Food Standards Agency

Health Protection Surveillance Centre

Millward Brown

Teagasc

MEMBERS OF THE EXTERNAL ADVISORY GROUP

Mr Kenneth Carroll

Managing Director, Carroll Food Services Ltd

Dr Kirsten Dunbar

Head of Primary Production, Food Standards Agency in Northern Ireland

Ms Tina Leonard

Freelance Journalist (Consumer Issues)

Prof. David McDowell

Professor of Food Studies, University of Ulster at Jordanstown

Mr Vincent Carton

Managing Director, Carton Brothers

Ms Amii Cahill

Executive Secretary, National Poultry Committee and National Pigs and Pigmeat Committee, Irish Farmers' Association

Mr David Nolan

Senior Superintendent Veterinary Inspector, Department of Agriculture, Fisheries and Food

Ms Ruth Dalton

Food Safety and Quality Auditor, Musgrave Retail Partners Ireland

Ms Ursula Lavery

Head of Quality and Technical, Moypark Ltd

Mr Jim O'Toole

Quality Assurance Manager, Bord Bia

Prof. Marlene Proctor

Professor Emeritus, Dublin Institute of Technology

ABBREVIATIONS

ACP	Assured Chicken Production
ACMSF	Advisory Committee on the Microbiological Safety of Food
ADI	Acceptable Daily Intake
AI	Avian Influenza
ALARA	As Low As Reasonably Achievable
AVI	Authorised Veterinary Inspector
BIP	Border Inspection Post
CIEH	Chartered Institute of Environmental Health
CMI	Checkmate International plc.
CPMP	Committee for Proprietary Medicinal Products
CSO	Central Statistics Office
CVMP	Committee for Veterinary Medical Products
DAF	Department of Agriculture and Food
DARD	Department of Agriculture and Rural Development
DEFRA	Department of the Environment, Food and Rural Development
EFSA	European Food Safety Authority
EFSIS	European Food Inspection Service
EHO	Environmental Health Officer
EMA	European Agency for the Evaluation of Medicinal Products
EU	European Union
FAO	Food and Agriculture Organisation
FEEDAP	Panel on Additives and Products or Substances Used in Animal Feed

FSA	Food Standards Agency
FSAI	Food Safety Authority of Ireland
FSTC	Food Safety Training Council
FVO	Food and Veterinary Office
HACCP	Hazard Analysis and Critical Control Point
HSE	Health Service Executive
IBEC	Irish Business and Employers' Confederation
IOI	Island of Ireland
JECFA	Joint FAO/WHO Expert Committee on Food Additives
LD₅₀	Lethal Dose
MRL	Maximum Residue Level
MRM	Mechanically Recovered Meat
MS	Member State(s)
MT	Thousand Tonne
ND	Newcastle Disease
NDSC	National Disease Surveillance Centre
NI	Northern Ireland
NMS	New Member State(s)
NOEL	No Observed Effect Level
NSIFCS	North South Ireland Food Consumption Survey
OVS	Official Veterinary Surgeon
PCB	Polychlorinated Biphenyl(s)
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzofuran
PMI	Poultrymeat Inspector

PVP	Private Veterinary Practitioner
QUID	Quantative Ingredient Declaration
RASFF	Rapid Alert System for Food and Feed
RDA	Recommended Daily Allowance
RIPH	Royal Institute of Public Health
ROI	Republic of Ireland
RSPH	Royal Society for Promotion of Health
SCF	Scientific Committee for Food
SMP	Salmonella Monitoring Programme
SKU	Stock Keeping Unit
TCDD	2,3,7,8-tetrachloro dibenzo- <i>p</i> -dioxin
TDI	Tolerable Daily Intake
TNS	Taylor Nelson Sofres plc.
UFAS	UKASTA Feed Assurance Scheme
UK	United Kingdom
UKASTA	United Kingdom Agricultural Supply Trade Association
VI	Veterinary Inspector
VMP	Veterinary Medicinal Product
WHO	World Health Organisation
WTO	World Trade Organisation

LIST OF TABLES

Table 2.1	Distribution of broilers by flock size NI
Table 2.2	Poultry slaughterings on IOI in 2009/2010 ('000 tonnes)
Table 2.3	Global production ('000 Tonnes) – indigenous chicken meat 2009
Table 2.4	Global chicken meat imports (excluding EU-27) 2009
Table 2.5	Global chicken meat exports (excluding EU-27) 2009
Table 3.1	Implicated food vehicles in 2010 foodborne outbreaks, England and Wales
Table 3.2	Animal feed legislation
Table 3.3	Relevant EU legislation on mycotoxins
Table 3.4	Relevant EU legislation on dioxins
Table 4.1	The nutritional value of different raw meats per 100g
Table 4.2	The fatty acid profile of chicken per 100g
Table 4.3	The micronutrient composition of chicken per 100g
Table 4.4	The nutritional composition of chicken products per 100g
Table 4.5	The effect of cooking on the nutritional composition of chicken per 100g
Table 4.6	The nutritional composition of composite chicken dishes per 100g
Table 4.7	Mean and SD values of food group intakes (g/day) for 18-64 year olds and those aged 65 and older, in consumers only
Table 4.8	Types of food eaten regularly by type of accommodation in the University Student Food Attitudes and Behaviour Survey
Table 4.9	Percentage contribution of chicken to mean daily nutrient intakes in Irish men and women

LIST OF FIGURES

- Figure 1.1 Foods consumers were most concerned about in 2009
- Figure 1.2 Summary of concerns in relation to chicken production and preparation on the island of Ireland (prompted, n=807)
- Figure 1.3 Effectiveness of key factors for consumers in ensuring safety of chicken (n=769)
- Figure 2.1 Overview of broiler processing
- Figure 3.1 Incidence rate of *Campylobacter* cases by year, ROI, NI and IOI 2004-2010.
- Figure 3.2 Crude incidence rate of confirmed cases of campylobacteriosis by age group, ROI and NI, 2009
- Figure 3.3 Incidence rates of salmonellosis (per 100,000 population) NI and ROI, 004-2010.
- Figure 5.1 Percentage of facings with the Bord Bia Quality Assurance Mark in ROI
- Figure 5.2 Percentage of stock-keeping units with the Bord Bia Quality Mark across retailers in ROI

EXECUTIVE SUMMARY

In 2005 **safefood** initiated a three year programme which involved two comprehensive food chain screening exercises per year. Each review profiled a specific food category, identifying and describing the relevant food safety issues connected with it at various points along the food chain, and identifying opportunities to communicate the human health benefits to various stakeholders. The primary focus of these reviews was food safety and nutrition issues. However, other concerns identified by the consumer not directly related to food safety were discussed, e.g. animal welfare.

As a considerable period of time has passed since these Consumer Focused Reviews were published, **safefood** wishes to revisit them in order to update their content. This will ensure consumers on the island of Ireland (IOI) are informed of any changes that have occurred since 2005.

Each review profiles a specific food category, identifying and describing the relevant food safety issues pertaining to it at various points along the food chain, and identifying opportunities to communicate the human health benefits to, and influence the behaviour of, various stakeholders.

In order to help define the food commodity for the initial consumer focused review in September 2004, **safefood** commissioned research to identify the foods that consumers had most concerns about. Those concerns were in relation to how the foods were produced, packaged, sold in shops, or handled in the home. The results of the research indicated that chicken was the food that consumers were most concerned about. There is also strong scientific evidence that consumption of contaminated chicken carries a high risk of illness compared with other foods.

The chicken industry is highly integrated with a small number of companies owning most of the market share on the island of Ireland. This integration enables the industry and the companies involved to have great control, and introduce new protocols including food safety measures, with high efficiency. In recent years, increasing imports from other EU and Third Countries have placed extra economic pressures on the indigenous industry, and have forced the closure of some processing companies and redundancies in others.

While the chicken industry must contend with the growing levels of imports, it also must concern itself with other challenges such as the human and economic significance of *Campylobacter*. Evidence suggests that chicken is the single most significant carrier of food poisoning micro-organisms causing illness in humans. The risk of illness through contamination of chicken with *Campylobacter* and *Salmonella* should be a concern for all parties from farm to fork.

While excellent efforts have been made throughout the chicken food chain in controlling *Salmonella* spp., particularly the heat treatment of feed and on-going surveillance, the control of *Campylobacter* spp. presents a different set of challenges. At the moment there are no viable alternatives to proper and sustained biosecurity. Once *Campylobacter* has infected at farm level, there is limited scope for further control efforts through the subsequent stages of production and the supply chain.

Allied to biosecurity is the concept of the 'all in, all out' system rather than the use of thinning, which is considered to compromise biosecurity measures. Such a system has been advocated by both the Food Safety Authority of Ireland (FSAI) and the Food Standards Agency (FSA). However, market demands are for a range of chickens of different sizes and the industry currently does not have an economically viable alternative to thinning.

Both the FSAI and FSA have recognised the significance of *Campylobacter*, and are currently implementing strategies to reduce the level of infection along the food chain. The FSA has set targets to reduce the level of *Campylobacter* in United Kingdom (UK) produced chickens on retail sale by 30% by 2015. The main focus of this strategy is on the broiler farm, specifically through biosecurity measures. However, it also considers potential options for control at the slaughterhouse. In its 2011 Scientific Committee Report, the FSAI made several recommendations relating to partial depopulation, risk management and good hygiene practices.

Chicken is the protein source of choice for many consumers, both from a nutritional and cost perspective. However, both qualitative and quantitative research conducted by **safe food** with consumers indicates that food safety, and other issues such as labelling and country of origin, are important for consumers.

The issue of country of origin is contentious. Market and economic statistics demonstrate that the value of imports of poultrymeat into the Republic of Ireland (ROI) increased from €187 million in 2003 to €246 million in 2009 (figures from Northern Ireland (NI) unavailable), and this is expected to increase in the future. The growth in imports is sustained by the increase in demand on the island of Ireland (IOI) for chicken, outstripping indigenous production, and the preference of consumers for white chicken meat.

Consumers identify country of origin with food safety, in the belief that locally produced chicken is safer than imported. Under the powers given to it by the Lisbon Treaty, the European Parliament has introduced legislation leading to a Directive (to be implemented in 2015) requiring that the country of origin be labelled on all meats, including poultry.

To assuage consumer concerns with regard to imported poultrymeat from Third Countries, it is important to recognise the respective roles of the EU Food and Veterinary Office (FVO) and Border Inspection Posts (BIPs) in the food chain. However, the frequency of sampling is currently relatively low. Furthermore, in 2008 the FVO highlighted a number of deficiencies in the operation and management of BIPs.

From an industry perspective, the main concern with regard to country of origin is freshness. Chicken fillets from mainland Europe are lower in price because they arise from surpluses all over the continent and are not as fresh as the locally produced. At present, fresh chicken meat from other EU countries is only presented for sale as chicken pieces (i.e. fillets, thighs etc), some having undergone substantial transformation and being labelled country of origin IOI.

Meanwhile, it is estimated that 90% of all chicken meat used in the catering industry has been sourced from other EU countries and a significant volume of cooked chicken meat originates from outside the EU. Thus, while consumers may give much time and effort to ensuring that they purchase IOI chicken from their retailer, there is no information provided to them (or onus put on the caterer to provide it) of the source of the chicken that they may eat in their sandwich or in a restaurant meal. This is compounded by the lack of labelling requirements at the catering stage of the food chain.

Some retailers, particularly butchers and premises with butcher counters, can legitimately sell loose, unlabelled chicken, which may not be of IOI origin. The legislation stipulates that information regarding the produce, including country of origin, must be displayed. Anecdotally this is not always the case.

Substantial transformation is an issue of concern to consumers. Regulatory bodies consider this is a customs issue and not a food safety one. Consumers do not understand this contentious trade issue and may be misled with regard to the country of origin of the chicken that they purchase. From an international trading perspective, country of origin is seen as a barrier to trade and not widely endorsed.

Conclusions

At farm level

- Much effort has been spent in ensuring that the grandparent stock and their offspring are disease free. The industry has also been proactive in identifying the potential risks to its business and the safety of the food chain. However, there remain a number of critical issues.
- Biosecurity on farms is at the corner stone of food safety along the food chain. The cessation of the practice of thinning may be a prudent step towards minimising the risks of *Campylobacter* at farm level. Standard biosecurity measures have not, so far, been very successful at reducing *Campylobacter*. The colonisation of chickens on IOI and other control strategies are now focussing on reducing the concentration of *Campylobacter* on chicken carcasses.
- The heat treatment of feed has been shown to be an effective step in the control of *Salmonella* and levels of animal infection and human salmonellosis have been on the decrease in recent years. There is merit in the introduction of mandatory heat treatment in NI. Best practice evidence, from countries such as Denmark and Sweden, suggests that the decrease in human salmonellosis is the direct result of the control programmes put in place at farm level.
- Surveillance of both *Campylobacter* and *Salmonella* is essential in the control of these micro-organisms.

- The issue of the GM status of feed is of concern to producers, particularly those involved in organic chicken production. This is also an area where the consumer is often provided with very little information.

Transport from farm to slaughterhouse

- The high integration of the industry on IOI means that most slaughterhouses are within close proximity of broiler farms. However, this remains a stressful process for the birds, leading to a potentially high cross-contamination situation. Evidence suggests that the current washing procedures used for crates are not sufficient to remove pathogenic micro-organisms. This could improve the microbiological load of animals entering the processing plants, and efforts should be made to try to reduce potential contamination.

Primary processing

- The processing industry is highly efficient. In modern processing plants the time that it takes from when the chicken is stunned and slaughtered to when its meat is packed and placed in storage for distribution can be less than 2 hours.
- In an ideal world, pathogen free chickens should be presented for slaughter. However, the reality is somewhat different, and the processing environment is highly susceptible to cross-contamination from infected birds.
- Even when steps are taken to reduce the pathogenic load of chickens coming from broiler farms, protocols within the processing plant can undo this. The slaughtering and processing of organic chickens (where there may be potentially higher infection rates, including *Campylobacter* levels) without subsequent decontamination of the line, poses a potentially serious risk of cross-contamination within the plant. This area warrants further investigation.
- The importance of HACCP and training within the processing environment is critical to the successful elimination and containment of potentially pathogenic micro-organisms.
- The acceptability of the use of antimicrobial procedures, such as irradiation, should be investigated amongst consumers.

Retail and catering

- The retailer and caterer represent the front line of the food industry to consumers. Therefore, both sectors must do everything within their powers to take the appropriate steps to ensure food safety.
- As with the processing industry, HACCP and training are at the core of good food safety practice. The influx of non-nationals into IOI, and their uptake, in large numbers, of employment within the food sector has put even more emphasis on the need for training, including in their native languages. The FSA and FSAI, and some members of the food sector, are to be commended for their proactive work in this respect.
- Surveillance of chicken and chicken products within the sectors over recent years has indicated that the levels of Salmonella positive samples are declining, while the numbers of Campylobacter positive samples has remained static. There is little that the catering and retail sectors can do once presented with raw chicken which is positive for pathogenic micro-organisms, other than ensure that all the necessary steps are taken to prevent cross-contamination and that foods are properly cooked.
- Current legislation states that all raw poultrymeat for sale at retail level must be labelled to include information in respect of class, price per weight, country of origin, etc. In butchers' shops and butcher counters in ROI, where loose produce is sold, this information must also be made available to the consumer. However, anecdotal evidence suggests that this is not always observed. In NI, the only requirement for poultrymeat sold loose is that the name of the product is displayed.
- There is currently no legislative onus on caterers to label their produce. Approximately 90% of all chicken meat used in the catering trade is imported. Consumers have identified country of origin as a major concern. The lack of information provided by the catering sector on this and other information about the product, such as ingredient listing and nutrition, serves only to misinform consumers or prohibit them from making informed choices.
- There is an onus on the industry and enforcement agencies to ensure not only that meat coming from Third Countries is safe, but also that the consumer is not misled about the source of this meat through substantial transformation.

In the home

- The consumer is an important link in the chicken food chain. All the other steps in the chain are regulated by legislation and industry codes of practice, and are monitored and audited on a regular basis.
- Consumers should be advised about the correct handling, storage and preparation of foods. This should extend to the steps which need to be taken to eliminate the potential risk of cross-contamination from raw to ready-to-eat foods.

This advice should include information with respect to the following points:

- Research suggests that consumers have significant understanding and awareness of the potential levels of Salmonella in chicken and its consequences. An education campaign should be undertaken to raise consumer awareness of Campylobacter.
- Research has shown that the packaging of chicken products may be contaminated with pathogenic bacteria. It is important that consumers ensure that all surfaces, including hands and utensils, are cleaned to prevent cross-contamination.
- The practice of washing chicken breast fillets and whole chickens, which was identified in some focus groups, should be discouraged. Such products, prepared for direct sale to consumers, are 'oven ready' and do not require further washing. Washing of such poultry creates aerosols, increasing the risk of cross-contamination.
- The proper and adequate cooking of foods will eliminate the risk of illness from contaminated chicken. This involves cooking chicken until the food is piping hot throughout, ensuring that there is no pink meat remaining and the juices run clear. Practices such as 'relying on taste' should be discouraged.
- The use of food thermometers is not widespread on IOI. Consumers should be advised that their use is the most reliable method to check that foods, including chicken, are cooked properly.
- All foods should be stored in a refrigerator at less than 5°C.
- Growth of pathogenic bacteria can be increased by a significant time delay in the transport of perishable foods to and/or from the home and also by incorrect storage during this time. Raw poultry should be packed in separate bags or containers away from others to avoid potential cross-contamination. The use of insulated bags or freezer bags is recommended during transportation. Food should be refrigerated, cooked or frozen, as soon as possible after purchase.

- The nutritional benefits of chicken can be compromised by the ingredients and methods employed in the manufacturing/cooking process. The importance of reading labels on commercially processed foods, cooking methods and the incorporation of fresh vegetables and fibre-rich starchy foods in meals prepared in the home should be emphasised.

Surveillance and controls

- The introduction of the Zoonoses Directive and the Hygiene Package were welcome developments towards the protection of human health.
- To further enhance the understanding of Campylobacter infection detailed typing data of human isolates, as well as those from food and animals, is needed.
- In some instances little scientific significance can be drawn from surveillance data, due to the low number of samples. This is both from a microbiological and toxicological perspective

1 INTRODUCTION

- 1.1 Background to *safefood*
- 1.2 Objective and terms of reference of the review
- 1.3 Consumer focused review of chicken
- 1.4 Conclusions

Key findings

- There is a high rate of chicken consumption on IOI.
- Ensuring that chicken is properly cooked is the issue of most concern for consumers on IOI.
- NI consumers appear less concerned than ROI consumers about many factors relating to chicken production.
- Consumers rate the ‘use by’ date as the factor of most importance when considering chicken safe to eat.
- In terms of the safety of chicken, NI consumers appear less concerned than ROI consumers regarding the country of origin/traceability of chicken. Since 2005 the country of origin and packaging of chicken is of more concern to consumers in ROI but of less concern in NI.
- While chicken is not regarded as a safe meat, consumers feel they are taking the necessary steps to minimise any potential hazards.
- Since 2005 chicken has maintained its popularity as a family favourite.

1.1 Background to safefood

safefood is a North-South body, responsible for the promotion of food safety on the island of Ireland. *safefood* advocates an environment where consumers have confidence in the food they eat. In order to create this environment, *safefood* works in close collaboration with its partners in food safety and nutrition.

The role of *safefood* is determined by its governing legislation, which sets out its functions. These functions are summarised as follows:

- Promotion of food safety
- Research into food safety
- Communication of food alerts
- Surveillance of foodborne disease
- Promotion of healthy eating
- Research into nutrition
- Promotion of scientific co-operation and linkages between laboratories
- Development of cost-effective facilities for specialised laboratory testing.

safefood's functions also include an independent science-based assessment of the food chain and the organisation has a role in giving advice on the nutritional aspects of certain foods.

1.2 Objective and terms of reference of the review

To address in part its function in relation to carrying out independent science-based assessment of the food chain, as well as adopting the theme of complementary working and added value, *safefood* initiated a three year programme in 2005 involving two comprehensive food chain screening exercises each year .

Each review focused on a particular food category or process with the objectives of:

- Providing consumers with the most relevant and pertinent information available to enable them to make informed choices in respect of the food they eat.

- Helping consumers understand: (a) how the food safety system works; (b) the efforts being taken by the regulators, producers, and industry to reduce the inherent risks; and (c) the prudent, sensible steps that can be taken to address both perceived and potential risks.
- Providing opportunities to promote good practice along the food chain.

The purpose of these reviews is to profile the food category, recognise and describe the relevant food safety issues pertaining to it at various points along the food chain, and to identify opportunities to communicate the human health benefits to, and influence the behaviour of, the various stakeholders.

The general terms of reference of each review are:

To report on foods in light of their impact on human health and consumer concerns, and in particular to:

1. Profile the food category, and identify and describe the issues relevant to human health at various points along the food chain.
2. Report on how the food safety system works across the entire food chain.
3. Identify opportunities to communicate the human health benefits and potential risks of this food category to the consumer.
4. Identify means to highlight best practice for key stakeholders.
5. Determine and communicate key issues for stakeholders with a view to influencing behaviour and practice across the food chain.

The primary purpose of these reviews is concerned directly with food safety and nutrition issues. However, other concerns identified by the consumer not directly related to food safety are discussed, e.g. animal welfare, animal diseases etc. This review of the chicken food chain will focus only on raw and cooked chicken meat, i.e. derived from chicken muscle or flesh and excluding chicken liver, kidney, skin, bone and other parts of the animal, and will not include processed chicken products.

1.3 Consumer focused review of chicken

1.3.1 From the consumer perspective

1.3.1.1 Quantitative research

safefood conducts bi-annual market research entitled *safetrak*, during which it determines consumers' attitudes and behaviour in relation to particular foods and food preparation habits. In its

September 2004 research consumers indicated that chicken was the food of most concern. Research carried out in November 2009 showed that chicken remained the food of most concern for consumers (Figure 1.1).

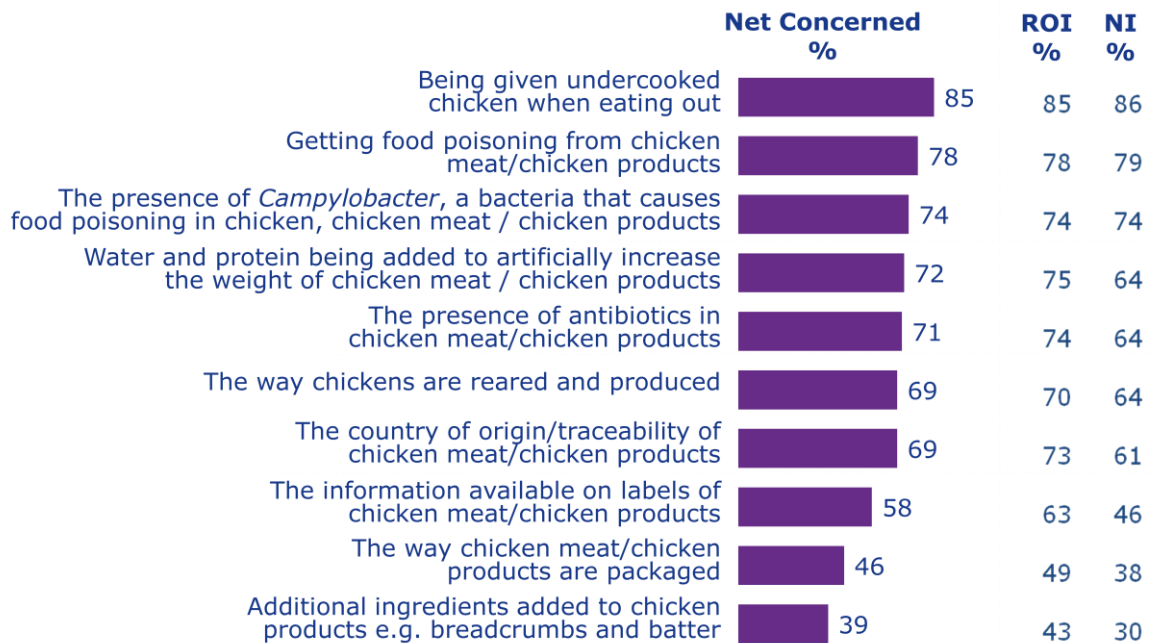
As a result of consumer concern in relation to chicken, **safefood** incorporated a number of questions in its 2005 and 2010 *safetrak* relating to specific concerns regarding chicken (see Appendix A). Results for 2010 showed that over 8 in 10 adults on IOI eat chicken at least once a week, with consumption more frequent in ROI.

Figure 1.1 Foods consumers were most concerned about in 2009

Base: All Respondents (804)		IOI Spontaneous %	Total Mentions IOI %	Total ROI %	Total NI %
Raw chicken	(41)	49	(63)	66	62
Raw pork	(22)	27	(42)	47	39
Shellfish	(11)	12	(26)	33	26
Raw beef	(16)	17	(33)	33	22
Food with preservatives, additives or colouring	(n/a)	8	(n/a)	28	18
Fish	(8)	10	(18)	24	23
Processed meat (sausages, burgers)	(11)	9	(29)	25	18
Cooked meat/poultry	(13)	12	(27)	24	19
Raw lamb	(11)	12	(26)	26	14
Eggs	(12)	11	(24)	22	25
Ready made meals	(7)	4	(20)	17	13
Foods with GM ingredients	(5)	4	(14)	18	7
Frozen foods	(5)	4	(13)	12	7
Other raw meat	(1)	6	(3)	12	3
Milk	(2)	4	(8)	9	7

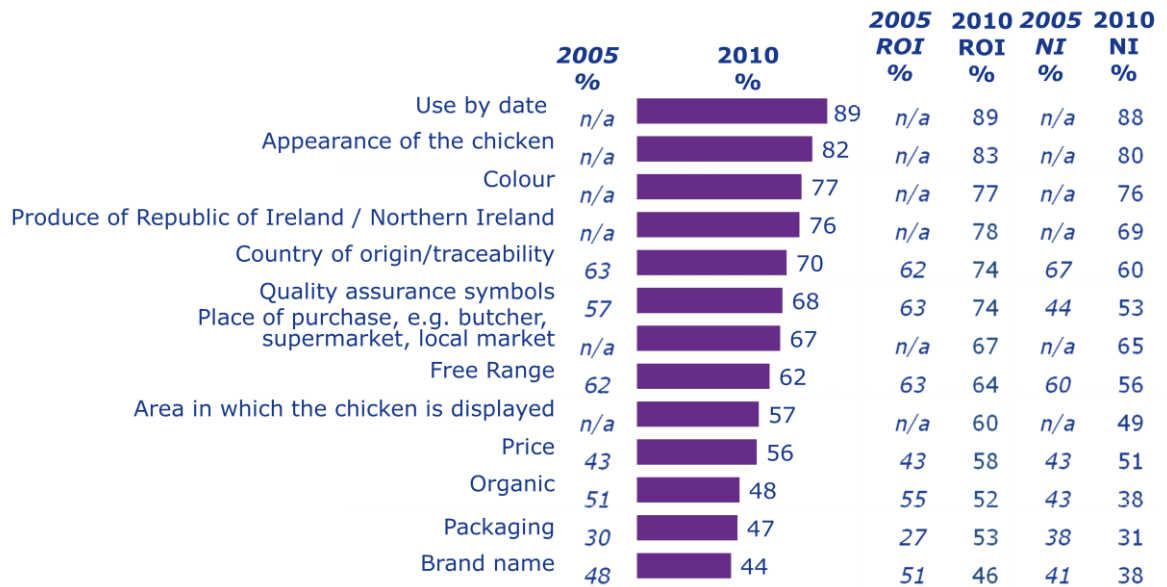
In general, consumers expressed significant levels of concern regarding most aspects of chicken production and preparation (Figure 1.2). Getting food poisoning is the most concerning factor, either from undercooking or due to the presence of bacteria. Additives such as protein and antibiotics are next most important, followed by how and where the chickens are reared. Packaging and labelling are relatively low on the list of concerns. NI consumers appear less concerned than ROI consumers about many factors relating to chicken production, including the presence of antibiotics in chicken and the manner in which chickens are reared.

Figure 1.2 Summary of concerns in relation to chicken production and preparation on the island of Ireland (prompted, n=807)



Consumers rate ‘use by’ date most, followed closely by their own judgement on colour and appearance, to feel confident that the chicken they buy is safe to eat (Figure 1.3). Since 2005, country of origin and packaging is of more concern in ROI but of less concern in NI. Price has grown slightly in importance in both regions, whereas the perceived importance of organic production in ensuring the safety of chicken has declined. It is not clear from our data why the level of concern differs considerably in NI and ROI. The chicken industry in NI is large and food that is local, or assumed to be local, may elicit a higher level of trust.

Figure 1.3 Effectiveness of key factors for consumers in ensuring safety of chicken (n=769)



1.3.1.2 Qualitative research

To develop some of the issues raised in the quantitative research, a number of focus groups were held by **safefood** throughout the Island of Ireland (IOI) in 2005 and 2011. The objective was to elicit consumers' perceptions of the chicken supply chain and analyse their opinions of both the industry and the commodity from farm to fork.

Overall in 2011 consumers considered chicken to be versatile, convenient, nutritious and 'good value.' Chicken was reported as the meat of choice, particularly when feeding children. It is strongly perceived as healthy as it is a lean, white meat and a good source of protein. A large variety of chicken is bought, with fresh chicken fillets and whole chickens very popular. Consumers did indicate a number of inherent issues of concern in the production and processing of chicken, including production methods, but reported that these did not affect food selection and consumption patterns. The assumption was that such issues were the responsibility of retailers, who they expect to act on their behalf. One exception to this pattern relates to country of origin, which consumers did consider important, especially when purchasing chicken to cook themselves.

The supermarket and butchers are popular purchase points for chicken. Consumers considered the retailer's reputation as fundamental, particularly in the purchase of fresh chicken. They saw the retailer's brand as an indicator of quality, origin, and safety. In the absence of a recognised brand

name, consumers assumed that retailers were taking the steps necessary to ensure food safety and quality. This dependence on the retailer is even more important if the retailer is a traditional butcher, who is believed to provide a range of benefits including the sale of quality meat, more trusted source, good reliable reputation and personalised service. Consumers use certain guidelines to aid their purchasing decisions. These include visual cues that indicate freshness, origin or source and value for money special offers.

The visual appearance of the product was reported as very important in the purchasing decision. Similarly, labelling was reported as central in purchasing decisions, specifically in terms of origin, 'use by' date and fat content. Consumers were prepared to buy unlabelled/unpackaged chicken from those butcher shops with which they had an established relationship of trust.

Recent media coverage regarding chicken has focused on the production and farming of poultry. Most don't like to dwell on how chicken is produced and consider it is not a pleasant process. Consumers saw little advantage in free-range/organic chicken in comparison with conventionally produced chicken, with the cost cited as too prohibitive to regularly eat these types of poultry.

Consumers reported the preparation of chicken products, both in the food chain and the home, as a risk. They were familiar with the dangers of undercooked chicken and they considered that it is the consumer himself/herself who has the ultimate responsibility to ensure food safety at this stage of the food chain. All have a series of checks they use to ensure chicken is properly cooked and as safe as possible. Many consumers feel that they are taking the necessary steps to minimise any potential hazards or risks associated with chicken consumption. However, consumers expressed conflicting opinions regarding best practice in relation to chopping board maintenance and the correct procedure for defrosting of chicken products.

In contrast to the 2005 focus groups, price was identified as a major determinant in purchasing decisions in 2011. However, consumers are actively seeking out value for money as opposed to the lowest prices available. Traceability was also identified as a major determinant in the purchase of chicken. The naming of the producer farm or farmer on labels was noted as providing reassurance for consumers in terms of food safety. Country of origin was not reported as a major determinant in the purchase of chicken-based frozen or ready meals.

1.4 Conclusions

Since 2005 chicken has maintained its popularity as a family favourite on IOI. Overall, ensuring that chicken is properly cooked is the issue of most concern for consumers on IOI. While chicken is not regarded as a safe meat, consumers feel they are taking the necessary steps to minimise any potential hazards. There are some differences between NI and ROI in relation to consumers' concern regarding chicken production. Both qualitative and quantitative research indicate that both country of origin and packaging of chicken are of concern to consumers on IOI.

2 THE CHICKEN MEAT SUPPLY CHAIN

- 2.1 Profile of the chicken industry
- 2.2 Outline of the chicken food chain
- 2.3 Conclusions

Key findings

- The poultry industry on IOI is worth an estimated €347 million (ROI at wholesale prices) and Stg£350 million (NI) to the economies annually.
- Approximately 192 million birds are processed annually on IOI.
- The poultry industry on IOI is currently facing serious economic strains due to high costs and increasing imports.
- It is estimated that over 90% of poultry used in the catering trade in ROI is imported.
- The main EU poultry producers are the UK, Spain, Germany, France and Poland.
- The largest chicken meat producers globally are the USA, China, Brazil, Thailand and the EU.
- Poultrymeat production systems can be described as intensive, free range or organic.

2.1 Profile of the chicken industry

2.1.1 Island of Ireland

At the farm gate the poultry industry on IOI is worth an estimated €347 (£305*) million (ROI) and Stg£350 (€400*) million (NI) to the economies annually.¹ Today's industry is characterised by vertical integration with large companies integrating several stages of the supply chain such as breeding, hatchery, feed production, rearing, primary processing, further processing and distribution within their company or under close contract systems. This is typical of poultry systems operating worldwide. There are a number of key players, with six companies representing in excess of 90% of all domestic broiler production on the island.

* Currency Conversion: €1.00 = £0.88

In total, it is estimated that poultry numbers exceed 192 million on IOI.¹ In Northern Ireland there are 657 poultry farms, of which 298 are broiler. Table 2.1 outlines the distribution of broilers by flock size in NI. The equivalent data for ROI is currently unavailable.

Table 2.1 Distribution of broilers by flock size NI (1)

No. of Farms	No. of broilers ('000)
29	0
6	19
8	68
77	1,259
26	606
86	3,199
66	6,764

¹ Personal Communication, Carton Brothers, November 2011

Statistics for poultry slaughterings on IOI can be seen in table 2.2. In NI, 256,600 tonnes of broilers (live weight) were produced in 2009, compared to 116,000 tonnes in ROI.

Table 2.2 Poultry slaughterings on IOI in 2009/2010 ('000 tonnes) (1-2)

Region	Slaughterings	
	2009	2010
NI	256	264 (provisional)
ROI	116	126
IOI	372	390

2.1.1.1 Employment

NI figures indicate employment of 4,769 in the poultrymeat processing sector alone, accounting for almost 25% of total employment in the food processing sector. In ROI the poultry industry employs approximately 1,100 workers.¹

2.1.1.2 Consumption

In 2010 ROI consumers ate an average of 25.9kg of poultry per person (2). Separate figures are not available for NI, but average UK consumption is approximately 30kg per person.

2.1.1.3 Imports

Despite the large numbers of broilers produced each year on the island, as indicated above, output volume does not currently meet market demand. There is an unusually high demand in Ireland for chicken fillets. It is estimated that for every sale at retail of a single chicken leg in Ireland, there is a matching sale of eight chicken fillets. This number increases to one leg sold for every 21 fillets when food service sales are added to retail.¹ This preference for chicken fillets by Irish consumers cannot be met by domestic supply and Ireland imports over four million chicken fillets weekly. Imports into Europe are facilitated by the significantly lower production costs in exporting countries. Most companies involved with domestic broiler production also import poultry products. It is estimated

that greater than ninety per cent of poultry used in the catering trade, including further processed products, is imported.¹ In 2010 ROI imported 85,000 tonnes of poultrymeat, which was up from 34,000 tonnes in 1998 (3).

Some of the larger companies in the UK have established subsidiaries in Third Countries, which export to the EU. Figures for NI imports are not available separately to overall UK figures.

2.1.1.4 Exports

In 2009 the value of poultrymeat exports for ROI was €183 million. This figure includes imports that were further processed and then re-exported. ROI exported 93,000 tonnes of poultrymeat in 2010 (2). The UK is the main market for ROI poultry exports, accounting for 82% of total sales. Figures for NI are not available separately to overall UK figures.

2.1.1.5 Expenditure

TNS (Taylor Nelson Sofres plc) Retail Sales Data indicates that the ROI value of sales of poultry for 2010 was over €233 million, with chicken sales valued at €193m and turkey sales valued at €40m (4). The recession has boosted chicken sales, with a 9.5% increase in volume sales in 2010, however prices were down 7.7%. The retail sector accounts for 70% of poultry consumption, with the remainder going to food service. Figures for NI are not available separately to overall UK figures.

2.1.2 European perspective

In 2011 the main EU poultry producers were the UK, Spain, France, Germany and Poland. In 2009 the EU produced an estimated 11,914,000 tonnes of poultrymeat. The EU imported an estimated 835,000 tonnes of poultrymeat in 2009 and exported approximately 936,000 tonnes. Brazil and Thailand remain the largest suppliers of broiler meat to the EU-27, followed by Chile and Argentina (5).

2.1.3 Global perspective

Global poultrymeat production increased from almost 41 million tonnes in 1990 to 91.3 million tonnes in 2009. In 2009, the largest chicken meat producers in the world were the USA, China, Brazil and Mexico (Table 2.3).

Table 2.3 Global production ('000 tonnes) – indigenous chicken meat 2009 (5)

Country	Rank	2009
USA	1	16,334
China	2	11,445
Brazil	3	9,940
Mexico	4	2,600
Russian Federation	5	2,313

Global consumption of poultry is an estimated 14.3kg per person per year. The leading importers of chicken meat outside the EU in 2009 were China, Russian Federation, Japan, Mexico and Saudi Arabia (Table 2.4).

Table 2.4 Global chicken meat imports (excluding EU-27) 2009 (5)

Rank	Country	Quantity ('000 MT)
1	China	1,740
2	Russian Federation	964
3	Japan	797
4	Mexico	725
5	Saudi Arabia	620

The leading exporters outside the EU in 2009 were Brazil, USA, China and Thailand (Table 2.5).

Table 2.5: Global chicken meat exports (excluding EU-27) 2009 (5)

Rank	Country	Quantity('000 MT)
1	Brazil	3,724
2	USA	3,907
3	China	916
4	Thailand	596

2.2 Outline of the chicken food chain

The chicken supply chain is extremely time efficient. It takes approximately 21 days to hatch an egg, 35-42 days to rear a 'conventional' (also known as 'commercial' or 'intensively reared') chicken and 81 days to rear an 'organic' chicken until the time of slaughter.

2.2.1 Poultry production systems

Poultry production systems can be divided into three main categories: Conventional, Free Range, and Organic, which are discussed briefly below. Appendix B contains a summary of some of the main differences between each of these systems.

2.2.1.1 Conventional

Conventional broiler production involves rearing chickens indoors on litter in a controlled environment and feeding a sequence of high nutrient diets. The birds are slaughtered when aged 35 to 42 days when their live weight reaches up to 3 kg. The breeds used are selected for rapid growth and birds have a high proportion of breast meat.

Recently, some producers have moved towards an enhanced welfare system for conventional broilers. This system uses intermediate growth rate breeds and limits stocking density. In addition, natural light is provided along with straw bales, perches and pecking objects. Some retailers offer these chickens to the consumer at no extra cost.

2.2.1.2 Free Range

In order to be classified as 'Free Range,' birds must have continuous access to range for at least half of their lifetime and be slaughtered at not less than 56 days. There are further restrictions on stocking density and feed.

2.2.1.3 Organic

Like 'Free Range,' an organic label indicates to the consumer that certain production methods were used. Organic birds must be produced in accordance with the standard practices set out by the European Council Regulation No 834/2007 on organic production and labelling of organic products and monitored by certifying bodies in each country (Appendix C). Claims for organic farming include the consideration and application of production methods that do not damage the environment; concern for animal welfare and the production of high quality goods. Organic poultry production standards require free range systems with access to the outdoors in both layer and broiler units. Maximum stocking densities, both indoors and outdoors, are specified. Broilers in the organic system cannot be slaughtered before they are aged 81 days.

Use of antibiotics and growth promoters in feed is prohibited. All feed used in organic farming must be certified GM-free and the use of synthetic amino acids and solvent-extracted products, such as Soya oil, is prohibited. Prophylactic use of drugs is prohibited and restrictions are placed on the use of conventional medicines. Veterinary inputs in the form of antibiotics, antiparasitic drugs and vaccines can only be used in the treatment of clinical disease or as a short term intervention to limit the threat posed by a specific disease.

2.2.2 Broiler breeding

The poultry industry operates as a 'pyramid' structure with large numbers of broiler farms at the foot of the pyramid and much smaller numbers of specialist or 'grandparent' flocks at the top. The breeding birds themselves originate from a small number of specialist flocks. The high levels of vertical integration allow major industry players to exercise a lot of control over most phases of production and processing. Additionally it means that innovations, which involve substantial economies of scale, can be employed that otherwise would be impossible due to the limited capital available to the average farmer.

Commercial layer and broiler chicks come from separate breeding lines, for example, 'Ross' and 'Cobb' are the standard breeds used in the broiler industry on IOI.

Day-old chicks (parent stock) produced from pedigree breeders are supplied to contracted rearers, who rear the birds for 18-20 weeks, before sending them on to contracted breeders, i.e. laying farms, where they produce eggs until aged approximately 60 weeks. These birds are then slaughtered; however their meat does not enter the food chain. The eggs are sent to a contracted hatchery, producing day-old (commercial) chicks after approximately three weeks.

2.2.3 Broiler rearing

Conventional broilers are reared on litter in environmentally controlled sheds housing up to 30,000 birds.

Chicken feed is formulated to meet the nutritional requirements of broilers or layers. Current bird strains used in the broiler industry have been selectively bred for increased growth rate and lower (more efficient) feed conversion ratios. The feeding programme on a broiler farm is dictated by both the stage in the growth cycle of the birds, and consumer/retail requirements in terms of overall bird weight or fat content, etc.

'Starter' feed (administered from 1 to 7 days approx.) has the highest level of protein a chicken receives during its lifetime. As the chick matures, it requires a lower percentage of dietary protein and a higher level of energy which is provided for in the 'grower' (8 to 21 days approx.) and 'finisher' feed (21 to slaughter-5 days approx.). Withdrawal feed is administered for a specific period (typically 5 days) before slaughter takes place as it does not contain any drugs.

NI currently produces approximately 55 – 60% of the total IOI production of broiler feed. In NI approximately 400,000 tonnes of poultry feed are produced per annum, of which 10,500 tonnes are sold outside of NI.

Annual production of compound feed in ROI is around 3.5 million tonnes, of which 500,000 tonnes is produced for poultry. Native cereals make up about one third of the ingredients. Most feed additives are imported from sources outside IOI. The remaining ingredients, predominantly plant proteins, are imported mainly from outside the EU.

In the case of organic production, there is one organic feed supplier in ROI. Alternatively, organic poultry feed is imported from the UK. All feed used in NI is produced in NI.

2.2.4 Slaughter and primary processing

Thinning of broilers is usually carried out in one stage before final depopulation to satisfy particular market weight requirements and to provide more space for the remaining birds. Conventional birds are 'harvested' at 5-6 weeks of age. Harvesting consists of the manual catching of the birds and placing them in transport crates, which are then stacked on a vehicle for transport to the processing plant. Journey times are short for live broilers on IOI due to the geographical proximity of farms and processing plants.

Poultry slaughter can take place in 'EU approved' slaughterhouses. In NI there are 5 approved slaughterhouses with co-located cutting premises, and 9 approved stand-alone cutting premises. In ROI there are 2 approved poultry slaughtering plants.

Prior to 2006 approved premises were classed as full-throughput or low-throughput. Low throughput premises were defined as those that slaughter no more than 150,000 birds per year or, in the case of cutting premises, those that cut less than 3 tonnes of meat per week. Above these levels, the premises were termed full-throughput. EU legislation requires an Official Veterinary Surgeon (OVS) to be present throughout ante-mortem and post-mortem inspection in full throughput premises. In low throughput premises, the OVS was required to carry out ante-mortem inspection but not to directly supervise post-mortem inspection if a meat inspector carried this out.

Following the introduction of new EU hygiene regulations on 1st January 2006, there is no distinction between full and low throughput premises. All premises require approval.

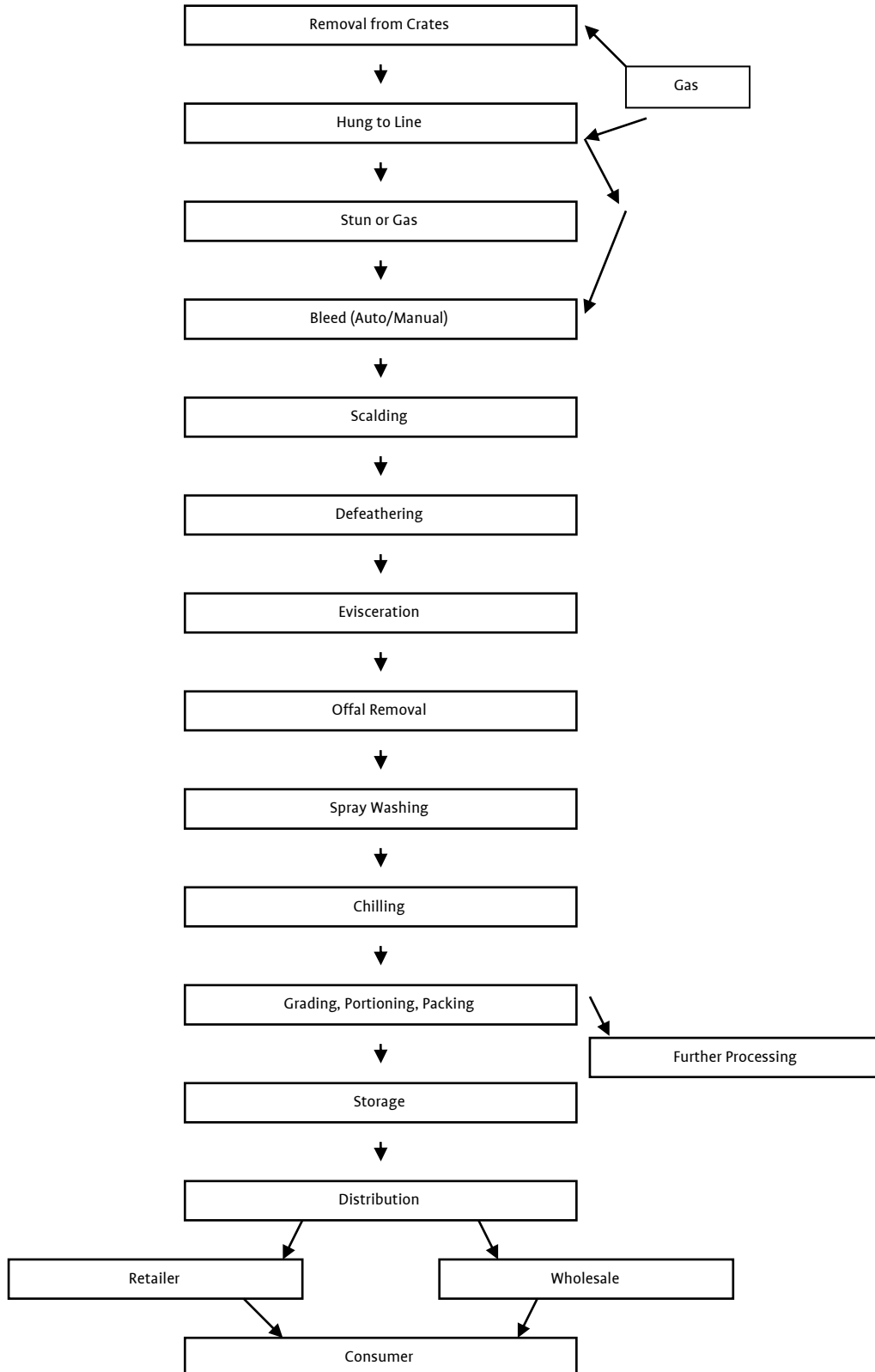
Exemptions exist for farmers who rear and slaughter less than 10,000 birds annually and retail this meat under certain conditions direct to the final consumer or to a retailer for sale direct to the final consumer. These premises operate under the supervision and control of the Local Authority Veterinary Services in ROI and District Council Environmental Health Control Departments in NI. The majority of these premises are involved in turkey production and a number only operate seasonally.

At the processing plant birds are removed from their crates by holding both legs, suspended upside down on an overhead rail, allowed to settle and are stunned/gassed. The latter renders birds unconscious, insensitive to pain, and immobilised, facilitating subsequent slaughter and processing. Birds can be stunned by being drawn through an open tank of water in which the water acts as a live electrode and a metal bar, which makes contact with the shackle, acts as the earth electrode. Thus, current flows through the whole of the bird (except for its feet), including its brain, rendering it unconscious. By law, the competent authority must ensure that birds are sufficiently stunned to ensure that they do not recover before dying through blood loss, and the competent authority in the plant oversees this. Gas stunning involves the use of carbon dioxide, which may be mixed with an inert gas, such as argon or nitrogen. An increasingly used alternative approach involves gassing of birds before their removal from the transport crates.

The necks of the birds are cut, either manually or automatically, and the birds are allowed to bleed for 1.5 to 2 minutes. The overhead rail moves the birds from the stunning/bleeding area and lowers them into a scalding tank, to open the feather follicles which facilitates their removal. During defeathering, finger-like projections remove the feathers from the bird. Defeathered birds are eviscerated, i.e. the contents of the body cavity are removed, and inedible parts of the bird are removed for rendering.

The resultant carcasses are washed to remove physical contaminants, such as blood, tissue fragments and faecal matter, and chilled by air chilling, air-spray chilling, or immersion chilling. The carcasses are then graded and subsequently prepared for [packaging](#) as whole birds or cuts, or sent for further processing. The finished products are held in chilled storage until distribution (Figure 2.1).

Figure 2.1 Overview of broiler processing



2.3 Conclusions

Poultry provide globally important sources of animal protein and are amongst the most intensively reared of all livestock species. Poultrymeat production systems can be described as intensive, free range or organic. For each of these enterprises there is a corresponding breeding business, undertaken as separate enterprises, with an imported foundation breeding stock. A small number of companies control the entire poultry breeding industry worldwide. This production system has remained relatively unchanged over the last five years.

The poultry industry on IOI is currently facing serious economic strains due to high costs and increasing imports. The poultry industry on IOI processes an estimated 192 million birds annually and employs approximately 5,000 people. The industry is worth approximately €347 and Stg£350 million to the ROI and NI economies respectively.

In 2011 the main EU poultry producers were the UK, Spain, Germany, France, and Poland. Globally, the largest chicken meat producers are the USA, China, Brazil and Thailand. The main chicken producing countries, both at European and global level, have remained relatively unchanged over the last five years.

In 2010 ROI exported 93,000 tonnes of poultrymeat. However, it is estimated that greater than ninety per cent of poultry used in the catering trade in ROI is imported. In 2010 ROI imported 85,000 tonnes of poultrymeat, which was up from 34,000 tonnes in 1998.

Over the last number of years high levels of imports, coupled with the rising cost of animal feed, have increased pressure on Irish chicken farmers. Since 2005 chicken has increased its volume of sales, however it has also fallen in price, making it difficult for Irish farmers to stay in business.

3 FOOD SAFETY ISSUES

- 3.1 Microbiological issues**
- 3.2 Chemical safety issues**
- 3.3 Third Country import controls**
- 3.4 Product traceability and recall**
- 3.5 Animal diseases**
- 3.6 Conclusions**

Key findings

- *Campylobacter* is the most common cause of bacterial gastroenteritis on IOI.
- The highest burden of illness caused by campylobacteriosis is seen in children under five
- A downward trend of salmonellosis cases has been observed on IOI.
- In 2008 EFSA reported that 98% and 86% of broiler carcasses from ROI and the UK respectively were contaminated with *Campylobacter*.
- In 2008 EFSA reported that 11.2% and 3.4% of broiler carcasses from ROI and the UK respectively were contaminated with *Salmonella*. Of the *Salmonella* found, all were *Salmonella* spp. other than *S. Enteritidis* or *S. Typhimurium*, suggesting that the National Control Plans are working well for those particular serovars.
- Standard biosecurity measures have not been very successful at reducing *Campylobacter* colonisation of chickens.
- A reduction in the concentration of *Campylobacter* on chicken carcasses would result in a reduced incidence of campylobacteriosis cases.
- Studies based on observations of consumer behaviour during food preparation and cooking in the domestic kitchen showed poor levels of food safety overall.
- Antimicrobial resistance is a threat to public health protection and specific measures need to be put in place to counter developing resistance.
- Monitoring programmes on IOI confirm that chemical contamination of chicken is extremely rare.
- EU Member States are required to establish and implement a yearly inspection and sampling programme designed to assess compliance with broiler feed legislation.
- Third Country import controls are undertaken at Member State Border Inspection Posts before they are allowed access to the EU market.
- Diseases of poultry are of concern, both locally and on an international scale.

3.1 Microbiological issues

3.1.1 Introduction

It is increasingly recognised that, in order to identify and prioritise food safety interventions, it is important to quantify the burden of human foodborne illness attributable to specific sources. Poultrymeat, and chicken in particular, is one of such sources that has been examined. A study conducted in Europe in 2010 found that 15% of cases of salmonellosis was attributable to meat and poultry-meat; while the majority of cases of campylobacteriosis were attributed to chicken (10%) (6). Similar findings have been published elsewhere. A case-control study on *Campylobacter* carried out on the island of Ireland in 2009 found that the most important risk factor for developing campylobacteriosis was the consumption of chicken (7).

Similarly, in England and Wales, poultrymeat was the most frequently identified food vehicle in all foodborne outbreaks in 2010 (table 3.1) (8).

Table 3.1 Implicated food vehicles in 2010 foodborne outbreaks, England and Wales (8)

Food Group/Type	Number of Cases	Percentage of cases
Poultrymeat	20	32%
Crustacean and Shellfish	13	21%
Red meat	10	16%
Composite/mixed foods	7	11%
Fruit and Vegetables	4	6%
Finfish	3	5%
Rice	2	3%

In addition to *Campylobacter* and *Salmonella*, other foodborne pathogens associated with the consumption of contaminated chicken include *Listeria monocytogenes* and *Staphylococcus aureus*, although these are more likely to be associated with the consumption of ready-to-eat chicken and ready-to-eat chicken products.

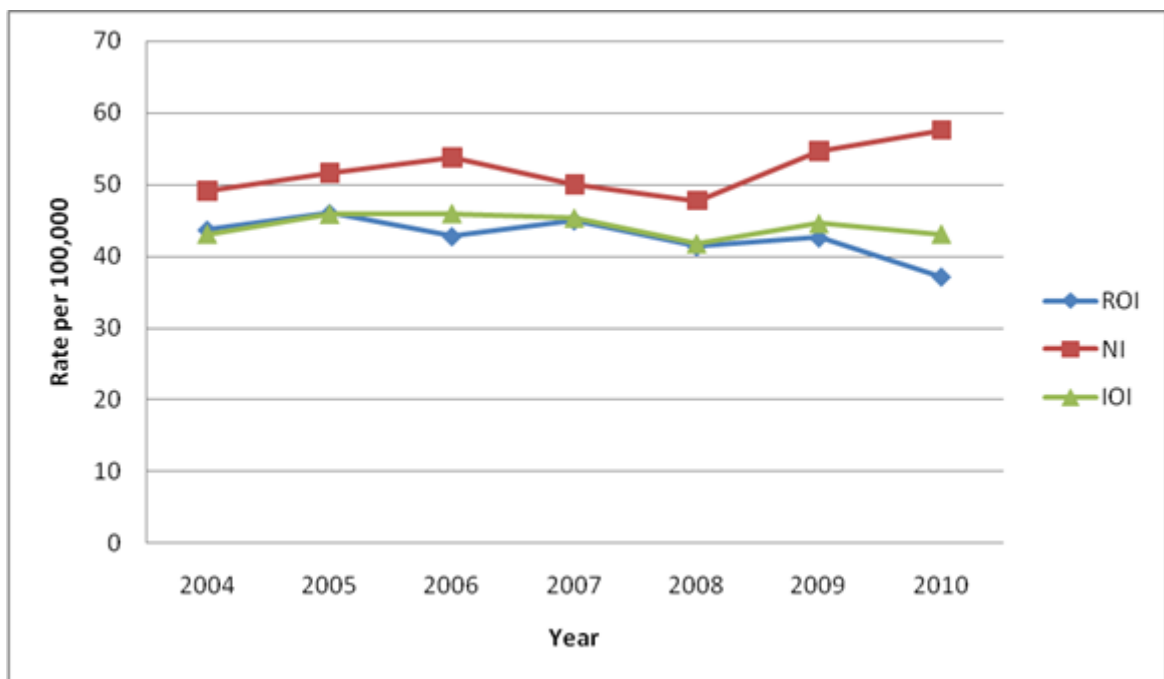
In this chapter a number of issues will be reviewed, including foodborne illness on IOI and any association with chicken consumption.

3.1.2 Chicken related foodborne illness on IOI

3.1.2.1 Campylobacteriosis

In 2010 a total of 2,702 cases of laboratory confirmed campylobacteriosis were reported on IOI (crude incidence rate of 43.09/100,000 population). Of these 1,662 cases were reported in ROI and 1040 cases in NI. This gives crude incidence rates of 37.17 cases/100,000 population for ROI and 57.59 cases/100,000 population for NI. Figure 3.1 illustrates recent trends in human campylobacteriosis on IOI(9-12).

Figure 3.1 Incidence rate of *Campylobacter* cases by year, ROI, NI and IOI 2004-2010



Campylobacter spp. are widespread in the intestinal tract of warm-blooded animals and are also commonly found in the alimentary tract of healthy birds, including domestic poultry. Thus raw meat

and raw milk can be readily contaminated during normal farming and food production processes. *Campylobacter spp.* are fragile organisms, sensitive to freezing, heating (pasteurisation/cooking), drying, acidic conditions (pickling), disinfectants and irradiation. The organisms normally die off quickly in the presence of air and are very sensitive to oxygen breakdown products. It has been estimated that consumption of a small number of organisms (500 or less) may be associated with illness. Therefore, the fact that the organism does not multiply very effectively in most foods does not prevent it from causing foodborne illness.

Campylobacteriosis is the commonest bacterial cause of human gastrointestinal illness in the developed world. Different species of *Campylobacter* are distinguished by a characteristic set of antigens. There are many *Campylobacter* species including *C. coli*, *C. fetus*, *C. jejuni*, and *C. lari*. *C. jejuni* is the predominant species associated with human illness, with the remainder mostly being *C. coli* and *C. lari*. It is primarily a diarrhoeal illness. The diarrhoea is often bloody and frequently associated with acute abdominal pain. Symptoms may subside after a number of days or may persist for weeks. Rarely, long-term side-effects may develop such as reactive arthritis, Reiter's syndrome (a subtype of reactive arthritis), or Haemolytic Uraemic Syndrome and approximately one in every 1000 cases leads to a severe neurological disorder called Guillain-Barré Syndrome.

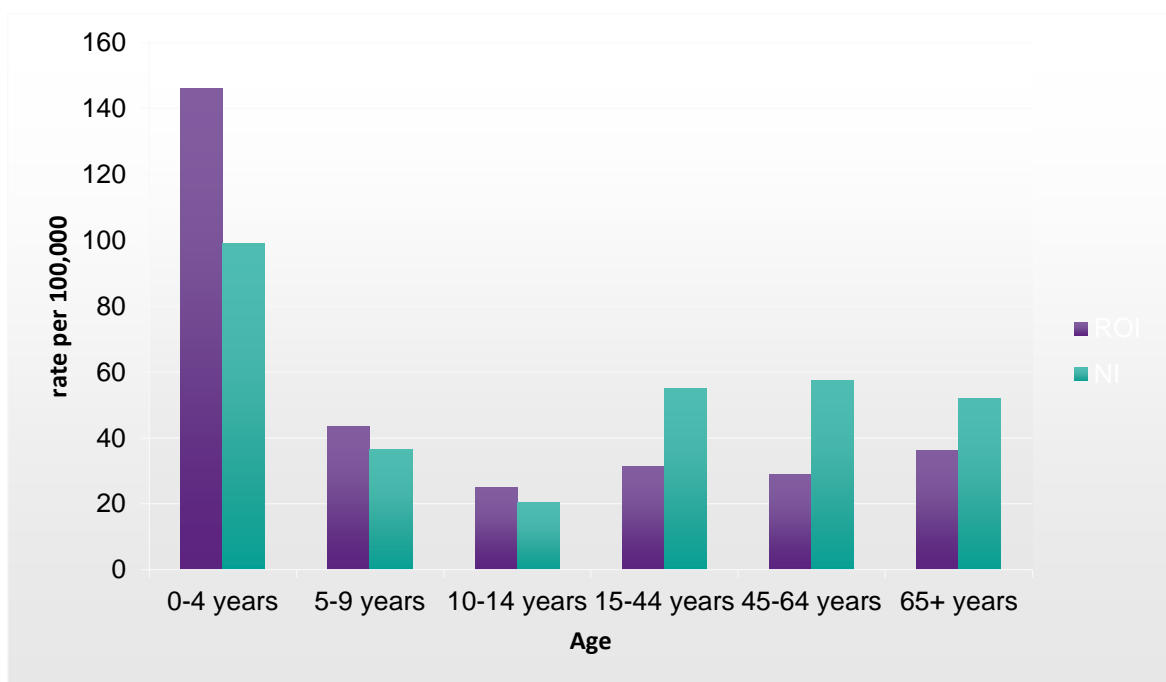
The dioxin crisis in Belgium in 1999 inadvertently provided a unique opportunity to observe exceptional changes in the occurrence of chicken related *Campylobacter* infections. Dioxin contaminated feed resulted in the withdrawal of chicken from the Belgian market, while a decline of 40% in the number of human *Campylobacter* cases was observed.

Human campylobacteriosis on IOI is known to have a well-characterised seasonal distribution, with a peak seen in early summer each year. The majority of cases are reported earlier in the year on IOI (2nd Quarter) compared with England and Wales (3rd Quarter) (13).

The majority of *Campylobacter* isolates on IOI are not speciated (99% in NI and 62% in ROI in 2010). However, where species are reported, 90% and 88% of infections are due to *C. jejuni* in ROI and NI respectively.²

By far the highest burden of illness due to infection with *Campylobacter* spp. is seen in children less than five years of age (Figure 3.2) and this is a feature of the illness worldwide.³ Figures from previous years also show that there is a second peak in incidence among young adults. Therefore campylobacteriosis can pose a danger for young mothers and their unborn child in that age category (14).

Figure 3.2 Crude incidence rate of confirmed cases of campylobacteriosis by age group, ROI and NI, 2009



2009¹

² Percentages calculated from figures provided directly from HSE and HSCNI

³ CIR calculated from figures provided directly from HSE and HSCNI and population estimates from CSO and NISRA

Outbreaks of campylobacteriosis are rare and the only one reported on the island of Ireland since 2000 was three cases in a foodborne outbreak in Northern Ireland in 2001.⁴

In 2008, 193,814 cases of campylobacteriosis (193,554 confirmed) were reported by 25 EU and EEA/EFTA countries. This exceeded the number of confirmed cases in 2006 (178,933 cases). The overall notification rate was 44.1 per 100,000 (down from 46.2 in 2007). *Campylobacter* remained the most frequently reported cause of human gastrointestinal disease in the EU in 2008. Although direct comparisons between different Member States are invalid (due to variations in reporting systems and the high degree of under reporting suspected to occur in some countries), common epidemiological features of the disease with respect to a higher incidence in summer months and the predominance of male cases, particularly in children, are observable. As described for 2007, the Zoonoses Report 2008 carried out by the ECDC suggests that fresh poultrymeat remains the most important foodborne source of *Campylobacter* in the EU (15).

3.1.2.2 Salmonellosis

Humans acquire *Salmonella* from contaminated foods such as poultry, beef products, unpasteurised milk, eggs and egg products. *Salmonella* spp. are eliminated by thorough cooking and by the pasteurisation of milk.

Salmonella is a bacterial zoonotic pathogen that is a relatively common cause of foodborne illness worldwide. At present, there are over 2,500 known serotypes of *Salmonella*. In recent years, two serotypes, namely, *S. enterica* serotype Enteritidis and *S. enterica* serotype Typhimurium have accounted for the majority of cases of human salmonellosis throughout Europe.

Salmonella are not fastidious organisms; they can survive and multiply under a variety of environmental conditions outside of living hosts and grow readily in many foods. Normally, relatively large numbers of bacteria are required to cause illness in healthy adults, but vulnerable groups, such as the very young, the elderly and immuno-compromised, can be infected by lower numbers. Animals become infected with the bacteria by direct contact with other animals, by consuming contaminated feed or water, or through environmental contact from grass, wild birds and rats.

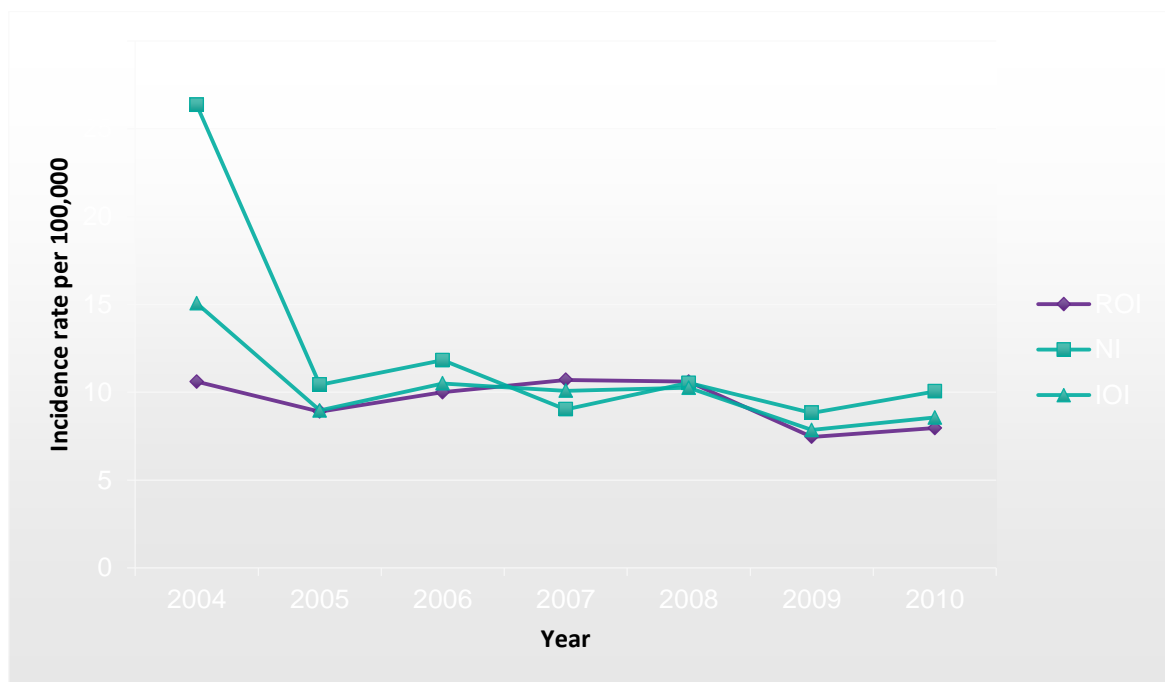
4

Information received in correspondence directly from HSCNI

Salmonellosis presents as an acute enterocolitis, with the sudden onset of headache, abdominal pain, diarrhoea, nausea and occasionally vomiting. Fever is almost always present. Dehydration, especially amongst vulnerable populations such as infants, the immunocompromised and the elderly, may be severe. *S. Typhi* and *S. Paratyphi* can cause enteric fever, a severe systemic life threatening condition, but this is very rare on IOI and mainly travel-associated.

In total, 537 cases of laboratory confirmed salmonellosis were reported on IOI in 2010, of which there were 356 cases in ROI and 181 cases in NI. This gives crude incidence rates of 7.96 cases/100,000 population for ROI and 10.05 cases/100,000 population for NI. ⁵ Figure 3.3 illustrates the recent downward trends in human salmonellosis on IOI.

Figure 3.3 Incidence rates of salmonellosis (per 100,000 population) NI and ROI , 2004-2010



The highest incidence rate in both jurisdictions is recorded in the 15-44 year old age group, with young children also having a high rate as is the global pattern. Overall, there is a marked seasonality in incidence rates, with a peak observed in late summer/early autumn.

⁵ Figures provided from direct correspondence with HSE and HSCNI

There has been a steady decrease in the EU notification rates for salmonellosis over the last three years. In 2008, the notification rates were very high in children, in particular 0–4 year-olds (161.2 per 100,000 population). The seasonal distribution showed a clear peak in cases over the summer months for three consecutive years. Although the overall proportion of imported salmonellosis cases was only 14.8 % in the EU in 2008, there is a wide variety between countries with some countries reporting the majority of salmonellosis cases as travel-related (15).

3.1.3. Microbiological risks along the food chain

The microflora associated with chickens on the farm is determined by a number of factors. Chickens can be exposed to micro-organisms found within poultry production units or in the environment surrounding the poultry houses. These can originate from a wide range of sources, including the production environment and husbandry practices, breeding stock, feed, other chickens, water sources, rodents or insects, and potentially farm personnel or other farm livestock. For intensively reared broilers, the risk of exposure to infectious agents is lower compared with extensive production systems, such as free range and organic systems, as greater levels of control are possible.

Hygiene measures taken during production on the farm, transport, and at slaughter will influence the micro-organisms present on the carcass. A major challenge for the chicken industry is to limit the attachment and colonisation of undesirable micro-organisms in live animals. The ultimate aim, if currently unattainable, should be to supply pathogen-free live poultry to the processing plant. In the present, industry has to contend with potentially contaminated flocks being presented for slaughter. In this scenario there is an opportunity for cross-contamination to occur within the processing environment, whereby micro-organisms may be transferred from contaminated carcasses to non-contaminated carcasses and/or equipment.

This section will consider the current risk status of each stage of the food chain with regard to the level of microbiological contamination and review the current legislation and best practices in operation to protect public health.

3.1.3.1 At farm level

Control of micro-organisms during the broiler breeding stages is critical to protect the end product from contamination with pathogens. Contamination of the grandparent or parent flocks, either

directly or through the consumption of contaminated feed, can result in limited scope for further control efforts through subsequent stages in production and the supply chain.

The legislation in place to ensure the safety of poultry and poultry products throughout the food chain in both NI and ROI is the hygiene legislation, commonly referred to as the 'Hygiene Package.' As EU regulations, the legislation is directly applicable. The regulations are:

- Regulation (EC) 852/2004 on the hygiene of foodstuffs;
- Regulation (EC) 853/2004 laying down specific hygiene rules for food of animal origin; and
- Regulation (EC) 854/2004 laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption.

All breeding flocks must be registered and up to date records regarding disease status must be kept. Owners of breeding flocks and hatcheries are required to take samples and submit them to authorised laboratories for testing for *Salmonella* at defined points in the life of each flock. The control of *Salmonella* is governed by Regulation (EC) 2160/2003 with the implementation of Regulation (EC) 646/2007 for the specific reduction of *S. Enteritidis* and *S. Typhimurium* in broilers. The tests are carried out by the competent authority, namely DAFF in ROI and DARD in NI. The results and any additional relevant information are reported as part of the report on 'trends and sources' provided for in Article 9(1) of Directive 2003/99/EC of the European Parliament and of the Council. Additional information is made available from each flock of broilers tested for analysis at national level or by the European Food Safety Authority at its request.

It is well established that contaminated feed is a potentially important route of flock infection with *Salmonella* species (16). With regard to *Campylobacter*, feed is generally not regarded as a primary source of infection, provided that it is stored under dry conditions and adequately protected from contamination by vermin (wild birds or rodents). Raw feed ingredients will often become contaminated with *Campylobacter*, however *Campylobacter* spp. are relatively susceptible to the effects of heat and generally have a low tolerance for aerobic conditions, and thus will not multiply or survive in feedstuff (17).

In addition to the regulations included in the 'hygiene package' there are a number of implementing regulations that support their application. One that has specific relevance to the safety of 'feed' is Commission Regulation (EC) No 1831/2003, enforced through national legislation, the Feed (Hygiene and Enforcement) Regulations (Northern Ireland) 2005, (SR 2005 No. 546-amended SR 2011 No. 48) and in the Republic of Ireland (S.I. No. 432/2009). Compliance with the regulations ensures feed safety throughout the food chain, starting with primary production of feed, up to and including the feeding of food-producing animals. The competent authorities in NI and ROI keep a register or registers of all feed business operator establishments.

While heat treatment of poultry feed is not a legal requirement in NI, the Code of Practice for the Prevention and Control of *Salmonella* in Chickens Reared for Meat on Farm, recommends obtaining feed from UKASTA approved suppliers and the treatment of feed with time/temperature combinations capable of eliminating *Salmonella* (18). Those producers participating in the Red Tractor Farm Assurance Poultry Scheme (previously known as Assured Chicken Production, ACP) must use feed which has been produced in accordance with the AIC Universal Feed Assurance Schemes (UFAS) or equivalent (19).

In ROI heat treatment is made compulsory under S.I. 364 Diseases of Animals (Poultry Feed) Order 1991. Feeds must be heated to at least 75°C for 1 minute, or equivalent.

***Campylobacter* at farm level**

Newly hatched chicks are reportedly *Campylobacter*-free, and normally remain so for the first two weeks, probably due to maternally derived anti-*Campylobacter* antibodies, although infections at earlier ages have been reported. Results from a recent study showed that *Campylobacter jejuni* has the ability to penetrate the pores of eggs after 3h contact with experimentally inoculated shavings. The organism caused high embryonic mortality, highlighting a potential problem for producers in the event of contact between eggs and contaminated organic material such as faeces and blood (20).

Most flocks become infected with *Campylobacter* two to three weeks after the introduction of chicks into a broiler house. Once exposed to infection, the bird's alimentary tract is rapidly colonised by *Campylobacter* spp. and, within a relatively short period following initial exposure, a high proportion of the flock become life-long excretors of large numbers of these bacteria (21).

Evidence remains that thinning is an important risk factor in the spread of *Campylobacter*, as teams of workers and their equipment (crates, modules and forklift trucks) may access multiple farms in a single working day for the purpose of removing a proportion of the flock for slaughter.

Recommendations in relation to thinning have been made in both jurisdictions (22-23).

The European Food Safety Authority conducted a Union-wide baseline survey on *Campylobacter* in broiler batches and on *Campylobacter* and *Salmonella* on broiler carcasses in 2008. Results at Community level showed the prevalence of *Campylobacter*-colonised broiler batches was 71.2% and *Campylobacter*-contaminated broiler carcasses was 75.8%. The prevalence by country showed that 98% and 86% of broiler carcasses were contaminated with *Campylobacter* in the Republic of Ireland and in the United Kingdom respectively (24). A recent **safefood**-funded study on Irish breeder and intensive broiler flocks in IOI showed that all breeder flocks tested positive for *Campylobacter* spp. and all broiler flocks were contaminated by the end of the rearing period (25).

Other known reservoirs of *Campylobacter* are cattle, sheep, pigs, rabbits and other wild animals (26). Water, particularly untreated, can pose a public health threat and is subject to the requirements of EU Directive 98/83/EC (26-29). Flies can pose a potential contamination risk (30).

***Salmonella* at farm level**

Statutory *Salmonella* monitoring programmes have been in place in breeding flocks in both ROI and NI since the late 1980s. Interventions were put in place to actively reduce the levels of *Salmonella* at farm level. *Salmonella* surveillance at laboratory level required private laboratories to notify positive results of samples to the relevant Department of Agriculture.

The current EU Zoonoses Regulation (EC) No 2160/2003 requires all Member States to take effective measures to detect and control *Salmonellae* of public health significance in specified animal species at all relevant stages of production. Regulation (EC) 646/2007 supplements Regulation 2160/2003 in that it lays down the Community target for the reduction of *S. Enteritidis* and *S. Typhimurium* in broilers.

Member States aim to meet these targets through an agreed National Control Programme (NCP) by achieving agreed targets through auditable three year programmes to reduce the prevalence of certain zoonoses in animal populations at primary production level and, where necessary, other stages of the food chain. Statutory Rules (SR 2008 No. 63) lay out the NCP for the control of *Salmonella* in Poultry in NI. NCPs for controlling breeding flocks and table egg layers have been in place in ROI since 2007 and 2008 respectively. They come under SI 706 of 2006 and SI 247 of 2008, which mandate the sampling type and frequency and obliges the reporting of serovars of public health significance, i.e. *S. Enteritidis* and *S. Typhimurium* for both breeders and layers, and in addition *S. Virchow*, *S. Hadar* and *S. Infantis* for breeders.

These NCPs are established to protect human health. They cover farm animal species which present a potential risk of transmitting *Salmonella* and other zoonotic agents to humans. These are currently restricted to poultry (breeding flocks, laying hens, broilers and turkeys) and pigs (herds of slaughter and breeding pigs). The Zoonoses Regulation provides the framework for adding zoonotic agents other than *Salmonella*, and other animal species, in the future.

The EU-wide survey of broiler carcasses showed a Community prevalence of *Salmonella* at 15.6%. The ROI results showed a prevalence of 11.2% and 3.4% in UK, all of which were *Salmonella* spp. other than *S. Enteritidis* or *S. Typhimurium*, suggesting that the NCPs are working well at reducing the level of these pathogens in poultry (31).

Along with other Member States, IOI will need to address serovars other than *S. Enteritidis* and *S. Typhimurium* in their national *Salmonella* control and surveillance programmes of broiler flocks and broiler meat in the interest of public health.

Biosecurity on poultry farms

The implementation of biosecurity procedures has been successful in reducing *Salmonella* colonisation of chickens. Standard biosecurity procedures have not, however, been very successful in preventing colonisation of commercial flocks with *Campylobacter*. It may therefore be more prudent to attempt to reduce the concentration of *Campylobacter* in the intestines of broilers on-farm and on the surface of processed chickens in the slaughterhouses (23).

A **safefood**-funded study in 2008 found that poultry processors were generally aware of the potential problem *Campylobacter* posed, however broiler farmers were unaware of the organism (32). As a result **safefood** undertook a series of presentations for farmers and poultry processors on the IOI to increase awareness, and to deliver information on the implementation of biosecurity and risk management measures. Both farmers and processors welcomed the initiative.

Numerous studies have identified a correlation between the level of *Campylobacter* in the intestines of colonised birds and the concentration found on the surface of carcasses (29, 33-36). *Campylobacter* contamination of chicken carcasses is dependant on the initial concentration in the birds' intestines and the cross-contamination during processing. Therefore, to reduce the public health risk, mitigation strategies are recommended to decrease the levels in the broilers' intestines and their concentration on the broilers' surface (23). The most effective strategy for the reduction of *Campylobacter* concentration on chicken meat is either freezing or decontamination (29, 36). Effective cleaning and disinfection procedures at farm level are also considered to be of prime importance in the control of *Salmonella* (37).

A further recommendation is the application of microbiological criteria at the end point of the food chain, which is relatively close to the stage of human exposure. The Food Safety Authority of Ireland (FSAI) in its recent Scientific Committee Report on *Campylobacter* control proposed a post-harvest target level of $\leq 4 \log_{10}$ on neck skin, taken post-chill, where: $n=5$ samples; $c=1$ sample between m and M ; $m= 4 \log_{10}$ cfu/g and $M= 5 \log_{10}$ cfu/g be implemented (23).

During the Food Standards Agency International meeting held in London on March 31st 2010, the following areas were identified as key to making a major impact on *Campylobacter* reduction in UK chicken: treatment of carcass post evisceration; hygiene barriers/footwear change; evisceration process; fly control; mandatory target and vaccination (34). The joint government and industry target is to reduce *Campylobacter* in UK-produced chickens from a baseline of 27% in 2008 to 10% by 2015, measured post-chill. This is a reduction in the percentage of the highest level of contaminated chickens produced in UK poultry slaughterhouses, i.e. those contaminated with more than 1,000 cfu/g. It is expected that chickens contaminated with less than 100 cfu/g, will get no worse or will improve upon the baseline of 42% by 2015. The baseline was determined in 2008 by the EU-widesurvey of *Campylobacter* in broiler batches and on *Campylobacter* and *Salmonella* on broiler carcasses (31).

Veterinary supervision of poultry farms

Under current legislation Regulation EC 2073/2005 all poultry farms and slaughterhouses must be approved by the relevant competent authorities. Poultry farms may be under the supervision of company veterinary surgeons or private veterinary practitioners (PVPs). Birds consigned from large holdings must either be accompanied by a health attestation signed by a veterinary surgeon, or the holding must be supervised by a veterinary surgeon and the birds accompanied to the slaughterhouse by a production report.

Additionally, PVPs undertake duties in relation to the export certification of poultry and poultry products, by inspecting the health and welfare of the birds, their eligibility for export, as well as completing export health certification.

In ROI, PVPs are not authorised to provide health attestation/certification for poultry flocks. Veterinary Inspectors (VIs) from DAFF District Veterinary Offices perform this function.

3.1.3.2 Transport from farm to slaughterhouse

The thinning process and subsequent transport from farm to slaughterhouse is potentially one of the most stressful periods of a chicken's life, due to the withholding of feed prior to transport, the catching and crating process, and the crowded conditions whilst in transit. Stress can lead to increased excretion of pathogens including *Salmonella* and *Campylobacter*, therefore increasing susceptibility to infection and the risk of bird-to-bird cross-infection. However, journey times for live poultry between broiler houses and slaughtering plants on IOI are relatively short due to the geographic proximity of broiler production sites and processing plants.

The practice of pre-harvest fasting can be implemented to reduce fecal excretion and cross contamination during transport and to reduce fecal contamination of poultry carcasses which may occur during evisceration procedures (38). Generally feed withdrawal of between 6 and 12 hours is effective. Chemical decontamination is not currently permitted under EU Law, however evidence exists of the efficacy of certain compounds to reduce *Campylobacter* concentrations in broiler carcasses namely: lactic acid; acetic acid; trisodium phosphate; chlorine/acidified chlorine; electrolysed water; ozone and irradiation (39-41).

Dirty crates can be a source of contamination during depopulation and transport. Crates, modules and vehicles should be cleaned and disinfected and this cleaning should be validated periodically by microbiological testing as recommended by the FSAI (23).

3.1.3.3 Primary processing

Campylobacter

Within the processing plant, carcasses pass through multiple stages before reaching the final product. The potential therefore exists for the prevalence and/or concentration of pathogenic micro-organisms on the carcass surface to change as carcasses pass through each stage. The defeathering stage of chicken processing can increase the prevalence and level of *Campylobacter* contamination, largely due to the escape of faecal material through the cloaca by the action of the picker fingers pressing on the abdomen. The prevalence of *Campylobacter* generally decreases after scalding and chilling. Improvements in defeathering and evisceration methods could reduce the amount of faecal contamination on the carcasses (42).

Since *Campylobacter* are ubiquitous in the natural environment, free range and organic poultry flocks may potentially have a higher prevalence of *Campylobacter* infection and therefore may represent a higher risk with regard to campylobacteriosis (43). The FSA's Advisory Committee on the Microbiological Safety of Food (ACMSF) in its second report on *Campylobacter* found that there is some evidence to support this hypothesis; however this evidence is not comprehensive (44). For traceability reasons, organic chickens are normally slaughtered at the start of a production period before conventionally produced chickens. There is no decontamination of lines between flocks, and consequently the potential exists that birds from flocks with lower rates of *Campylobacter* may become contaminated by exposure to equipment previously used for organic birds. Research carried out by the FSA has shown, however, that carryover from a contaminated flock to a non-contaminated flock is small and confined to the first birds coming through the line.

Salmonella

During primary processing the areas where the risk of *Salmonella* contamination is high are scalding, defeathering, evisceration and offal removal. Scalding tank water temperature is normally maintained at 54±1°C to ensure inactivation of *Salmonella*. Cleaning procedures for de-feathering

machines must be effective. They are normally cleaned and disinfected overnight, but during the day they are continuously rinsed with cold water, which at best will reduce numbers of *Salmonella*. Evisceration must take place without rupturing viscera as this would result in the release of intestinal contents which may contain large numbers of potentially pathogenic bacteria. Similarly, offal must be removed intact. There is some evidence to support the possibility for cross-contamination of *Salmonella* between carcasses during primary processing operations (45).

The processing environment (walls, floors and other surfaces) may become contaminated by splashes or contact during a production run. One study has shown that *Salmonella* spp. can remain viable on surfaces such as Formica, stainless steel and ceramic tiles for extended periods (46), so effective cleaning and disinfection regimes are essential.

Hygiene in poultry slaughter and cutting premises

In slaughter and cutting premises the primary aim of the Veterinary Public Health Service of DAFF and the Veterinary Service in the Veterinary Public Health Unit of DARD is to protect public health and safeguard animal health and welfare.

Veterinary supervision of hygiene in slaughter premises is carried out by teams, led by the OVS in NI or VI in ROI. They are assisted by Poultrymeat Inspectors (PMI) and Poultry Inspection Assistants (PIA) in NI and by Poultry Officers and Temporary Veterinary Inspectors in ROI. OVS/VIs are responsible for securing the observance of hygiene requirements in relation to staff, premises, equipment and implements, and the hygiene requirements for slaughter and the handling and storage of poultry and poultrymeat. Only premises that meet the minimum standards set down in the food hygiene regulations are approved to slaughter, process, and store poultrymeat. These standards include programmes such as a HACCP plan, and HACCP prerequisite programmes including staff training (e.g. in food safety, HACCP, Good Manufacturing Practice, Good Hygiene Practice, etc.) and medical certification (e.g. pre-employment medicals, fitness to return to work certificates, etc.). In the case of non-compliance, appropriate enforcement action is initiated.

Ante-mortem inspection

Food Business Operators must comply with Regulations (EC) 852/2004; 853/2004 and 854/2004 laying down specific rules regarding the hygiene of food of animal origin. In ROI, poultry farms are under the

supervision of veterinarians based in the District Veterinary Offices in each county. The producers in these supervised facilities have to provide appropriate farm production records (flock records) to the VI in the slaughter plant in advance of the intended date of slaughter. The contents of the flock records will determine whether special checks are required during ante and post mortem procedures. In addition, spot checks are carried out on individual loads of birds presented for slaughter. The different approach to ante-mortem inspection with poultry compared to red meat reflects the much greater numbers being slaughtered in a given period.

Post-mortem inspection

Post-mortem inspection ensures that only meat that is fit for human consumption enters the food chain. Provisions are made in the Regulations for the OVS/VI to personally inspect a random sample of rejected birds and examine a random sample of 300 birds which have passed post-mortem inspection.

Own checks and HACCP

There is an onus on the owner/occupier to carry out checks (including microbiological checks) on the general hygiene conditions in his establishment to ensure that all equipment, machinery, instruments, fittings and facilities and, if necessary, fresh meat, comply with requirements.

Occupiers are also required to apply HACCP principles (Appendix D) to their operation as a prevention-based approach to ensure the safe production of food. This relies upon the identification of 'hazards,' which unless eliminated or reduced, could cause adverse health problems for consumers. Under EU regulations, DAFF and DARD enforce HACCP programmes for meat products, minced meat and meat preparations, including slaughter and cutting of fresh meat operations.

Notifiable diseases

Notifiable animal diseases are those where there is a statutory duty for the suspicion or confirmation of disease to be notified to the respective Departments of Agriculture. Some of these diseases are potentially zoonotic, whilst others are not of concern to human health, but have serious implications for the farming and food industry and the economy in general. The Disease of Animals Act 1966 and the Diseases of Animals Order (NI) 1981 provide the basic legislation for the control and eradication of animal diseases in ROI and NI respectively, supplemented by various pieces of subordinate legislation.

Both DAFF and DARD work in conjunction with the industry to protect national flocks against diseases which are notifiable.

Zoonoses

National Control Plans (NCPs) are in place in both ROI and NI, and are prepared in accordance with the requirements of Regulation (EC) No. 882/2004. The NCPs contains general information on the structure and organisation of the systems of controls for food, feed, animal health and animal welfare in Ireland. Annual progress reports on implementation, as required by Regulation (EC) No. 882/2004, are provided to the European Commission.

The current legislation facilitates the harmonisation of zoonoses monitoring schemes, with the aim of making evaluation of trends and sources at EU level possible, and to provide data to be used as a basis for risk assessment in this field. It also introduces control measures in more types of animal populations, and for more types of *Salmonella* and other zoonotic agents. The five most frequent *Salmonella* serotypes of public health significance are used to establish targets for poultry breeding stocks. In recent years, next to *S. Enteritidis* and *S. Typhimurium*, most cases of human salmonellosis in the EU have been caused by *S. Infantis*, *S. Virchow* and *S. Hadar*. The monitoring takes place at the stage or stages of the food chain most appropriate to the zoonoses or zoonotic agent concerned. The European Food Safety Authority (EFSA) is instrumental in collating, assessing and reporting surveillance data.

3.1.3.4 Storage and distribution

The most critical control during the distribution and storage of chicken meat and chicken meat products is the maintenance of the correct storage temperature. Council Regulation (EC) 1234/2007 (amendment Regulation (EC) 1047/2009) stipulates that fresh poultrymeat must be kept at a temperature not below -2 °C and no higher than 4 °C at any time. Frozen poultrymeat must be kept at a temperature no higher than -12 °C at any time.

3.1.3.5 Retail and catering

Campylobacter

Results from a **safefood**-funded study to assess the levels of *Campylobacter* and *Salmonella* in retail chicken on the IOI showed the overall prevalence of *Campylobacter* spp. was 84.3% using both the

recommended ISO method and direct plating (47). A UK-wide survey undertaken by FSA in 2007/2008 to determine the prevalence of *Campylobacter* and *Salmonella* in raw chicken found *Campylobacter* positive samples, with *C. jejuni* being the predominant species isolated, followed by *C. coli* (48). The study showed *Campylobacter* contamination in a significant proportion of fresh chicken on sale in the UK. From over 3000 samples 65% were *Campylobacter* positive with a 76% prevalence in whole chicken of UK-origin.

Salmonella

An FSA UK-wide study found *Salmonella* at 6.6%, indicating the prevalence of this pathogen remains low (48). *Salmonella* prevalence was significantly higher in chicken of non-UK origin. The overall contamination level was higher in whole chicken compared to chicken portions and in frozen chicken rather than chilled chicken (48). *Salmonella* spp. were present in 5.1% of samples, but the eight serovars found caused less than 7% of human salmonellosis reported in the ROI. The results suggest that on-farm controls to limit *Salmonella* infection of broilers have been successful and that in Ireland raw chicken it is not a significant vehicle for causing salmonellosis in humans (47).

Food safety controls at retail and catering level

Risk management by the business operator is at the core of ensuring food safety during retail and catering activities. HACCP systems are mandatory requirements for food businesses. A **safefood** study of food safety knowledge, microbiology and refrigeration temperatures in restaurant kitchens on IOI (49) gave some indicators of the knowledge of those responsible for food safety in relation to the possible food safety risks associated with poultry. Of the 200 interviewees all had heard of the pathogen *Salmonella*, with 72% of those associating poultry as the source of the pathogen. However, with regard to *Campylobacter*, only 41.5% of those interviewed had heard of the pathogen and 14% of these associated poultry as a source.

Northern Ireland

In January 2006, following the implementation of Regulation (EC) No 178/2002, laying down the general principles and requirements of food law and of procedures in matters of food safety, all food business operators, including catering facilities, within the EU, have an obligation to ensure the safety of food for the protection of public health.

In the UK SI 2004 No. 3279 provides for the enforcement of certain provisions of Regulation (EC) 178/2002 (including imposing penalties) and amends the Food Safety Act 1990 to bring it in line with Regulation (EC) 178/2002. Similar legislation applies in Northern Ireland (SI 2004 No. 505).

As a result of the implementation of this legislation, the Butchers Licensing Scheme no longer exists. However, following an outbreak of *E. coli* O157 in South Wales in 2005, the Pennington Report (2009) recommended that butchers in the UK should commit to the principles underpinning the Butchers Licensing Scheme, which guided food hygiene measures in facilities producing and processing raw meat and unwrapped ready-to-eat food (50).

In NI District Councils, via Environmental Health Officers (EHOs), have responsibility at the point where food enters a distribution network and retain control until sale to the final consumer. EHOs regularly inspect food premises with the frequency of inspection based upon the assessment of the risk the business poses i.e. whether the business trades with a small or large customer base; whether that customer base is local, regional or national; if customers are likely to be within the susceptible groups for *E. coli* O157; and whether the foods handled are of a type more or less likely to present a risk to food safety.

The role of the EHO includes ensuring that managers and staff understand the possible hazards that the foods they handle could create for consumers, and facilitating the knowledge and capacity to control those risks to an acceptable level. Where inspecting officers identify food safety risks, they operate a hierarchy of measures from provision of advice to formal letters, legal notices requiring action, and instigation of legal proceedings. Where significant risks are posed to the public by the condition or operation of a business, it may be closed immediately.

In addition to a programme of inspections, EHOs undertake sampling of foods along the food chain to determine their microbiological fitness. Sampling programmes are co-ordinated across NI by the Northern Ireland Food Liaison Group and frequently link with regional or national sampling surveys. Unsatisfactory results are followed up and may result in a review of food handling practices or even in product recall and formal action being taken against a business.

There is a legislative requirement that new businesses register with District Councils four weeks prior to opening. This allows environmental health staff to advise and assist the new business to ensure that standards are met when opened. There is also a general requirement for all food businesses to ensure that food handlers are supervised, instructed and/or trained to enable the safe preparation and handling of food.

Republic of Ireland

In ROI, under the Food Safety Authority of Ireland Act 1998, as amended, the FSAI is the responsible agency charged with protecting consumers' health and interests by ensuring that food produced, distributed or marketed in ROI meets the highest standards of food safety and hygiene and that it complies with legal requirements or, where appropriate, with recognised standards. The Health Service Executive (HSE) employs EHOs and carries out official food control activities through service contracts with the FSAI. EHOs are responsible for implementing national and EU laws on food safety and hygiene. The role of the EHO in ROI is similar to that of his/her counterpart in NI.

The FSAI has also developed a guide for all food businesses, to include butcher shops, to assist in the development and implementation of HACCP. With the introduction of the Food Hygiene Package in 2006, however, previous legislation was replaced with ISO 22001 entitled 'Food Safety Management Systems – Requirements for Organisations throughout the Food Chain' in order to address the consolidation of food legislation.

After registration, inspections are carried out using a risk based approach which determines the nature, frequency and type of inspection, with due regard being given to the nature of the risk presented by the business (as categorised by FSAI Code of Practice No. 1(51)), the history of compliance with food safety legislation and the outcomes of previous inspections.

To assist catering businesses to comply with EU legislation, the FSAI in ROI has produced 'The Safe Catering Pack' launched in 2009 (52) and 'Safe Catering Guide,' produced in NI by the FSA in 2007 (53), as tools to help caterers develop a system to manage food safety. The pack and guide were developed with help and expertise from the food industry and environmental health officers. They are based on the principles of HACCP (Hazard Analysis and Critical Control Point).

Furthermore, the pivotal role played by the food handler in reducing foodborne illness has been recognised and a number of recommendations relating to hygiene, reporting, fitness to work, health surveillance, work exclusion/restriction, specific pathogens and prevention of infection with foodborne pathogens at work have been proposed (54).

3.1.3.6 The home

Consumers may also play a pivotal role in the reduction of foodborne illness by a change in their behaviour with respect to food storage and preparation. A **safefood**-funded study on the persistence and dissemination of *Salmonella*, *E. coli* and *Campylobacter* in domestic kitchens (55) showed that the presence of pathogenic bacteria on the exterior of packaged chicken is a potential source of cross-contamination. This can occur through transferring from packaging to hands to other fresh produce during shopping and during transit between supermarket and home. The study investigated the persistence of the three pathogens on various types of worktops and chopping boards. *Campylobacter* survived on the surfaces for up to 60 minutes, roughly the amount of time it takes to prepare a meal. *Salmonella* was recoverable after 6 hours, and *E. coli* survived for 24 hours on surfaces and tea towels.

The results of a **safefood**-funded study, based on observations of consumer behaviour during food preparation and cooking, showed that participants displayed poor levels of food safety overall and that behaviour was found to be influenced by food safety knowledge. Embedded in overall poor food safety behaviour hand cleanliness was poor, despite a high level of awareness of the perceived risk of contracting food poisoning associated with the failure to wash hands prior to food preparation (56).

Safefood ran a number of television campaigns with a view to raising awareness on the proper handling, storage and preparation of foods. For example 'Don't Take Risks' involved informing consumers of the need to wash surfaces and utensils properly while preparing food, and included advice on handwashing and cooking meats.

The studies mentioned demonstrate that the basic food safety messages that revolve around home practices such as storage, handling and cooking, are critical to eliminating the possibility of cross-contamination from raw to ready-to-eat foods. This is particularly important with *Salmonella*, since the pathogen will readily multiply in many ready-to-eat foods if they are not adequately refrigerated. Therefore consumer actions may amplify the risk associated with a particular food product through improper handling.

3.1.4 Other microbiological risks

3.1.4.1 *Staphylococcus aureus*

Staphylococci are ubiquitous in nature, with humans and warm-blooded animals as the primary sources. *Staphylococcus aureus* can be found on hands and around the nose areas of healthy humans. During food preparation food handlers can easily transfer the organism on to food. Essentially all raw foods, especially raw meats and poultry, can be contaminated with staphylococci, either by humans or animals, or both (57). *S. aureus* produces heat-stable toxins in foods when conditions are suitable.

The presence of *S. aureus* on chicken is generally indicative of poor hygiene and poor food handling practices. Contamination does not derive from infected flocks. Surveillance by the FSAI in 2001 found unsatisfactory ($10^0 - <10^4$ cfu/g, according to the Irish Microbiology Guidelines) or potentially hazardous ($>10^4$ cfu/g) levels of *S. aureus* in 12/432 (2.78%) samples of cooked chicken pieces (diced/shredded/sliced) taken from retail outlets (58).

3.1.4.2 *Listeria monocytogenes*

Listeria monocytogenes is widespread in the environment and is most commonly found in soil. Eating foods containing high levels of *Listeria monocytogenes* can cause listeriosis resulting in serious illness in at risk groups, including pregnant women, infants, the elderly and the immunocompromised. *Listeria* is not highly pathogenic in otherwise healthy adults.

Foods can become contaminated with *Listeria* at any stage in the food chain, from the farm, through processing and distribution, to the consumer's kitchen, especially in moist environments. *L. monocytogenes* can be found in a wide range of foods including milk, soft cheese, raw and pre-

cooked chickens and meats, pâté, fermented sausage, vegetables, smoked and lightly processed fish products and seafood.

The importance of *Listeria* spp. (and *L. monocytogenes* in particular) as a foodborne pathogen stems from its ability to grow at low temperatures (down to 0°C), and soft cheeses and meat-based pâté have been implicated in outbreaks in the past. *Listeria* can also survive freezing and drying, but is inactivated by pasteurisation.

Listeria spp. have been shown to be present within the poultry processing environment and hence the opportunity for cross-contamination of raw and cooked chicken products during processing exists (59). Two studies of retail chicken products in NI confirmed the presence of *L. monocytogenes* in 18% of fresh chickens tested (60), and in 11% of ready-to-eat chicken products (61).

3.1.5 Antimicrobial resistance and cross-resistance

Antibiotics are at the cornerstone of the practice of human medicine, but this great achievement is under threat by the emergence and development of antimicrobial resistance. Many potentially life-threatening infections (both in hospital and the community) are caused by pathogens that are now resistant to commonly used antimicrobials (so called first line treatments) and, in some cases, to agents held in reserve for severe infections.

It is difficult to determine at present the extent to which food is involved in the spread of antimicrobial resistance, however, according to the EFSA Panel of Biological Hazards, food-borne pathogens and commensal flora are displaying an increasing and diverse level of antimicrobial resistance (62).

Antimicrobial resistant *Campylobacter* and *Salmonella* are spread to humans via contaminated foods, thus the principles applied to the prevention and control of the spread of pathogenic bacteria will also contribute to the prevention of the spread of antimicrobial-resistant bacteria. As this phenomenon is a particular public health risk, other measures may be required e.g. limiting the use of antimicrobials at pre-harvest phase (62).

Prior to 2008, resistance to cephalosporins was not reported for isolates of *Salmonella* from food animals in Ireland. From October 2008 to March 2009, seven of 115 isolates of *S. Kentucky* were found to be resistant to cefotaxime and ceftazidime. This is a cause for concern as previous experience indicates that such resistant *Salmonella* isolates in food animals are to be associated with human disease. There are a number of cases of *S. Kentucky* in Ireland annually so this rise in cephalosporin resistant isolates may be a cause for public health concern in the future (63).

In 2009, 25 Member States along with three other European countries submitted information on the occurrence of antimicrobial resistance in zoonotic bacteria to the European Commission, the European Food Safety Authority and the European Centre for Disease Prevention and Control. The results, which were published in an EU Summary Report, showed that for *Campylobacter* isolates of human origin resistance to the antimicrobials ciprofloxacin (47%), ampicillin (43%) and nalidixic acid (40%) was high. Resistance to another important antimicrobial, erythromycin, was low (3.1%). With respect to *Salmonella*, resistance to common antimicrobials like ampicillin, tetracycline and sulphonamide was moderate, with around 20% of the tested bacteria considered resistant. Resistance to the clinically important third-generation cephalosporins and fluoroquinolones was below 10%.

For isolates of animal origin *Campylobacter* also showed high levels of resistance to ciprofloxacin. This was in particular the case for chickens (46% of *Campylobacter jejuni* and 78% of *Campylobacter coli*) and also pigs (50% of *Campylobacter coli*). High levels of resistance to ampicillin, tetracycline and sulphonamide were recorded in *Salmonella* isolates recovered from pigs and pig meat (47-60%), cattle (37-40%) and chicken meat (27-33%). A moderate level of resistance to ciprofloxacin was recorded in *Salmonella* isolated from chickens and chicken meat (around 20%).

As a matter of priority, specific measures need to be put in place to counter the developing microbial resistance to fluoroquinolones as well as to third and fourth generation cephalosporins found in a variety of foods and in animals in primary production. The transmission source of human exposure to fluoroquinolone resistance via food appears to be poultry, whereas poultry, pork and beef are important for cephalosporin resistance. It is these food production systems that require particular attention to prevent the spread of such resistance from these sources. The EFSA panel recommends that a full risk assessment of AMR for a specific food-bacterium-combination should be undertaken. Uniform adaptation of modified methodologies at both MS and EU level are required (62).

3.1.6 Antimicrobial treatment (decontamination) of poultrymeat

As mentioned earlier in this review, chemical decontamination during the poultry process is not permitted in the EU. However, following uncertainties originating from evidence of reduced susceptibility to biocides other than those listed below, EFSA has published its Scientific Opinion assessing the possible development of antimicrobial resistance to four decontaminants: chlorine dioxide; acidified sodium chlorite; trisodium phosphate and peroxyacids (62). The BIOHAZ Panel concluded that, although there is evidence of a long history of use, there is no evidence of resistance among bacterial populations to any of these compounds. The report does state that research into the potential emergence of reduced susceptibility to chemical decontaminants should be encouraged.

Methods to effect the post-slaughter decontamination during poultry processing may be a worthwhile intervention in the reduction of pathogenic micro-organisms. This may be particularly relevant where current hygiene-related processing protocols are unable to sufficiently control the hazard when present in the birds at slaughter e.g. with *Campylobacter* spp. Furthermore, the use of such strategies may have a potential food safety benefit if used in special circumstances in addition to existing controls, e.g. with known positive *Campylobacter* spp. or *Salmonella* spp. flocks if no other control measure is available or has been successful. It is important that these potential benefits are balanced with consumer concerns and informed by risk assessments to determine the toxicity of reaction products.

Electrolysed water (EO) is generated by passing a current of electricity through diluted sodium chloride, the products of the reaction are hypochlorous acid and sodium hydroxide. The result is a low pH solution containing active chlorine. This has shown to produce a 3 log₁₀ reduction of *Campylobacter jejuni* on poultry carcasses (39).

Ozone (O₃) has a number of applications in the food industry as a strong antimicrobial agent. Ozone is a viable disinfectant that can reduce the microbial load on food safely as it spontaneously decomposes into O₂, and has high reactivity and penetrability. However, further research is required to optimise its use as overuse can lead to discoloration and deterioration of food flavour (39).

Gamma irradiation is an effective way of reducing the microbial loadings on a range of food products including poultrymeat. Both *Salmonella* spp. and *Campylobacter* spp. may be inactivated by the application of low doses (2.5kGy) of gamma radiation, a practice which is employed in the USA. In view of consumer resistance to this technology, it is uncertain how acceptable such an approach would be to consumers on IOI.

A recent study conducted in University College Dublin used an emerging technology called High-Intensity Light Pulse (HILP) to assess its efficacy in reducing the levels of three pathogens, *Campylobacter* spp. *E. coli* and *Salmonella* Enteritidis, on chicken meat, contact surfaces and packaging. Results showed that short treatment times of between two to five seconds could significantly reduce contamination levels of all three bacteria on all three matrices (64).

Surface pasteurisation treatments to reduce contamination levels are utilised in red meat species in the USA and ROI to lower microbial numbers on carcass surfaces. Exposure to hot water or steam effects a surface decontamination of the product in question. However, there is potential damage to the outer epidermal skin, making this treatment unsuitable for products, such as chicken, to be sold with the skin retained. Unacceptable damage/discolouration of poultry skin as a consequence of hot water immersion and steam pasteurisation was reported in a study by Whyte et al. (65).

Another interesting development is the possibility that carcass surfaces could be frozen in a transient manner so that underlying tissues are not affected and the quality is not impaired. This strategy has the potential to reduce surface contamination with *Campylobacter* in a commercially acceptable fashion. The value of this approach in the future remains to be seen (66).

This review recognises that the antimicrobial treatment of foods of animal origin should only be part of an effective HACCP system and should not be used as the primary or only pathogen control measure. Additionally, the food business operator should inform the consumer, through labelling, when the food has been treated with a particular antimicrobial substance. However, under the current proposal, such labelling is not required where the treated poultry carcass or pieces have had the skin removed after treatment, or have been subsequently processed into meat products or meat preparations.

3.1.7 International recommendations

There are emerging co-ordinated international activities to reduce the prevalence of *Campylobacter* in poultry. As part of the proceedings from an FSA-organised International Meeting held in March 2010 in London, UK, a number of countries presented recommendations for pre- and post- harvest interventions to control the pathogen in chicken. All representatives agreed that strict biosecurity measures in broiler holdings, particularly hygiene barriers, change of clothes and boots and handwashing were a priority, along with fly netting/screens. A 'no thinning' or 'decreased thinning' policy was recommended along with various decontamination procedures and freezing (34). Other measures included incentives to farmers who deliver *Campylobacter*-free flocks and risk communication to consumers. From this meeting it became obvious that there is intense international interest in the development of criteria to reduce both the prevalence and the load of *Campylobacter* in poultry in the interest of public health.

Poultry and poultry-related intervention measures were presented at the 15th International Workshop on *Campylobacter*, *Helicobacter* and related organisms, held in Japan (67). The UK opted for the biosecurity measures e.g. improved crate washing and vaccination programmes and/or lytic bacteriophage therapy to reduce cecal levels in birds. The USA advocated the use of bactiocins or feed containing caprylic acid (8 C-medium chain fatty acid) three-to-seven days prior to slaughter to reduce caecal contents. Japan suggested the use of probiotics or strongly acidic electrolysed water, the Netherlands presented a method for the prevention of colonisation in birds utilising short- and medium- chain fatty acid fed supplementation.

From these reported interventions it is clear that there is no single intervention that can be relied upon by the industry to control *Campylobacter* spp. in poultry (67).

3.2 Chemical safety issues

The results of IOI National Residues Monitoring Programmes, year on year, indicate that the chemical contamination of chicken meat is largely a result of residues left over from primary production. While contamination is also possible from environmental sources such as mycotoxins, dioxin and PCBs, the monitoring programmes on the island of Ireland confirm that such contamination is extremely rare.

3.2.1 Broiler feed formulation

The feed used in the broiler industry on IOI, for conventionally-grown, free range and organically-grown chicken, is primarily based on GM-free European wheat (see Appendix G for breakdown of the composition).

Approximately 90% of the broiler feed manufactured on IOI contains added enzymes, specifically a phytase which liberates phosphorous from plant material thereby preventing its accumulation in the litter, and a combination of three enzymes Endo-1,3(4)-betaglucanase, Endo-1,4-beta-xylanase and Endo-1,4-betaglucanase), which serve as digestion aids.

Micro-organisms, although sanctioned for use in broiler feed under EU legislation, are not used as a feed additive in the broiler industry on IOI.

Different feed formulations (starter, grower or finisher) require a different spectrum of coccidiostat drugs (discussed later in this chapter). Withdrawal feed does not contain these or other drugs, which are also absent from all feed (i.e. not just withdrawal feed) used in organic production.

There is no prohibition on the use of ingredients of GM origin in the formulation of broiler feed. In ROI approximately 60% of broiler feed is formulated using certified non-GM ingredients and 40% do not specify this requirement. Soya and soya products are the source of approved GM material. The requirement for certified GM-free material is market driven. Currently, organic broiler feed can contain up to 5% of non-organic raw material, but this is due to be cut to zero from January 2012.

3.2.1.1 Control systems for broiler feed on IOI

Within the EU, Council Directive 95/53/EC requires the designated competent authority in each MS to check compliance with the provisions laid down in Community legislation, including legislation in Table 3.2. This includes provisions to assess control procedures in Third Countries and to resolve disputes between MS.

Table 3.2 Animal feed legislation

Legislation	Concerning
Regulation 767/2009	Placing on the market and use of feed
Regulation 183/2005	Feed hygiene
Regulation 882/2004	Official food and feed controls
Directive 70/524/EEC, Regulation 1831/2003	Additives in feedingstuffs
Regulation 178/2002	General food law
Directive 2002/32	Undesirable substances in animal feed
Directive 2000/766/EC	Protection measures with regard to TSEs and the feeding of animal protein
Directive 96/25/EC	The circulation of feed materials
Directive 79/373/EEC	The marketing of compound feedingstuffs
Directive 82/471/EEC	Certain products used in animal nutrition
Directive 93/74/EEC	Feedingstuffs intended for particular nutritional purposes such as nutritional supplements
Directive 96/23/EC	Monitoring certain substances and residues thereof in live animals and animal products
Directive 98/68/EC Directive 95/53/EC	Certain rules for checks at the introduction into the Community of feedingstuffs from third countries

MS are required to implement a yearly inspection and sampling programme designed to assess compliance with feed legislation. A detailed report is then forwarded to the Commission for discussion among MS. MS are also required to establish protocols and procedures for a contingency plan to minimise the effects of any non-compliance. Both feed operators and laboratory personnel are expected to be proactive in this regard. If a non-compliance with EU regulations is raised following an inspection, a warning is issued to the offending establishment. The consignment of feed can be seized and detained and it is the responsibility of the operator to instigate measures for the recall of all non-compliant products.

Both indigenously-produced and imported feedingstuffs (from within the EU and from Third Countries) are inspected, the latter at one of the 283 EU Border Inspection Posts (BIPs) currently operated by individual MS. Following these inspections, imported feedingstuffs can, in principle, circulate freely in the internal market once they are accompanied by documentary evidence indicating a positive outcome to the inspection (see Section 3.3.2 for further information on BIPs). The competent authority at the point of destination may instigate further checks.

Regulation (EC) No.178/2002 lays down detailed requirements for ensuring feed safety and traceability, and the responsibilities of feed business owners in this regard.

Under EU food safety legislation, individual feed business operators are responsible for the safety of the feed they produce. In ROI the competent authority with regard to the enforcement of EU legislation on feedingstuffs is DAFF, specifically the Feedingstuffs Inspectorate, which implements the inspection and sampling programme each year. In NI DARD is the enforcement authority in relation to all animal feeds and is the competent authority with regard to medicated and zootechnical feedingstuffs. The FSA, however, is the competent authority for all other animal feeds.

3.2.2 Compounds classified as additives for use in animal feedingstuffs

Chemicals classified as feed additives are legislated for under Regulation (EC) No. 1831/2003, which allocates feed additives to one of five different categories:

Technological additives which include any substance added to feed for a technological purpose; Sensory additives which include any substance, the addition of which to feed improves or

changes the organoleptic properties of the feed, or the visual characteristics of the food derived from animals;

- i. Nutritional additives;
- ii. Zootechnical additives which include any additive used to affect favourably the performance of animals in good health or used to affect favourably the environment, and;
- iii. Coccidiostats and histomonostats.

(See Appendix H for further information)

3.2.2.1 Legislation concerning the authorisation of feed additives and bioproteins on IOI

Regulation (EC) No 1831/2003, concerning additives for use in animal nutrition, supersedes Directive 70/524/EEC and establishes an EU-wide procedure for authorising the marketing and use of feed additives, as well as defining rules for labelling. Similarly, Directive 82/471/EEC concerning certain products used in animal nutrition, establishes this procedure for bioproteins.

The legislation on feed additives requires that Maximum Residue Levels (MRLs) are established where considered necessary for the protection of consumers. These limits, or MRLs, are primarily based on the Acceptable Daily Intake (ADI) value which is derived from the intrinsic toxicological properties of a chemical. Derogation exists where an MRL has already been established for the use of the substance as a veterinary medicinal product (VMP).

3.2.2.2 Coccidiosis

Coccidiosis is the disease state induced by a protozoan parasite, called Coccidia, that infects the intestinal gut wall of the host animal. Several species of Coccidia have been identified and most are species specific in terms of the host animal they infect. While there are species of Coccidia that can infect people, such as *Toxoplasma* and *Cryptosporidium*, the *Eimeria* species found in chickens are not parasitic in humans.

Coccidial infection is a common risk for the broiler industry where it can have a significant economic impact if not controlled. At least seven Coccidia species are important and these are classified on the basis of the coccidiosis they induce which is either intestinal or caecal. The death rate in infected birds may be quite high. Unlike in other animals, in which the infection manifests as a disease state

in young, old or otherwise immuno-compromised individuals, in broiler chickens otherwise healthy adults may be affected. The confined nature of modern broiler production units is probably a significant factor in the prevalence of the disease. The strains reared in these units are not sufficiently immunocompetent to meet the challenge presented by disease outbreaks. Immunity to one species of *Coccidia* will not confer immunity to other species as well.

Details of the mechanism of infection and diagnosis of coccidiosis can be accessed in the **safefood** report on Coccidiostats (68).

Treatment and prevention

Treatment of coccidiosis in poultry is based on inhibiting coccidial reproduction. A comprehensive database of veterinary medicinal products, including anticoccidiostats, currently authorised for use in ROI, together with their conditions of use, can be accessed on the Irish Medicines Board website (69).

The presence of coccidiosis is not necessarily an indication of poor animal husbandry practices. In fact, practical animal husbandry procedures, such as the avoidance of overcrowding, the provision of dry bedding, and good ventilation, can augment drug-based control strategies by reducing the potential for oocyst (immature *Coccidia*) build-up. Insect control within broiler houses is also important as they can act as mechanical vectors for *Coccidia*. However, in modern broiler production units, these procedures are probably insufficient in themselves. Vaccines against the most pathogenic species of *Coccidia* are used as an alternative to coccidiostatic treatments, especially on young birds. However, vaccination is, as yet, an expensive procedure. Its use will not give the indirect benefits associated with coccidiostat use, including improved performance and other therapeutic effects, such as a reduction in the incidence of clostridial infections which can cause necrotic enteritis. This has been further emphasised with the removal from the market of many feed additive antimicrobials such as flavomycin. (70).

Good animal nutrition is also an integral part of anti-*Coccidia* treatment regimes. Deficiencies in vitamins A or K can aggravate the effects of infection as will other diseases that deplete the bird's resistance to coccidiosis (71-72).

Cocciostatic drugs used on IOI

Most of the cocciostat drugs currently used on IOI are listed as authorised additives for use in broiler chickens within the EU (Council Directive 70/524/EEC and therefore do not require a veterinary prescription for use. A further two antiprotozoal drugs, Toltrazuril and Sulfadimidine sodium, are prescription-only medications and are sanctioned for use under EU Directive 2004/28/EC. These are used for supplemental control with in-feed cocciostats as well as a primary anticoccidial with non-medicated feed.

In a survey of broiler producing companies on IOI in 2001, between five and ten of the approved fifteen drugs were commonly used as part of treatment programmes against coccidiosis (68).

In practical terms, a starter diet containing Nicarbazine is administered for the first two weeks of life, as susceptibility to coccidiosis is greatest in chicks. This is followed by treatment with ionophore-containing grower and finisher diets from two to four weeks. Narasin, which has both cocciostat and anti-gram-positive effects, is the main treatment drug but other ionophore/antimicrobial drug combinations are also used. Non-medicated withdrawal feed is administered to broilers from four weeks until slaughter at five to seven weeks. Summer and winter treatments are varied to prevent the development of resistance by the parasite. Outbreaks of clinical coccidiosis are generally treated with Toltrazuril by its inclusion in drinking water.

Toxicological evaluation of cocciostat drugs used on IOI

The toxicological profile of most of the cocciostat and antiprotozoal drugs is not adequately completed. Of the drug data packages evaluated by the FEEDAP Panel of EFSA, four were of a sufficient standard to permit the derivation of an ADI, and six MRLs were established.

There is no evidence of a genotoxic or carcinogenic potential, or for reproductive or developmental effects, for those cocciostats/ antiprotozoals for which adequate data is available. However, there is some suggestion of fetotoxicity in rats administered Decoquinat. For all drugs withdrawal times have been recommended.

On 1st January 2006 Avilamycin and Flavophospholipol were withdrawn from the EU market, along with all Salinomycin and Monensin-based formulations classified as growth promoters (those formulations classified as cocciostats are not scheduled to be withdrawn).

Changes in husbandry practices

The critical points for contamination by *Coccidia* are during feed manufacture, bin handling on the farm, the feed delivery systems, and drug recycling. The use of a 'buffering' system in the manufacture of feed in which medicated and non-medicated feed production are separated by a less medicated feed such as turkey grower feed, has been advocated as a cross-contamination alleviation measure.

The use of single bins for medicated finisher and withdrawal feed was implicated in the cross-contamination of non-medicated with medicated feed. The adoption of a double-bin system was advocated as a precautionary measure and has been successful in the reduction of residues detected.

3.2.3 Compounds classified as contaminants in animal feedingstuffs

3.2.3.1 Legislation concerning the analysis of animal feedingstuffs and feed additives for contaminants

The aim of EU legislation regarding undesirable substances in animal nutrition is to ensure that feed materials, feed additives and feedingstuffs are put into circulation only if they are sound, genuine and of merchantable quality and, when correctly used, do not represent any danger to human health, animal health, the environment, or do not adversely affect livestock production. This EU legislation was consolidated by Council Directive 1999/29/EC and subsequently replaced by Directive 2002/32/EC, which introduced several major amendments. This Directive, and its subsequent amendments, includes maximum limits for heavy metals such as arsenic, lead, mercury and cadmium as well as for dioxin, aflatoxins B₁, certain pesticides, and botanical impurities in certain feed materials, feed additives and feedingstuffs.

3.2.3.2 Mycotoxins

Mycotoxin contamination of cereals used in feedingstuffs arises from mould growth that can occur during crop production or storage. As a group, mycotoxins can elicit a range of toxic effects in humans and animals including effects on the liver, kidneys and the immune system. Mycotoxins are highly potent with adverse effects observed after exposure to trace level amounts. Certain mycotoxins, such as the aflatoxins group, are known human carcinogens and some, such as Ochratoxin A, have been shown to elicit neoplasia via a genotoxic mechanism. For these substances there is no exposure threshold below which harmful effects will not occur and consequently no tolerable daily intake can be established.

Current scientific technical knowledge and improvements in production and storage techniques have not led to any major developments in the prevention of these moulds and, consequently, the presence of these mycotoxins cannot be entirely eliminated from the food chain. It is, therefore, advisable to set maximum permissible limits as low as reasonably achievable (ALARA) for precautionary consumer protection.

The recognition that mycotoxins can cause major illness in humans and animals, as well as significant economic losses for the poultry industry, has led to limits being set for aflatoxins and some other mycotoxins in different countries, often however on an *ad hoc* basis. Within the EU, attempts are being made to harmonise limits established in the MS. However, new residue limits can result in increasing technical demands on producers which can lead to trading tensions. Current EU legislation on mycotoxins is tabulated in Table 3.3.

Table 3.3 Relevant EU legislation on mycotoxins

Legislation	Concerning
Commission Regulation (EC) No. 2174/2003	Established maximum levels of 2 µg/kg and 4 µg/kg for aflatoxin B1 and total aflatoxin levels, respectively, in raw cereals
Commission Regulations (EC) No. 123/2005 updating Commission Regulation (EC) No 466/2001	Established maximum levels of 5 µg/kg for Ochratoxin A, also in raw cereals
Commission Directive 2003/100/EC amending Directive 2002/32/EC	Established a maximum level of aflatoxins B1 in complete feedingstuffs for poultry of 20 µg/kg which reduces to 10 µg/kg for chicks.
Commission Recommendation 2006/576/EC	Established guidance values for the presence of deoxynivalenol, zearalenone, ochratoxin A, T-2 and HT-2 and fumonisins in products intended for animal feeding

Sampling and analytical methodologies for mycotoxins have been established in Commission Directives 98/53/EC (aflatoxins), as amended by 2002/27/EC, and 2002/26/EC (Ochratoxin A). Furthermore, there are national laws and regulations in the MS covering both foodstuffs not regulated by European law and other mycotoxins. EU regulations for deoxynivalenol and zearalenone levels in raw cereals have not been established.

3.2.3.3 Dioxins

The term dioxins generally relates to a group of theoretically 75 polychlorinated dibenzo-*p*-dioxins (PCDDs) and 135 polychlorinated dibenzofurans (PCDFs). Seventeen specific PCDD/F compounds are considered to have particular toxicological significance and these are generally the focus of analyses. Although dioxins can arise from natural sources, most environmental contamination is the result of human activity. Their persistence in the environment underpins the likelihood that these compounds may enter the food chain. Dioxins are known to biomagnify and the clearance half-life in human tissue is approximately seven years. Certain dioxins, including 2,3,7,8-tetrachloro dibenzo-*p*-dioxin (TCDD), are classified as known human carcinogens.

The Scientific Committee for Food (SCF) of the EU has assessed the risks to public health arising from the presence of dioxins and dioxin-like polychlorinated biphenyls (PCBs) in food. This includes an assessment of the dietary intake of dioxins and dioxin-like PCBs by the EU population, and identifying the main contributors to dietary intake. Given the persistent nature of these compounds, the SCF has established a tolerable weekly intake of 14 pg toxic equivalents per kg body weight for dioxins and dioxin-like PCBs. Relevant EU legislation governing dioxins is outlined in Table 3.4.

Table 3.4: Relevant EU legislation on dioxins

Legislation	Concerning
Directive 1999/29/EC	Undesirable substances and products in animal nutrition
Commission Directive 2003/57/EC amending Directive 2002/32/EC	Maximum levels of dioxin permissible in feedingstuffs and feed additives
Recommendation 2002/201/EC	Concerning the reduction of dioxins, furans and PCBs in feedingstuffs and foodstuffs
Directive 2002/70/EC	Establishing requirements for the determination of levels of dioxins and dioxin-like PCBs in feedingstuffs
Recommendation 2004/704/EC Recommendation 2004/705/EC	Monitoring of background levels of dioxins and dioxin-like PCBs in foodstuffs

A threshold level of 0.75 ng/kg dioxin has been established for compound feedingstuffs above which a MS, in cooperation with operators, is required to: (a) initiate investigations to identify the source of contamination;

(b) check for the presence of dioxin-like PCBs;

(c) take measures to reduce or eliminate the source of contamination.

As part of the feedingstuffs inspection programme conducted by DAFF in ROI, a variety of feed materials and additives are analysed for dioxin contamination, including those destined for use in broiler production. As part of the 2008 inspection programme, a number of additives, pre-mixtures and compound feedingstuffs were analysed for dioxins. No non-compliances were detected (see Appendix I).

3.2.3.4 Nitrofurans

Nitrofurans are a group of chemicals previously used as veterinary medicinal products. Nitrofurans have been banned for use in food-producing animals in the EU since 1995 due to toxicological

concerns including an increased cancer risk in humans as a result of chronic exposure. Nitrofurans, specifically furazolidone, contamination of chicken products had been a problem in the UK. The contamination resulted from furazolidone deposition in the sediment of old water tanks on broiler farms. However, following the replacement of water tanks that were in use prior to 1998, nitrofurans were not detected in poultrymeat in random sampling programmes in the UK in 2008 and 2009.(73-74).

3.2.4 Compounds classified as veterinary medicinal products for use in animal health

- EU Directive 2004/28/EC of 31st March 2004, amending Directive 2001/82/EC on the Community code relating to Veterinary Medicinal Products (VMPs), defined the latter as: any substance or combination of substances presented as having properties for treating or preventing disease in animals;

or

- any substance or combination of substances which may be used in, or administered to, animals with a view either to restoring, correcting or modifying physiological functions by exerting a pharmacological, immunological or metabolic action, or to making a medical diagnosis.

The Directive does not apply to medicated feedingstuffs as defined in Council Directive 90/167/EEC or any additives for use in feedingstuffs covered by Council Directive 70/524/EEC.

The European Agency for the Evaluation of Medicinal Products (EMA) co-ordinates the scientific evaluation of the safety, quality and efficacy of medicinal products for human and veterinary use for licensing throughout the EU. Within the EMA the Committee for Proprietary Medicinal Products (CPMP) is responsible for opinions on the marketing of medicinal products. EC decisions agreed under this system are binding on MS and there is no scope for MS to take a national decision on a product out of line with a majority Community opinion. The Irish Medicines Board is the designated competent authority for the licensing of VMPs in ROI and advises the Minister of Agriculture on their control. The Veterinary Medicines Directorate and DARD are responsible for the licensing of VMPs in NI. VMPs controlled under this legislation are not for sale to the general public and require a prescription for use by authorised personnel.

Current EU legislation requires the establishment of an MRL for all pharmacologically active substances in VMPs marketed in the EU for administration to food-producing animals. The conditions

for establishing an MRL are set out in Council Regulation (EEC) No. 2377/90. Vaccines and coccidiostatic drugs are not covered by this regulation.

The list of VMPs approved for use in broiler chicken production is dynamic. An up-to-date comprehensive list is accessible on the website of the Irish Medicines Board, which includes a full description of each product/active substance and the associated conditions of use (75).

3.2.5 Surveillance programmes

Both ROI and UK operate annual residue and contaminant monitoring programmes to ensure that consumer health is protected and that the principles of Good Agricultural Practice and Good Manufacturing Practice are applied. These form part of an EU-wide endeavour in which each MS is required to implement residue surveillance plans and to submit their programmes annually to the European Commission for approval (Council Directive 96/23/EC). Third Countries wishing to export animal products to the EU are similarly required to satisfy the European Commission that their residue surveillance measures provide equivalent guarantees for EU consumers. The scope of such programmes is quite extensive and involves government, and public and private laboratories. MRLs for residues and action levels for contaminants in chicken meat have been established. The legislation also underpins the actions that are deemed necessary following any identified breaches of these limits, or ‘non-compliances.’

Implementation of the plan requires sampling food producing species at both farm and primary processing levels. Samples are generally taken in accordance with criteria designed to target animals or products which are likely to contain illegal residues or where the presence of illegal residues is suspected. In addition to residue testing at farm and primary processing levels, the respective Departments of Agriculture monitor the use of veterinary medicines on an ongoing basis, mainly through inspections at various commercial premises involved in distribution.

The analytical data generated under these programmes is published annually. The data gives some indication of the contribution made to the total human body burden of xenobiotic chemicals resulting from the consumption of various food products. As part of the residue surveillance plan for 2009, over 652,000 samples were tested in ROI. Sampling was conducted on eleven domestic food-producing species (including chicken and bees) and from products imported from Third Countries, particularly those where the European Commission had taken a ‘safeguard decision.’ The residue groups fall into three broad categories: banned substances, such as growth-promoting hormones and beta-antagonists; approved veterinary medicines (these usually arise where animals enter the food

chain before expiry of the prescribed withdrawal period of the medicine concerned); and environment contaminants.

The residue surveillance plan for Northern Ireland feeds into the larger plan for the UK as a whole. The Veterinary Residues Committee has responsibility for assessing and advising on the scope and operation of the statutory surveillance programme and the formulation of an annual non-statutory surveillance programme, as well as all associated communications and evaluation requirements. In 2009 poultrymeat products were analysed for hormones, banned substances, β -agonists, antimicrobials, anthelmintics, coccidiostats, pesticides and PCBs, heavy metals and mycotoxins. Ionophore (lasalocid, monensin, salinomycin) and nicarbazin residues in excess of statutory or other limits (called Reference Points) were detected in 47 of 600 (7.8%) samples tested in a screen of broiler liver.

3.2.5.1 Surveillance results for coccidiostat residues on IOI

In recent years the residue levels of most coccidiostats in broiler meat were within acceptable upper limits. However, the notable exception had been Nicarbazin residue levels which exceeded the JECFA MRL. As a result of the way that feed additives, such as nicarbazin, were previously regulated in the EU, there was no MRL and in the absence of an EU limit, an international MRL set by JECFA in 1998 of 200 $\mu\text{g}/\text{k}$ was used. Highest levels were detected in chicken liver and muscle samples, especially in the UK, with certain samples registering Nicarbazin levels of up to 3,400 $\mu\text{g}/\text{kg}$ in the 2004 surveillance programme.

In April 2010 EFSA published a scientific opinion, which recommended a maximum residue limit (MRL) for nicarbazin residues in chicken liver of 15,000 $\mu\text{g}/\text{kg}$. This was subsequently adopted by the European Commission. With this higher MRL, it is unlikely that there will be many non-compliant samples in the future.

3.2.5.2 Surveillance results for chemical and drug residues

During the 2009 residue surveillance programme in ROI no residues of growth promoters covered by the EU hormone ban were found. Testing for residues of antibiotic medicines continued at levels in excess of those required by EU obligations. In the poultry sector the results incorporate the outcome of an ongoing programme conducted in conjunction with the FSAI in the context of a strategy to

address the antibiotic resistance problem. Under this programme, samples are tested for the presence of antimicrobials and for antibiotic resistant bacteria.

In 2008, as part of the feedingstuffs inspection programme conducted by DAFF in ROI, a series of additives, pre-mixtures and compound feedingstuffs used in the poultry industry (both broilers & layers) were analysed for undesirable substances and products, including heavy metals, dioxins and PCBs, pesticides, mycotoxins, fluorine, prohibited animal proteins and banned additives. The results were unremarkable (see Appendix I).

3.3 Third Country import controls

Live animals or animal products imported into the EU may only originate from a Third Country, or part of a Third Country, approved by the Community via routine audits conducted by the Food and Veterinary Office (FVO). The

establishments from which products are derived must be approved in

accordance with the relevant EU legislation by the competent authority of the

Third Country.

Council Directive 2009/158/EC on Animal Health Conditions Governing Intra-Community Trade in, and imports from, Third Countries of poultry and hatching eggs lays down the animal health principles on which the importation of live poultry is based. This Directive, which has been amended several times, harmonises the rules and establishes the general animal health conditions for the importation into the EU of live poultry. Furthermore, under this Directive it is possible to regionalise a country. This means that, depending on the animal health situation and the guarantees offered by that country, only a part of its territory may be authorised for the importation into the EU of live poultry.

Council Directive 2002/99/EC lays down the animal health requirements for fresh meat. This Directive forms the legal basis for all animal health rules governing the production, processing, distribution and introduction of products of animal origin for human consumption and continues to provide harmonised rules and animal health guarantees for the importation into the EU of fresh meat.

Commission Regulation (EC) No. 798/2008, as amended, lays down a list of Third Countries, territories, zones or compartments, from which poultry and poultry products may be imported into and transit through the Community and the veterinary certification requirements.

3.3.1 European Union Food and Veterinary Office

The function of the FVO is to assure effective control systems through the evaluation of compliance with the requirements of EU food safety/quality, veterinary and plant health legislation, both within the EU and in Third Countries exporting to the EU. The FVO does this mainly by carrying out inspections in MS and in Third Countries exporting to the EU.

Each year the FVO develops an inspection programme, identifying priority areas and countries for inspection. In order to ensure that the programme remains up to date and relevant, it is reviewed mid-year. The FVO makes recommendations to the country's competent authority to deal with any shortcomings revealed during the inspections. On IOI the competent authorities are FSA/FSAI for public health related issues and DAFF/DARD for animal/plant health issues. The competent authority is requested to present an action plan to the FVO on how it intends to address any shortcomings. Together with other Commission services, the FVO evaluates this action plan and monitors its implementation through a number of follow-up activities.

In its role, the FVO, where appropriate, may highlight areas where the Commission may need to consider clarifying or amending legislation or areas where new legislation might be required. In addition, the FVO produces other reports, such as general overview reports that summarise the results of a series of inspections to a number of MS on the same subject, or the annual EU-wide pesticide residues monitoring reports. The FVO also publishes an annual report on its activities, which reviews the progress of its inspection programme and presents the global results (76).

3.3.2 Border inspection posts

Veterinary border control is a key factor in ensuring that live animals and products of animal origin entering the European Union are safe and meet specific import conditions laid down in the Community legislation. The importation of live animals and products of animal origin present the highest level of risk as they can transmit serious human and animal diseases. Therefore it is necessary to subject them to specific controls at their point of entry, so called veterinary border inspection ports (BIPs).

A consignment of live animals or product of animal origin from Third Countries can only enter the EU through a designated BIP having satisfactorily undergone the specific checks after which a Common Veterinary Entry Document (CVED) is issued. Third Country import controls can be undertaken in any one MS before the product is allowed to circulate freely in other MS, which effectively means that each MS is dependent on every other state to ensure that imports are controlled. It should be noted that the BIP is not always in the country of final destination of the product. The BIPs are situated in strategic locations in each MS and are under the supervision of the relevant competent authority of the MS. Competent Authorities in each MS issue guidelines for the operation of the BIP in their jurisdiction. The Food and Veterinary Office of the European Commission routinely audits the controls carried out in these BIPs.

The list of approved veterinary BIPs is laid down in Commission Decision 2009/821/EC, as amended. There are currently five BIPs on IOI, namely Dublin Airport, Dublin Port, Shannon Airport, Belfast Airport and Belfast Port.

Council Directive 97/78/EC governs the organisation of veterinary checks on products entering the EU from Third Countries. Such imports must be accompanied by health certification signed by an official veterinarian in the country of export and must be presented at the BIP at point of entry into the EU. The animal products must be appropriately wrapped, packaged and labelled with a health mark. The importer must be registered with the Competent Authority and must give 24 hours advance notification to the latter.

All consignments from Third Countries undergo a 100% documentary and identity check, while physical checks are carried out at frequencies laid down in EU law under Commission Decision 94/360/EC. Poultrymeat comes under category 2, which means the frequency of physical checks is 50%, while for other fresh meats the frequency is 20%. Sampling for laboratory analysis may also be carried out. Foods failing to comply with the control checks may be detained for further examination, returned to the exporting country or destroyed. All rejections are notified to the EU Commission and if deemed a public health risk communicated to all MS via the Rapid Alert System for Food and Feed (RASFF). Once the shipment has met the required conditions it is released for free circulation within the EU. However, copies of the Health Certificate and the BIP clearance document must accompany the consignment to its destination. The aforementioned Directive has been transposed into national legislation in NI by the 'Products of Animal Origin (Third Country Imports) Regulations (Northern Ireland) 2007' as amended, and in ROI by 'European Communities (Importation of Animal and Animal Products from Third Countries) Regulations, 1994' (S.I. No. 255 of 1994).

The Competent Authority in the MS carries out initial monitoring of controls at BIPs. In the case of ROI this is done by VIs in DAFF on behalf of the FSAI, and in NI by VOs in DARDNI. The FVO is required to inspect BIPs with an annual throughput of more than 2000 consignments each year and smaller ones less frequently, with all MS visited at least every three years, to assess the performance and uniformity of national enforcement systems. Where the operation or the facilities for checking product at a BIP is considered inadequate, approval of the BIP may be withdrawn. In the FVO Annual Report for 2003 the findings of BIP Audits conducted during that time period in MS visited show that there were minor non-compliances in the areas of staff training, identification and selection of consignments, working procedures, supervision of transit trade, hygiene and documentation. In addition, a number of major non-compliances were also found, mainly related to facilities and equipment in BIPs. In the FVO Annual Report for 2008 progress was noted with supervision of BIPs, training of staff and working procedures (77). In addition to this, improved co-operation between the veterinary services and other services involved in import/transit controls was noted in the Member States. Nevertheless, common shortcomings in general of a minor nature were found in the areas of identification and selection of consignments, checks on non-commercial pet animals, BIP facilities including equipment and hygiene and for destruction of animalby-products (galley waste). Some previously identified shortcomings continued to exist in some Member States.

3.4 Product traceability and recall

In recent years there have been a series of high profile food scares, which have focused attention on how the supply chain operates, from production through processing, and finally distribution. Such 'scares' have the potential to seriously damage consumer confidence in the food chain, whether they present real or perceived food safety risks. They have also highlighted serious deficiencies in traceability systems and also in European Law, resulting in the formulation and adoption of Regulation (EC) No. 178/2002, as amended. This Regulation lays down the general principles and requirements of food law and pays particular attention to traceability and recall systems and the role of food/feed business operators. In today's global food market, effective traceability and product recall systems are paramount, even in the best-managed food business, where an issue involving the safety of a foodstuff may occur.

3.4.1 Product traceability

Regulation (EC) No. 178/2002 clearly states that all food businesses must have a traceability system in place. Traceability is fundamental to establishing and eliminating the root cause of a problem. The objective of a traceability system is to identify a unique batch of product and then follow that batch, and each individual unit comprising the batch, through the production and distribution process to the

immediate customer in the event of a food safety/quality issue arising. Such an issue may be the result of a packaging defect, a preservation failure, a production, storage or ingredient problem.

There are three basic levels of traceability required:

- 1) Supplier Traceability: the traceability of suppliers and their goods entering a business;
- 2) Process Traceability: the traceability of foodstuffs through a business;
- 3) Customer Traceability: the traceability of foodstuffs to the immediate customer.

Regulation (EC) No. 178/2002, as amended, is minimal in its description of what is required and therefore does not reflect what is considered to be best practice. The legal minimum is a system in which a food business records what ingredients / food products it receives and from who, together with what product it dispatches to which customers, with the only exception being direct supply to final consumers. This is called the one-up-one-down system. Traceability information must be transferred up/down the chain on the product or on accompanying documents.

3.4.2 Product recall

The objective of a product recall is to protect public health by informing consumers of the presence on the market of a potentially hazardous foodstuff and by facilitating the efficient, rapid identification and removal of the unsafe foodstuff from the distribution chain. There are two levels of product recall:

- 1) Recall – the removal of unsafe food from the distribution chain extending to food sold to the consumer, and
- 2) Withdrawal – the removal of an unsafe food from the distribution chain. Does not extend to food sold to the consumer.

Regulation (EC) No. 178/2002, as amended, in addition to laying down the requirements for product recall, also established RASFF, which is a notification system operated by the European Commission to exchange information on identified hazards between MS. In each MS there must be a single liaison contact point to deal with alerts, arising within that State, or issued by RASFF. The FSANI and the FSAI in ROI are the primary contact points on IOI.

Notifications of alerts are issued by the single liaison contact point within each MS to official agencies and food businesses relating to an identified hazard and are classified in either one of two categories,

‘For Action’ or ‘For Information.’ Action is required when there is an identified direct or indirect risk to consumers. Information alerts do not require action, but relate information concerning a food or feed product that is unlikely to pose a risk to health, e.g. inform relevant authorities of consignments blocked at border inspection posts.

The FSAI has issued a Guidance Note relating to Product Recall and Traceability (applicable only to food) (78) and also a Code of Practice on Food Incidents and Food Alerts (79). A similar guidance document has been issued by FSA, and includes guidance on product recall and traceability (80).

In ROI a National Food Incident Management Plan (81) was developed by the FSAI in conjunction with all of the official agencies so that a structured, coordinated and efficient response to any food safety incident can be employed when it arises. The FSA has set up an incidents taskforce to strengthen existing controls in the food chain so that the possibility of future food incidents occurring may be reduced, and to improve the management of such incidents when they do occur (82).

3.5 Animal diseases

In some cases, the presence of disease in flocks of food-producing animals might be perceived by consumers as a risk that undermines their confidence in derived food products. However, the risk for human health from eating products from animals associated with some of these diseases is negligible or non-existent.

Potential risks associated with foodborne pathogens are minimised through stringent animal health control measures. Diseased animals cannot be used to produce human food. Animals arriving at the abattoir to be slaughtered are inspected for signs of clinical illness by trained personnel before and throughout the slaughter process.

3.5.1 Avian influenza

Avian influenza (AI) is a naturally occurring infectious disease of migratory waterfowl caused by influenza A viruses. Of the 15 main subtypes of influenza A virus, strains H5 and H7 are highly pathogenic and contagious and result in high mortality (up to 100%) among susceptible bird species, especially domestic chickens. Since 1959 several AI subtypes have crossed the species barrier to infect humans on a number of occasions. Most infections result in mild respiratory symptoms or

conjunctivitis. However, infection with the H5N1 strain results in a severe disease state and high mortality, as recorded in outbreaks occurring in 1997 (Hong Kong), 2003 (China, Hong Kong) and 2004 (Thailand, Vietnam). There is no evidence to date of human infection with AI on IOI. As of 5 September 2011, 565 confirmed human cases of infection with avian influenza H5N1 virus from 15 countries have been reported to the World Health Organisation (WHO). Of these, 331 died (CFR: 58.6%). Epidemiological investigations have identified only limited human-to-human transmission of this virus since its emergence, and no community-level spread. 2008 marked the beginning of a renewed geographic expansion of the H5N1 virus both in poultry and wild birds.

The principal risk factor for human infection is close contact with live infected poultry, either directly from the infected birds or via an intermediate host. Reports from infected areas of limited human-to-human transmissions remain unsubstantiated. The immediate slaughter of infected flocks is highly effective in preventing the spread of the disease in both animal and human populations as shown in Hong Kong in 1997. This is facilitated by the rapid and obvious onset of symptoms once flocks have become infected.

To date there is no epidemiological information to suggest that the disease can be transmitted through contaminated food or that products shipped from affected areas have been the source of infection in humans. Infected chicken flocks are rapidly destroyed before entering the food chain. Freezing and refrigeration of meat does not reduce the concentration or virulence of viruses. However, proper cooking will destroy the virus and WHO recommends that foods should be cooked to reach an internal temperature of at least 70°C.

3.5.2 Newcastle disease

Newcastle disease (ND) is a highly contagious viral disease of domestic poultry, cage and aviary birds, as well as wild birds. Infection is characterised by digestive, respiratory and/or neurological symptoms. Many European countries have been free of the disease for many years. However, it is still endemic in some countries. In January 2011 France confirmed an outbreak of ND in a holding of meat pigeons. In 2011 there were four reported cases of ND affected racing pigeons in Cork, ROI, and the outbreak was confined to urban areas.

Although mild conjunctivitis and influenza-like symptoms have been reported in people who have been in contact with infected birds (those working in poultry processing plants and laboratories where

infected birds have been handled), exposure through food is not considered a risk factor. The spread of the virus within bird populations is usually by contact with infected or diseased birds. The virus can be readily destroyed by heat but is also readily deactivated by soaps and detergents, hypochlorites, alkalis and gluteraldehyde. A minimum temperature of 80°C for one minute deactivates the virus in meat products.

There is no treatment for ND. The control strategy is immediate eradication of ND infected flocks and the disposal of infected or exposed products to remove the most dangerous source of the virus.

3.6 Conclusions

Campylobacter is the most common cause of bacterial gastroenteritis cases on IOI, with a crude incidence rate in 2010 of 43.09/100,000 population. While many risk factors for campylobacteriosis have been identified, the consumption of undercooked chicken is seen as the most significant risk. In 2008 EFSA reported that 98% and 86% of broiler carcasses from ROI and the UK were contaminated with *Campylobacter* respectively. A downward trend of salmonellosis cases has been observed on IOI with crude incidence rates in 2010 of 7.96 cases/100,000 population for ROI and 10.05 cases/100,000 population for NI. In 2008 EFSA reported that 11.2% and 3.4% of broiler carcasses from ROI and the UK were contaminated with *Salmonella* respectively. Of the *Salmonella* found, all were *Salmonella* spp. other than *S. Enteritidis* or *S. Typhimurium*, reflecting the success of the National Control Plans in reducing the level of these pathogens in poultry. Standard biosecurity measures have not, however, been very successful at reducing *Campylobacter* colonisation of chickens and control strategies are now focussing on reducing the concentration of *Campylobacter* on chicken carcasses.

HACCP systems are mandatory requirements for food businesses. Risk management by the business operator is at the core of ensuring food safety during retail and catering activities. Good hygiene practices can ensure that food safety risks are minimised along the farm to fork continuum. However, studies based on observations of consumer behaviour during food preparation and cooking in the domestic kitchen showed poor levels of food safety overall. It is important that consumers are educated in terms of best practice for food storage, preparation and cooking in the kitchen.

Antimicrobial resistance is a threat to public health protection. While the use of antibiotics for growth promotion is banned in the EU, resistance in *Salmonella* and *Campylobacter* to some

important antimicrobials is high. Prudent use of these antimicrobials is necessary in order to preserve these drugs for the treatment of both animals and humans.

Monitoring programmes on IOI confirm that chemical contamination of chicken is extremely rare. Both ROI and UK operate annual residue and contaminant monitoring programmes to ensure that consumer health is protected and that the principles of Good Agricultural Practice and Good Manufacturing Practice are applied. These form part of an EU-wide endeavour in which each MS is required to implement residue surveillance plans and to submit their programmes annually to the European Commission for approval.

Third Country import controls are undertaken at Member State Border Inspection Posts before they are allowed access to the EU market. The function of the Food and Veterinary Office (FVO) is to ensure effective control systems through the evaluation of compliance with the requirements of EU food safety/quality, veterinary and plant health legislation, both within the EU and in Third Countries exporting to the EU. The FVO does this mainly by carrying out inspections in MS and in Third Countries exporting to the EU.

In today's global food market, effective traceability and product recall systems are paramount. EU Regulation lays down the general principles and requirements of food law and pays particular attention to traceability and recall systems and the role of food/feed business operators.

Avian Influenza (AI) and Newcastle Disease (ND) affect various avian species, especially domestic poultry. These viruses may have a global impact on poultry health and limit international trade in poultry and poultry products. Cases of human infection by AI and ND viruses have been documented, but are rare, and exposure through food is not considered a risk factor. Although trade restrictions have been imposed on some countries to protect animal health, there is no epidemiological evidence that AI or ND can be transmitted to humans via properly cooked food. WHO and other expert bodies, therefore, do not currently consider AI or ND a food safety risk for consumers.

4 NUTRITION AND HEALTH

4.1 Introduction

4.2 Nutritional consumption patterns

4.3 Current consumption patterns

4.4 Chicken and health

4.5 Conclusions

Key findings

- Poultrymeat has become a mass consumer product throughout the world and is the second most commonly consumed meat in the European Union.
- ROI guidelines, which are based on the Irish Food Pyramid, recommend consumption of any two portions of meat, fish, eggs or alternatives per day, for example, 60g/2 ounces of cooked lean poultry. NI guidelines, based on the UK's Eatwell Plate, recommend that one fifth of the daily diet should consist of meat, fish or alternatives.
- In comparison to other meats, chicken meat is often promoted because it is rich in protein and low in fat.
- White chicken meat contains a lower level of total (1.1g/100g) and saturated fat (0.6g/100g), than dark chicken meat (2.8g/100g and (0.8g/100g respectively).
- Chicken meat contains essential minerals and vitamins as well as being an excellent source of protein in the diet.
- The nutrient content of chicken can be changed dramatically by added ingredients, through the methods used in the manufacturing and/or processing of the product and in the preparation and/or cooking methods used in the kitchen.
- Methods to reduce the fat content of chicken include removing any visible fat and skin from the chicken portion, dry frying, or grilling.
- In ROI chicken is the second most commonly consumed meat, while in the UK it is the most commonly consumed meat.
- The average consumption among 18-64 years olds is 51g/day in ROI and 58g/day in the UK.
- Younger age groups tend to eat the most white meat (i.e. chicken and turkey) and women tend to eat more white meat than men.
- While chicken can be considered a highly nutritious food, compared to other meat, it is relatively low in iron. It is important that the younger age groups and women are aware of iron-deficiency anaemia and the importance of consuming adequate levels of the mineral.

4.1 Introduction

Meat and meat products, including chicken, are an important source of a wide range of nutrients. The dietary guidelines in the Republic of Ireland (ROI), in the form of the Food Pyramid, classify meat, fish, eggs and alternative protein sources (such as beans and nuts) as a food group. These guidelines recommend that individuals should strive to consume any two portions of meat, fish, eggs or alternatives per day. These two portions are equivalent to 60g or two ounces of cooked lean poultry (roughly half a small chicken breast) (83). In Northern Ireland (NI) guidelines known as the Eatwell Plate recommend that one fifth of the average individual's diet (i.e. of all food consumed daily) consists of meat, fish or alternatives (84). Dietary guidelines do not give specific advice on the consumption of chicken alone.

4.2 Nutritional composition of chicken meat

4.2.1 General

From a nutritional perspective the benefits of chicken meat are often promoted, particularly for those who wish to follow a healthy, low-fat diet. Chicken has achieved much of its reputation on the basis of it being a food that is rich in protein and low in fat, in comparison to other meats (Table 4.1) (85).

Table 4.1 The nutritional value of different raw meats per 100g (85).

Type of Raw Meat	Energy (kcal)	Protein (g)	Fat (g)	Saturated Fat (g)	Iron (mg)	Sodium (mg)
Beef, average, trimmed lean, raw	129	22.5	4.3	1.7	2.7	63
Lamb, average, trimmed lean, raw	153	20.2	8.0	3.5	1.4	70
Pork, trimmed lean, raw	123	21.8	4.0	1.4	0.7	63
Chicken meat, average, raw	108	22.3	2.1	0.6	0.7	77
Light chicken meat, <i>raw</i>	106	24.0	1.1	0.3	0.5	60
Dark chicken meat, <i>raw</i>	109	20.9	2.8	0.8	0.8	90

With regard to total fat content, 100g (equivalent to a small breast of chicken) of raw, white chicken meat, without its skin, contains approximately 1.1g fat and 106 kcal (449KJ). (85) (Table 4.1)

There are two main types of fat in the diet, saturated and unsaturated. The predominant type of fat in chicken is unsaturated, with almost half of the total fatty acids being monounsaturated. Saturated fatty acids form the next largest category and polyunsaturated fatty acids the smallest. (Table 4.2) The exact fatty acid profile present in the chicken reflects the fatty acid profile of the feed that the live chicken consumed.

Saturated fat is normally found in animal foods and consumption of high levels of saturated fatty acids is associated with increasing levels of cholesterol in the blood which may lead to coronary heart disease. Therefore, as part of a healthy diet, consumers are advised to try and lower their intake of saturated fatty acids (86). In comparison to other meats (lean raw beef 1.7g, lean raw lamb 3.5g and lean raw pork 1.4g), raw chicken meat has lower levels of saturated fat, having just 0.6g of saturated fat per 100g. (Table 4.2)

Table 4.2 The fatty acid profile of chicken per 100g (85).

Type of chicken meat	Fat (g)	Monounsaturated fat (g)	Saturated fat (g)	Polyunsaturated fat (g)
Meat, average, raw	2.1	1.0	0.6	0.4
Light meat, raw	1.1	0.5	0.3	0.2
Dark meat, raw	2.8	1.3	0.8	0.6

Generally the breast portions of chicken meat contain the lowest levels of total and saturated fat, followed by the thigh and the drumsticks. Chicken wings have the highest fat content.

Chicken is an excellent source of protein in the diet. One hundred grams (100g) of raw chicken meat contains 22.3g of protein, which is relatively similar to the protein content of other meats. (85) (Table 4.1)

From a micronutrient point of view, chicken is a source of a range of vitamins, minerals and trace elements and this varies by chicken part. Fat-soluble vitamins (A, D, E and K) accumulate in larger concentrations in the skin and separable fat than in the lean tissue, while minerals are more highly concentrated in the lean tissue than in the fat and skin of chicken meat.

Chicken meat has relatively low levels of iron in comparison to red meats, with the exception of pork (Table 4.1). Iron, zinc and riboflavin levels are higher in the thigh and drumstick, than in the white breast meat and chicken wings. In contrast to dark chicken meat, white chicken meat contains higher levels of niacin and Vitamin B₆. (Table 4.3).

Table 4.3 The micronutrient composition of chicken per 100g (85)

Type of chicken meat	Iron (mg)	Zinc (mg)	Riboflavin Vitamin B ₂ (mg)	Niacin Vitamin B ₃ (mg)	Vitamin B ₆ (mg)	Vitamin B ₁₂ (µg)
Meat, average, raw	0.7	1.2	0.18	7.8	0.38	Tr
Light meat, raw	0.5	0.7	0.14	10.7	0.51	Tr
Dark meat, raw	0.8	1.7	0.22	5.6	0.28	1

4.2.2 Effect of processing and cooking on the nutritional composition of chicken

The nutrient profile of chicken meat can be changed dramatically by the ingredients and methods employed in the manufacturing and/or processing of the product and in the preparation/cooking methods used in the kitchen. It can result in a final chicken product that may be high in fat (particularly saturated fat), total energy and sodium, and lower in total protein per serving (85). For example, choosing to bread chicken breasts with white flour and deep frying them in oil with saturated fat, or cooking chicken with the skin on, can add many unwanted and unhealthy fats and calories.

The overall fat, energy and salt content of a 100g portion of grilled chicken meat without the skin is much lower than in 100g portions of chicken products available in fast food outlets across the Island of Ireland (IOI).

In comparison to a grilled chicken breast, a chicken burger has over 5 times more fat in grams (2.2g to 10.8g respectively) and almost double the amount of energy (148kcal to 267kcal respectively). A 100g portion of chicken nuggets (87), a children's favourite, contains approximately 13.0g fat (3.3g saturated fat) and 265kcal. The fat content of products such as burgers and nuggets can be attributed to other ingredients used to process the products, such as binders and coatings (Table 4.4, 4.5).

The type of meat product chosen and how it is cooked can also make a big difference to the saturated fat content. A fried chicken breast in breadcrumbs contains nearly 6 times as much fat as a chicken breast grilled without the skin (12.7g fat and 2.1g saturated fat per 100g compared with 2.2g fat and 0.6g saturated fat per 100g) (Table 4.5) (85).

Unprocessed chicken is naturally low in sodium and comparing a grilled chicken breast to a chicken burger, the latter has over 10 times more sodium per 100g, while a portion of 6 chicken nuggets contains over 9 times more sodium. The higher sodium content in these processed products may be attributed to the addition of coatings and seasonings including salt during preparation (Table 4.4).

A **safefood** commissioned survey which examined the nutritional composition of take-away chicken and potato products across IOI found that both chicken burgers and nuggets contain very low amounts of protein per 100g (chicken burger v grilled chicken breast: 12.5g to 32.0g respectively; chicken nuggets v grilled chicken breast: 18.7g to 32.0g respectively). This is because these products are more likely to be processed and contain other ingredients, which have the impact of lowering the protein content. Products that are coated in breadcrumbs and batter will have lower protein content because the coating is often high in fat and carbohydrate (88).

Table 4.4 The nutritional composition of chicken products per 100g (85)

Type of chicken product	Energy (kcal)	Protein (g)	Fat (g)	Saturated Fat (g)	Iron (mg)	Sodium (mg)	Niacin (mg)
Chicken burger, <i>Takeaway</i>	267	12.5	10.8	N	0.4	560	4.3
Chicken nuggets, <i>Takeaway</i>	265	18.7	13.0	3.3	0.6	510	6.3
Chicken pie, <i>individual, chilled/frozen, baked</i>	288	9.0	17.7	7.0	0.8	430	1.5
Chicken roll	131	17.1	4.8	1.5	0.4	680	6.5

Table 4.5 The effect of cooking on the nutritional composition of chicken per 100g (85).

Type of meat and type of cooking	Energy (kcal)	Protein (g)	Fat (g)	Saturated Fat (g)	Iron (mg)	Sodium (mg)	Niacin (mg)
Breast,							
<i>Casserole, meat only</i>	160	28.4	5.2	1.5	0.5	60	8.8
<i>Grilled without skin, meat only</i>	148	32.0	2.2	0.6	0.4	55	15.8
<i>Strips, stir-fried</i>	161	29.7	4.6	N	0.5	61	14.4
Breast in crumbs, chilled, fried	242	18.0	12.7	2.1	(0.1)	(420)	7.6
Drumsticks, roasted, meat and skin	185	25.8	9.1	2.5	1.0	130	5.5
Roasted, meat, average							
<i>dark meat</i>	177	27.3	7.5	2.9	0.8	100	6.2
<i>light Meat</i>	196	24.4	10.9	1.0	0.4	60	12.6
<i>Leg quarter, meat and skin</i>	153	30.2	3.6	2.1	0.7	80	9.2
<i>Wing quarter, meat and skin</i>	236	20.9	16.9	4.6	0.8	95	5.0
Skin, dry, roasted/grilled	226	24.8	14.1	3.9	0.6	100	10.0
	501	21.5	46.1	12.9	1.3	80	N

When preparing chicken in the home or catering sector, a number of steps can be taken to minimise the fat content of the cooked chicken product:

- The healthy option is to choose fresh meat without skin and preferably without coating.
- Removing any visible fat and skin from the chicken portion considerably lowers the overall fat content of the meat (crackling and poultry skin are much higher in fat than the meat itself) (Table 4.5).
- Using healthier cooking methods such as dry frying/grilling will result in a lower fat product compared to other methods (Table 4.5) (85).
- Many soy sauces and marinades have added sugars and sodium which alter the nutritional content of chicken meat when used.
- Avoiding the addition of extra fat or oil when cooking meat will reduce the overall fat content.
- Roasting meat on a metal rack above a roasting tin will result in the fat running off.

Further cooking and processing of chicken can increase the sodium content of dishes as well as the fat and overall energy content (89). Therefore an emphasis should be placed on the importance of reading the labels of commercially processed foods.

4.2.2.1 Nutritional composition of chicken as part of composite dishes

Composite meals that contain meat are mostly pasta dishes (e.g. Chicken Milano, Chicken Alfredo), stews, burger sandwiches (i.e. in a bun) and rice dishes (e.g. curry, stir-fry and sweet and sour).

In ROI, according to the results from the 2001 North South Ireland Food Consumption Survey (NSIFCS), intake of poultrymeat via composite dishes is roughly 34 g/day for both men and women. This contributes to approximately 39% of all poultrymeat intake in ROI (89). The study found that the contribution of composite foods to total meat intake is significantly higher in women than men and results indicated that women consumed poultrymeat as part of a composite meal more often, and in younger age groups, than men (89). Information regarding consumption of poultrymeat via

composite dishes is not yet available from the most recent (2011) ROI National Adult Nutrition Study (NANS) and there is limited information regarding consumption of composite dishes in NI.

Table 4.6 outlines the nutritional composition of popular composite chicken dishes. Marinated chicken wings are the highest in total and saturated fat, having approximately 16.6g fat, 4.6g saturated fat and 274kcal per 100g portion. The healthiest option is 'Chicken Chasseur' as it is the lowest in overall fat (4.1g), saturated fat (1.0g), energy (97kcal) and sodium (208mg) content per 100g serving (85).

Composite dishes containing chicken can contribute positively to the diet depending on the added ingredients and the cooking method used. It has been previously shown that, on IOI, composite meat dishes make a major contribution to vegetable intakes (90).

Table 4.6 The nutritional composition of composite chicken dishes per 100g (85).

Type of chicken dish	Energy (kcal)	Protein (g)	Fat (g)	Saturated Fat (g)	Iron (mg)	Sodium (mg)
Chicken chasseur	97	12.8	4.1	1.0	0.64	208
Chicken chow mein, <i>takeaway</i>	147	8.5	7.2	1.2	1.01	466
Chicken curry, <i>average, takeaway</i>	145	11.7	9.8	2.9	2.32	356
<i>Chilled/frozen, reheated, with rice</i>	137	7.6	5.0	2.2	N	250
Chicken curry, <i>made with canned curry sauce</i>	150	18.7	6.5	N	1.2	663
Chicken satay	191	21.7	10.3	3.0	1.0	613
Chicken tandoori, <i>chilled, reheated</i>	214	27.4	10.8	3.3	1.8	590
Chicken tikka masala, <i>retail</i>	157	12.9	10.6	3.6	1.2	424
Chicken wings, <i>marinated, chilled/frozen, reheated</i>	274	27.4	16.6	4.6	1.3	390
Chicken, <i>stir-fried with rice and vegetables, frozen, reheated</i>	132	6.5	4.6	N	1.1	410
Sweet and sour chicken, <i>takeaway</i>	194	7.6	10.0	1.3	2.4	259

4.3 Current consumption patterns

4.3.1 Consumption based on market data

Poultrymeat has become a mass consumer product throughout the world with the highest consumption rates recorded in industrialised western countries (91). It is now the second highest consumed meat in the European Union after pork (91). Individual consumption levels vary widely within Europe (92). The ROI is the highest consumer of poultrymeat in the European Union (92). The culinary versatility of poultrymeat, particularly chicken, together with its perception as a healthy meat option and low retail prices has, in recent times, driven the increased consumption of poultry in

the Western diet (93). It is predicted that consumption of animal products could rise by a further 44% by 2030, with the biggest contribution coming from poultry (94).

4.3.2 Consumption based on dietary surveys

4.3.2.1 Adults

This review refers to the key food consumption and nutrition surveys conducted across IOI over the past 10 years including:

Survey	Description of survey
North South Ireland Food Consumption Survey (NSIFCS)	Conducted during 1997-1999 throughout IOI and published in 2001.
National Diet and Nutrition Survey (NDNS)	Conducted during 2008-2009 across all 4 countries in the UK. Only a small sample of this study population came from NI, therefore consumption patterns must be considered with caution as they may not be representative of the actual NI population.
National Adult Nutrition Survey (NANS)	Conducted during 2008-2010 across ROI and published in 2011.

Results from both the NSIFCS and NANS suggest that poultrymeat (including chicken) is the second most common type of meat consumed by the adult population after bacon and ham (95-96). These results also show that there has been a fall in the percentage of the population consuming meats over the past 10 years. However, despite this decrease, there has been an increase in the amount consumed per day, jumping from 31g/ day in 2001 to 51g/day in 2011 in 18-64 year olds. (99,100). Similar results were found when assessing intakes of poultry dishes. It was found that the percentage of consumers eating poultry dishes has decreased from 35% to 29% but again the average amount consumed per day has increased from 60 grams to 87 grams (95-96).

In 2008/2009, the UK NDNS found that chicken and turkey dishes have the highest percentage of consumers over a four-day period, followed by beef and veal dishes, bacon and ham, and sausages, the order varying with age group (97). In men aged 19-64 years average consumption of chicken and turkey dishes is 65g per day and for women average consumption is 52g per day. Sixty seven percent and 65% eat chicken and turkey among male and female consumers respectively.

Consumption of chicken on the IOI is higher in younger than in other age groups. Data from NANS indicates that, among consumers, the average intake of chicken, turkey and game is roughly 51 grams per day in the 18-64 year age group and 46 grams per day in those aged 65 years and older (96) (Table 4.7). Similarly, the 2007 National Survey of Lifestyles Attitudes and Nutrition (SLÁN) in ROI reported that younger individuals consume significantly more servings of poultry ($p < 0.001$) (98). This observation was also noted in the NSIFCS study. Data from NDNS surveys indicate that the average intake of chicken and turkey is 58 and 37 grams per day in the 18 to 64 year age group and for those aged 65 years and older respectively (99).

Table 4.7 Mean and SD values of food group intakes (g/day) for 18-64 year olds and those aged 65 and older, in consumers only (96).

Type of meat	18-64 y (n=1274) Mean	SD	% of the population who are consumers	≥65 y (n=226) Mean	SD	% of the population who are consumers
Bacon and ham	28	25	73	30	24	73
Beef and veal	49	32	38	44	29	36
Lamb	40	23	11	40	26	25
Pork	36	20	16	46	33	19
Chicken turkey & game	51	37	58	46	27	49

Women tend to eat white meat (i.e chicken and turkey) more often and in larger quantities than men (89, 97, 99). Results from a ROI study, using data from the NCIFCS, indicate that 77% of men and 81% of women eat white meat (100). Similarly, sex-specific data from the NSIFCS survey revealed that females consume more chicken on average in comparison to males. It was reported that males consume 41.3g per day of poultrymeat with both beef, and bacon and ham consumed in larger amounts daily. In contrast, poultrymeat represents the highest contribution to the total intake of meat for females (32.4g/d, 31.9% of total daily meat intake) (89). Data from the NDNS indicate that women over the age of 65 consume more chicken and turkey than men of the same age (97).

The NSIFCS survey reveals that individuals with manual skilled occupations consume significantly more meat than those in other occupations and that individuals with no formal educational qualifications have significantly higher intakes of bacon and ham, beef, lamb and offal, and significantly lower intakes of poultry, than individuals with third-level qualifications (89, 100). This information is not currently available from either the NANS or the most recent NDNS report.

Results from the NI University Student Food Attitudes and Behaviour Survey indicate that the majority (68%) of students eat meals prepared from raw fresh chicken (101). Most students who live with their families (75%) said they regularly eat food prepared from fresh chicken compared with those who live alone (31%) or with other people (68%) (Table 4.8).

Table 4.8 Types of food eaten regularly by type of accommodation in the University Student Food Attitudes and Behaviour Survey (101) (% Saying 'Yes').

Type of chicken meat	With family	Alone	With other students, friends or professionals	University accommodation	All
Meals using fresh fish	22	31	13	9	16
Meals using fresh chicken	75	63	68	57	68
Meals using other fresh meat	63	62	48	42	52

4.3.2.2 Children and adolescents

In ROI the intake of chicken, turkey and game among children aged 5-12 years old is considerably lower than in adults. On average 12 grams are consumed per day (102). Among teenagers aged 13-17 years the average intake is 25 grams per day (103). The NI 'Eating for Health' survey of eating habits among children and young people revealed that children are more likely to eat white meat than red meat but eat it less frequently. Just over a quarter (28%) of children surveyed eat white meat on most days but the majority eat it once or twice a week (66%) (99).

4.3.3 Contribution of chicken to nutrient intakes

Chicken is an excellent source of protein in the diet. A small portion (100g) of grilled chicken, without skin, provides approximately 60% of the recommended daily allowance (RDA) of protein for men and 70% of the RDA for women or 40% and 50% of the guideline daily amount (GDA) for men and women respectively.

From a micronutrient point of view, chicken is a source of a range of vitamins, minerals and trace elements. Data from the NCIFCS shows the contribution of chicken to the micronutrient intakes of adults on IOI. It indicates that chicken is a good contributor of niacin and Vitamin B₅ but a relatively poor contributor to iron intake in the diets of men and women (Table 4.9).

Table 4.9 Percentage contribution of chicken to mean daily nutrient intakes in Irish men and women (104)

Nutrients (%)	Men	Women			
	n = 366	Mean	SD	Mean	SD
Macro					
Energy		2.1	2	2.4	2
Protein		7.7	5	9.1	6
Total fat		2.2	2	2.3	2
Saturated Fat		1.6	2	1.7	2
Monounsaturated Fat		2.5	3	2.5	2
Polyunsaturated Fat		2.2	2	2.0	2
Micro					
Sodium		1.5	2	1.7	2
Potassium		3.0	2	3.5	2
Phosphorous		4.3	3	4.9	3
Iron		1.8	2	1.9	2
Copper		2.8	2	2.9	2
Zinc		3.3	3	3.5	3
Total Vitamin A		1.2	2	1.4	3
Vitamin D		2.4	3	2.5	3
Thiamin		1.4	1	1.6	2
Riboflavin		2.9	2	2.9	3
Niacin		10.0	7	11.9	8
Vitamin B6		4.0	3	4.8	4
Vitamin B12		1.3	3	1.5	3
Panthenic Acid		5.7	4	6.3	5

Higher white meat intake has been previously associated with significantly lower intakes of white bread, potatoes and red meat in men ($P < 0.01$), and lower intakes of cheese, butter and red meat in women ($P < 0.01$) (100). Similarly, earlier analysis from the NSIFCS found that high consumers of chicken, and particularly men, tend to have a significantly lower intake of carbohydrates (105). Evidence from the survey suggests that 77% of adults on IOI are not meeting the population goal of non-starch polysaccharides, including fibre, of 18g/day, and of those adults, 37% fail to meet the minimum 12g/day (105). It is important from a public health perspective that we communicate the intake of any given food in the context of the overall diet and that emphasis is placed on foods such as breads, cereals and potatoes, and fruits and vegetables that accompany chicken in a meal.

4.4 Chicken and health

As previously outlined, chicken meat is the second most common type of meat consumed by the adult population on IOI and, in comparison to other meats, its benefits as a 'healthy food' are often promoted. It is a food which is low in fat and high in protein.

4.4.1 Chicken and iron status

Iron has a fundamental role in the body in the transportation of oxygen to various organs. Iron-deficiency anaemia is associated with an increased proportion of maternal deaths; higher incidence of low birth weight; and intrauterine malnutrition (106). In children it is associated with impaired psychomotor development, impaired intellectual performance and changes in the child's behaviour. At an individual level it is associated with increased infections and increased fatigue and thus reduced work capacity. Dietary iron intakes on IOI are low among a significant proportion of the population, especially in children and women of child bearing age (107-108). The richest source of bioavailable haem iron in the diet is meat, particularly liver and red meat.

Dietary intake is the single most important factor determining the risk of developing iron deficiency anaemia. While chicken can be considered a highly nutritious food, compared with other meats such as beef, it is relatively low in iron (100g raw chicken meat contains 0.57mg iron while 100g raw beef contains 2.7mg) (85). SLÁN estimates that 20% of the population fail to meet the 2 servings per day of meat, fish, eggs and alternatives, as recommended by nutrition guidelines in ROI, thus increasing the potential for a decrease in iron intake (98). The NSIFCS indicates that as the amount of poultrymeat consumed per day increases, the amount of red meat consumed decreases and that women tend to eat more poultrymeat than beef or other red meats (89), resulting in a lower iron intake. Results generated from the NSIFCS also indicate that over 50% of women in the 18-35 year age group, and 45% of women aged 36-50 years, have mean daily intakes of iron below the average requirement for

menstruating women (108). In contrast to this, the survey indicated that 40% of the population were consuming in excess of the recommended 140g meat per day. This emphasises the importance of a balance of different types of food in the diet and also the relevance of appropriate portion sizes.

4.4.2 Chicken and cancer

Dietary patterns that include red meat and processed meat have been shown to be associated with an overall increased risk of diseases including cardiovascular disease (109-111), colon cancer (112), oesophageal cancer (113) and type 2 diabetes (114), compared with dietary patterns including poultry. In some cases white meat has even been found to be protective against colon cancer (115-116).

A report in the Journal of Cancer Research revealed that the mutagenic and carcinogenic compounds heterocyclic aromatic amines (HAAs) are found in meats cooked at high temperatures. The study suggests that people who consume chicken that has been cooked by roasting/baking, stewing/braising, or deep frying receive little HAA PhIP exposure, while those who consume chicken cooked by pan-frying, oven-broiling, and grilling/barbecuing may have substantial exposure (117)

4.5 Conclusions

More and more attention is being paid to the effects of diet on our health and well-being. Meat products, in particular poultrymeat, represent an important part of our diet as white meat, including chicken meat, has become the meat of choice for many people living in the West.

The benefits of chicken meat are often promoted, particularly for those who wish to follow a healthy, low-fat diet. Significantly, chicken meat has a lower total fat content and, more importantly, has a higher percentage of this total fat as monounsaturated and polyunsaturated fatty acid content than any other meat. The quantity of fat in chicken meat differs according to the edible portion, with the breast portion having lower levels of total fat and chicken wings the highest. Chicken meat contains essential minerals, vitamins and amino acids as well as being an excellent source of protein in the diet. It has significant amounts of vitamins from group B such as thiamine, riboflavin, niacin and Vitamin B₆, although vitamin B₁₂ content is less than in other meats. In contrast to other meats chicken is relatively low in iron.

The culinary versatility of poultrymeat, particularly chicken, together with its perception as a healthy meat option and low retail prices has, in recent times, driven the increased consumption of poultry in the Western diet. It is predicted that consumption of animal products could rise by a further 44% by 2030, with the biggest contribution coming from poultry. It is readily purchased and can be a healthy addition to a nutritious diet if prepared appropriately.

5 LABELLING, LEGISLATION AND OTHER ISSUES

- 5.1 Introduction
- 5.2 Labelling
- 5.3 Animal welfare
- 5.4 Training
- 5.5 Quality assurance schemes
- 5.6 Conclusions

Key findings

- Labelling of poultrymeat is governed by EU legislation.
- Detailed regulations exist with regards to the marketing standards for poultrymeat.
- Health marking indicates that the chicken carcass has passed ante and post mortem inspection and that hygiene regulations have been complied with, however it should not be confused with country of origin.
- In July 2011 the European Parliament agreed to extend mandatory labelling regarding [country of origin](#) to fresh meat from poultry.
- EU legislation protects all animals that interact with humans and lays down specific rules for the welfare of chickens kept for meat production.
- Training on food hygiene and controls is aimed at increasing levels of expertise in food safety issues at all stages of the production, processing and distribution of chicken meat.
- Quality Assurance schemes guarantee that the chicken has come from farms and processors that comply with certain hygiene and welfare standards.

5.1 Introduction

This chapter examines issues which, though not food safety issues *per se*, were cited as concerns from a consumer perspective and are therefore necessary to address. It also covers other aspects of the food safety continuum, such as training, which are at the core of ensuring food safety.

5.2 Labelling

Labelling allows consumers to make informed decisions about the food they buy and also builds confidence in products. The labelling of chicken products is governed by Council Directive 2000/13/EC as amended on the Labelling, Presentation and Advertising of Foodstuffs, and by Commission Regulation 1234/2007/EC as amended, on Establishing a Common Organisation of Agricultural Markets and on Specific Provisions for Certain Agricultural Products. Commission Regulation 543/2008/EC, as corrected, lays down detailed rules for the application of Council Regulation 1234/2007/EC as regards the marketing standards for poultrymeat.

5.2.1 General food labelling requirements

Council Directive 2000/13/EC as amended sets out general provisions on the labelling of pre-packaged foodstuffs to be delivered to the ultimate consumer. Sale of loose/over the counter, non-pre-packaged food (when it is packaged on the premises from where it is sold) is governed by Article 14 of Directive 2000/13/EC. It permits individual MS to decide what labelling information needs to be shown, and how it should be displayed, subject to the condition that the consumer still receives sufficient information. The only requirement for foods sold loose specified on IOI is that the name of the product must be given.

Directive 2000/13/EC is implemented in ROI by the European Communities (Labelling, Presentation and Advertising of Foodstuffs) Regulations 2002 (S.I. No. 483 of 2002) and in NI by the Food Labelling Regulations (Northern Ireland) 1996 (SR NI 1996 No. 383), as amended. Enforcement of this legislation lies with the FSAI in ROI and the District Councils in NI.

5.2.2 Specific meat labelling requirements

Commission Directive 2001/101/EC, an amendment to the General Labelling Directive, sets out specific rules regarding the labelling of meat. This Directive only applies to the labelling of products which

contain meat as an ingredient and does not apply to the labelling of meat cuts and anatomical parts, which are sold without further processing. The latter, such as offal, including the heart, intestine and liver, have to be labelled as such and not as 'meat.'

Mechanically recovered meat (MRM) is not covered by the definition of meat and therefore must be designated as MRM and by the name of the species. However, there is provision for a certain part of the fat and connective tissue content, where it adheres to the muscles, to be treated as meat, subject to maximum limits laid down in the definition. The Directive also provides for the systematic indication of the species from which the meat comes so that, for example, 'chicken meat' is distinguished from 'pig meat.'

In ROI there is no legislation in place that stipulates the compositional standard of processed chicken products (i.e. in order for it to be called 'chicken' e.g. chicken burger, chicken nugget). The only requirement is that the chicken is 'quided,' (QUID: Quantitative Ingredient Declaration), meaning that the percentage of chicken in the product is stated in the ingredient listing if mentioned in the name of the product. Pictorial representation or graphics that selectively emphasise certain ingredients may also trigger this requirement. In NI this is also generally the case; however chicken burgers are defined in the Meat Products Regulations (NI) 2004. The FSAI has issued a guidance note on Directive 2001/101/EC (118) so has FSA NI (119).

5.2.3 Specific poultrymeat labelling requirements

Commission Regulation (EC) No 543/2008 lays down detailed rules for the application of Council Regulation (EC) 1234/2007 regarding the marketing standards for poultrymeat. These Regulations apply to fresh, chilled or frozen whole carcasses, parts and offal of poultry, and relate to the grading by quality (Class 'A' or 'B'), weight classification, packaging/presentation (including labelling), water content, storage (including temperature control), and Special Marketing Term criteria. The latter specify the criteria which must be met before certain claims about types of farming can be made, e.g. 'Fed with% of,', 'Extensive indoor' ('Barn reared'), 'Free range', 'Traditional free range' and 'Free-range-total freedom.'

The Regulations do not apply to poultrymeat preparations e.g. chicken nuggets, chicken burgers, chicken sausages or delayed eviscerated poultry as referred to in [Regulation \(EC\) No 853/2004](#), for example New York Dressed (NYD). Other exemptions include the direct supply of small quantities of

poultrymeat by a producer with an annual production of under 10,000 birds or poultrymeat intended for export from the EC.

Poultrymeat marketed in the EU must be graded for quality and weight and marketed, packed, labelled, transported and presented for sale in accordance with the requirements of the Regulations. In addition to complying with the labelling requirements of [Directive 2000/13/EC](#), prepackaged poultrymeat intended for the final consumer must comply with additional requirements set out in [Commission Regulation \(EC\) No 543/2008](#). In the case of fresh poultrymeat, the date of minimum durability is replaced by the 'use by' date in accordance with Article 10 of [Directive 2000/13/EC](#).

The declaration of added water in food, including poultrymeat, is covered by the General Food Labelling Regulation, stating that when added water exceeds 5% of the finished product it must be listed in order of weight in the finished product. Water added during the preparation of frozen or quick-frozen chicken carcasses is governed by the Marketing Regulations. Frozen and quick-frozen whole chickens may only be marketed within MS if the water content does not exceed technically unavoidable values. If the added water level exceeds these limits then the competent authority may allow the batch to be marketed, providing it carries a declaration of same, i.e. 'Water content exceeds EC limit.' Different methods of chilling used in basic processing will result in different amounts of water being incorporated into the chicken carcass, ranging from 2% to 7%. Within this piece of legislation, each method has an associated limit for the maximum amount of water permissible. The slaughterhouse is required to carry out regular checks to determine water content, and enforcement authorities are also required to carry out sampling checks.

Council Regulation (EC) 1234/2007 states that the labelling of prepackaged, unprocessed poultrymeat must indicate the following particulars: the class; price per weight unit; condition (fresh, frozen or quick-frozen); recommended storage temperature; approval number of slaughterhouse/cutting plant (except in the case of cutting and boning at the place of sale); and country of origin if imported from a Third Country. In NI, this Regulation extends the application of the aforementioned Article 14 of Directive 2000/13/EC in relation to the labelling of non-prepackaged unprocessed poultrymeat (i.e. sold loose), which effectively means that the latter may not contain all of the above particulars at the point of sale. In 2004 in ROI legislation was introduced (SI No. 50 of 2004) which requires that the labelling provisions for non-prepackaged, unprocessed poultrymeat are extended to those for prepackaged, unprocessed poultrymeat.

For frozen chicken breast fillets sold to wholesalers or caterers and not directly to the ultimate consumer, a derogation allows for some labelling information to be carried on the accompanying commercial documentation rather than on the label. All other information listed above must appear on the pre-packaging label. Since the 1st May 2010, as referred to in [Regulation \(EC\) No 1047/2009](#), poultrymeat and poultrymeat preparations may only be marketed in one of the following conditions; fresh, frozen or quick frozen. Therefore, poultrymeat which has been frozen or quick-frozen must be sold in that state, or be used in preparations marketed as frozen or quick-frozen, or in meat products.

Enforcement of the Poultrymeat Marketing Regulations lies with the FSAI in ROI and with DARD in NI. The [Poultrymeat \(England\) Regulations 2011](#) came into force in March 2011. The Regulations transpose Council Regulation (EC) No. 1234/07 and Commission Regulation (EC) No. 543/08 in England. Similar but separate legislation will be introduced in Northern Ireland in late 2011. In ROI, SI 328/2010 European Communities (Marketing Standards for Poultrymeat) Regulations 2010 implements Commission Regulation (EC) 543/2008 laying down detailed rules for the application of Council Regulation (EC) No 1234/2007.

5.2.4 Health marking

EU (Council Directive 92/116/EEC on Health Problems Affecting Trade in Fresh Poultrymeat) and national legislation require that unprocessed poultry should bear a health mark. This enables an enforcement officer to identify the factory in which the product was packaged. All such factories which meet the specified hygiene requirements and are licensed, are allocated a code number which is part of the health mark along with the code of the particular country. A health mark indicates that the carcass has passed ante and post mortem inspection and that hygiene regulations have been complied with. Health marking is carried out under Veterinary Inspectorate staff in the slaughter/processing plant. Processed poultry products, as part of the controls on foods of animal origin, are also required to have a 'health mark' on their label.

Health marking is an important element of any traceability system; however, it should not be confused with, or related to, country of origin, as is often the case. A product produced in one country can be exported to another country, where it is repackaged and relabelled, and can bear the health mark of the factory in which the latter took place.

5.2.5 Country of origin

With the exception of a number of primary foodstuffs, e.g. beef, there is no compulsory requirement to declare origin of food sold over the counter under EU food law. However, under the General Labelling Directive (2000/13/EC), the place of origin of the foodstuff must be given 'only if its absence might mislead the consumer to a material degree.'

When two or more countries are involved in the production of a good, its origin must be determined in accordance with Article 24 of Council Regulation No. 2913, establishing the Communities Customs Code which states: 'Goods whose production involved more than one country shall be deemed to originate in the country where they underwent their last, substantial, economically justified processing or working in an undertaking equipped for that purpose and resulting in the manufacture of a new product or representing an important stage of manufacture.'. This means that a product whose main ingredients have been sourced outside of IOI can be described as being a product of IOI when it is processed within IOI.

Substantial transformation can result in the consumer being easily misled about the true origin of a product, or given a false impression that the product originated elsewhere than where its main ingredients were sourced. This is a term used in Codex Alimentarius for which there is neither clear legislation nor any agreed definition, although there is a draft definition awaiting EU approval.

Labelling issues, however, are no longer just about country of origin but also about how, where, and when, poultrymeat was grown and processed. This issue has been addressed in ROI in relation to Beef Labelling Implementing Regulation (EC) No. 1760/2000. In July 2011 it was agreed that this legislation will be extended to include fresh meat from pigs, sheep, goats and poultry. The new rules will also allow producers to provide further information on the origin of their products according to specific criteria.

The FSA has issued a guidance note on Origin Labelling (120).

5.2.6 Nutrition labelling

The nutrition labelling of foodstuffs is governed by Council Directive 90/496/EEC, as amended by Commission Directives [2003/120/EC](#) and [2008/100/EC](#). This piece of legislation states that nutrition labelling is compulsory when a nutrition claim is made. In this instance, and in other instances where

nutrition labelling is provided voluntarily, the information given must consist of one of two formats - group one (the 'Big Four') or group two (the 'Big Eight'). Group one consists of energy value, protein, carbohydrate and fat; while group two consists of the latter four plus sugars, saturates, fibre and sodium. Nutrition labelling may also include starch, polyols, mono-unsaturates, polyunsaturates, cholesterol and any minerals or vitamins that are listed in the legislation. Nutrition information must be given 'per 100g/ml.' It may also be given 'per serving size,' provided that the serving size is also stated.

This piece of legislation applies to prepackaged foodstuffs to be delivered to the ultimate consumer and also foodstuffs intended for supply to 'mass caterers' i.e. restaurants, hospitals, canteens, and so on. It does not however apply to non-prepackaged foodstuffs packed at the point of sale at the request of the purchaser or prepackaged with a view to immediate sale.

5.2.7 Labelling of organic chicken

Organic production methods may be included in the labelling of products, where the appropriate requirements are met, but are not covered within the Poultrymeat Marketing Regulations. In June 2007 Council Regulation (EC) No 834/2007 on Organic Production and Labelling of Organic Products was published and it came into force on January 1, 2009. Commission Regulation (EC) No 889/2008 lays down detailed rules for the implementation of Council Regulation (EC) No 834/2007 with regard to organic production, labelling and control.

The European Commission has issued a European wide organic food label, which has been mandatory throughout the EU since July 2010. Packaged organic food must indicate the name and/or code number of the organic certification body. Organic products imported from Third Countries must be produced in conformity to EU standards.

5.2.8 Re-labelling

The practice of re-labelling to change the 'use by' date is not illegal if undertaken by the person originally responsible for setting this date, is within the recognised shelf life of the product, and is done safely and lawfully in the interest of public health.

In 2010 the Food Safety Authority of Ireland (FSAI) issued the results of a survey into the microbiological quality of raw chicken fillets distributed to butchers in gas flushed bulk packs and sold loose to the consumer. The survey found that the majority of butchers (92%) stored chicken

fillets at the recommended temperature of 5°C or cooler, however 8% did not provide a 'use-by' date as required by law and 23% provided a 'use-by' date for which they had no basis. Furthermore, at least 23% of butchers provided a 'use-by' date that was unrealistically long for the product to remain unspoiled in the consumer's fridge. The FSAI has issued a factsheet giving guidance on best practice for opening gas flushed packs, storage temperature, and applying 'use-by' dates (121).

5.2.9 Adulteration

Adulteration involves the addition of ingredients to chicken such as water, animal protein, salt and others, without adequately informing the consumer that the product has such added ingredients. It is not illegal to process chicken fillets by adding water and other ingredients, provided that these ingredients are approved and clearly stated on the label of pre-packed products, in addition to the added water content. The percentage of meat content must also be accurately labelled. While there is no major food safety risk associated with such practices, the consumer is being misled by the inclusion of other ingredients, such as undeclared pork and bovine material, in chicken fillets.

Council Regulation (EEC) No. 1906/90 first defined poultrymeat as 'poultrymeat suitable for human consumption, which has not undergone any treatment other than cold treatment to ensure its preservation.' This definition allowed for chicken fillets with added water and other ingredients to be termed 'poultrymeat.' Council Regulation (EEC) No. 317/93 amended the latter piece of legislation to redefine poultrymeat as 'poultrymeat suitable for human consumption, which has not undergone any treatment other than cold treatment.' As a result, unfrozen chicken fillets with added water are no longer covered by the Marketing Standards for Poultrymeat (1906/90); they are, however, still controlled by the General Labelling Directive.

The issue of adulteration had its beginnings in 1996, when Thailand and Brazil began to export salted chicken meat in direct response to requests from European food companies. This meat was used in the manufacture of processed products. Until 2002 it was permissible to import salted chicken into the EU under a reduced import tariff (15.4%) covering chicken for further processing (Code 0210). In the period 1996 – 2001 EU imports of salted chicken meat from Brazil and Thailand soared from 3,000 million tonnes in 1996 to 400,000 million tonnes in 2001. In 2002 the European Parliament reclassified the products as 'salted meat' rather than 'frozen products,' subjecting the imports to a 58.9% tariff rate (Code 0207) instead of the 15.4% rate. On 30th May 2005 the World Trade

Organisation (WTO) ruled that the EU's tariffs on such imports were illegal and restrictive under the body's trade rules. In 2006 the Commission negotiated a ceiling volume of poultry at the 15.4% tariff rate with Thailand and Brazil.

On import, European processors tumble or inject defrosted imported chicken fillets with water and binding agents, such as animal proteins (derived from a variety of different sources, including gelatine, blood, whey protein, spray-dried beef and pork protein, some of which may be mechanically recovered), which help retain the water, and other ingredients, in the meat. Following processing, the chicken breasts are packed into 10 kg boxes and frozen prior to distribution throughout the EU, including ROI and NI. These fillets are then sold to wholesale catering suppliers at a lower price than normal unprocessed chicken fillets.

In butcher shops it is possible that these products could be sold directly to consumers as raw chicken breast fillets either in a frozen or unfrozen state. The cyclical freezing and defrosting of such fillets does not contravene food safety, provided that it is done in a controlled manner. The issue of 'freshness' also arises as fillets with added ingredients that have been frozen and refrozen at different stages in the food chain may be sold in establishments as 'fresh chicken' despite the definition of 'fresh' in the EC Marketing Regulations. The Food Labelling Regulations (NI) 1984 required a statement to be displayed near any meat that had been frozen but was being sold thawed, to the effect that it had been 'previously frozen, do not refreeze.'

The FSA first reported the issue of inaccurate labelling of many chicken products supplied to UK catering establishments in 2000. Follow up surveys in December 2001 and in March 2003 concluded that these practices were still occurring. The FSAI conducted surveys in 2002 and 2003 and uncovered similar findings. These surveys found that chicken fillets, which reputedly had no added water, other than technologically unavoidable water incorporated during preparation and freezing, did in fact contain added water and other ingredients in the form of animal protein.

5.3 Animal welfare

Animal welfare legislation protects all animals that interact with humans. Staff from the Veterinary Public Health Service of DAFF and the Veterinary Service of DARD monitor and enforce regulations on the welfare of animals during their regular visits to farms.

[Council Directive 2007/43/CE](#) of 2007 lays down minimum rules for the protection of chickens kept for meat production, and aims to reduce the overcrowding of chicken holdings by setting a maximum stocking density of 33kg/m², or up to 42kg/m² if stricter welfare standards are met. The poultry houses in which the chickens are kept must allow all chickens adequate access to a litter tray, a drinking channel and food. The buildings must have adequate lighting and ventilation, and should be inspected at least twice a day. Any chickens that are seriously injured or in poor health must be treated or immediately culled. Most surgical procedures performed for purposes other than medical treatment are prohibited. Holdings must be equipped with ventilation, heating and cooling systems to maintain the appropriate temperature, humidity and CO₂ and NH₃ concentrations. Furthermore, the producer must keep a detailed record of the chickens reared, the conditions in which they are kept, their state of health, the mortality rate and any medical treatments administered. The Directive also provides for the Commission to possibly introduce further measures in the future, based on the scientific data and practical evidence collected by the Member States. The final implementation date of [Council Directive 2007/43/CE](#) on the protection of broilers was 30 June 2010.

Council Regulation (EC) No [1/2005](#), as amended, on the protection of animals during transport and related operations aims to prevent injury or undue suffering to animals and to ensure that they have appropriate conditions that meet their needs. This regulation strengthens existing legislation on animal welfare during transport by identifying the parties involved and their respective responsibilities, putting in place enhanced measures on inspections and laying down stricter rules on transport. Checks must be carried out by the competent authorities at key stages of the journey, including at exit points and border inspection posts. In addition, supplementary checks may be carried out at any stage of the journey on a random or targeted basis.

Council Regulation (EC) No [1099/2009](#) of 2009 on the protection of animals at the time of killing establishes standard operating procedures, the training of personnel and the use of new equipment for the welfare of animals at slaughter. Moreover, the objective pursued by this Regulation is to provide a level playing field within the internal market for all operators.

5.4 Training

Training initiatives for staff are crucial to ensuring the production of safe food, in addition to being a legal requirement. Deficiencies in staff training can result in non-compliance with a Quality

Assurance Standard. Training is also essential due to the substantial number of foreign nationals in the workforce on IOI.

It is a legal requirement that staff who are involved in a food environment are trained and/or supervised commensurate with their work activity. The responsibility for the supervision and training of staff lies with the proprietor of the food business. From the 1st of January 2006 staff in a food business responsible for the development and maintenance of the Hazard Analysis Critical Control Point (HACCP) system must have received adequate training in the application of the HACCP principles. There is, however, no legal requirement for individuals to undergo certified training programmes.

5.4.1 On the island of Ireland

The FSAI does not provide general food safety/hygiene training courses; however, the FSAI runs two specific training courses:

- ‘Train the Trainer’ workshops for the FSAI’s ‘Food Safety and You Induction Training Programme.’ Completion of the ‘Train the Trainer’ workshop allows a member of staff to deliver the FSAI’s 3 hour induction programme on food safety for new staff in the food service industry.
- ‘Training for Management in the Chinese Food Sector’: Chinese nationals deliver this programme in Mandarin or Cantonese to Chinese food premises on behalf of the FSAI.

To assist the industry in deciding what information should be included during training for employees and management in a food business, the FSAI has published a suite of Guides to Food Safety Training. These are the first national guidelines on food safety training in Ireland and detail the food safety skills that food handlers and non-food handlers should be able to demonstrate at various stages in the workplace:

[Guide to Food Safety Training Level 1 and Level 2](#)

- Level 1 provides information on basic food safety skills to be demonstrated within the first month of employment.
- Level 2 provides information on the additional food safety skills that staff should be able to demonstrate within 3-12 months of commencing employment in a food business.

Guide to Food Safety Training Level 3

- Level 3 food safety skills for management are the food safety skills to be demonstrated by managers and supervisors in food operations.

In NI the FSA recommends three levels of training: foundation, intermediate, and advanced. FSA does not provide a database of training providers in NI but recommends three professional bodies for food safety training: the Chartered Institute of Environmental Health (CIEH), the Royal Institute of Public Health (RIPH), and the Royal Society for the Promotion of Health (RSPH).

Training is a major focal point in quality assurance schemes such as Red Tractor Assurance, Bord Bia Chicken Assurance Scheme, and also in quality standards such as British Retail Consortium, EFSIS and ISO 9000:2000.

5.4.2 At European level

'Better Training for Safer Food'(BTSF) is an initiative of the European Commission aimed at organising a Community training strategy, complementary to action taken by MS at national level. This covers the area of official controls performed to ensure compliance with food and feed law, animal health and welfare rules, and plant health rules. The aim of the initiative is to ensure a high level of training of staff of the Competent Authorities of MS involved in official control activities. Training is also available to participants from Third Countries, and in particular developing countries, to assist in their understanding of and familiarisation with EU import requirements. The Commission has recently adopted a Staff Working Document on the BTSF programme. This sets out the principal challenges which BTSF is currently facing and identifies a series of possible actions to overcome them. It sets targets for the short-medium term (up to and including 2013) and long term (from 2014). The overall aim is to increase the size, quality, impact and productivity of BTSF while generating economies of scale.

5.5 Quality assurance schemes

There are two quality assurance schemes specific to chicken produced in IOI, the Red Tractor Farm Assurance Poultry Scheme (formerly Assured Chicken Production) and the Bord Bia Chicken Quality Assurance Scheme.

5.5.1 Red Tractor Farm Assurance Poultry Scheme

Reflecting the tightly integrated nature of the chicken industry, the Red Tractor Farm Assurance standards for poultry provide an integrated assurance chain to internationally recognised standards and are applicable in respect of breeder replacement farms, breeder layer farms, broiler rearing and free-range chickens for human consumption. Red Tractor Assurance is owned by Assured Food Standards (AFS), the independent organisation that manages and promotes the Red Tractor quality mark on food packs. Specialist Certification Bodies independently verify that producers are adhering to the published standards. Red Tractor standards encompass food safety, hygiene, animal welfare and environmental protection. Certification to the Red Tractor Farm Assurance Chicken Production Standard is now a fundamental requirement of all leading poultry marketing groups, primary processors, further processors and retailers in the UK.

5.5.2 Bord Bia Chicken Quality Assurance Scheme

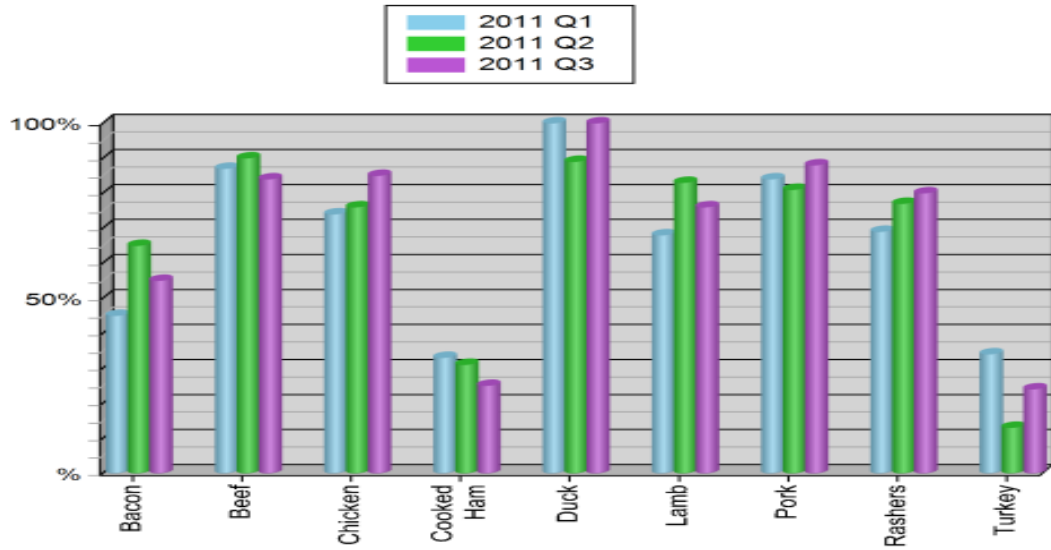
In 2004 Bord Bia introduced its Chicken Quality Assurance Scheme. This scheme involves the marketing of Quality Assured chickens and derived products through identification of approved product with a 'Country of Origin' label. The scheme was revised and accredited under EN45011 in 2008.

Control of the scheme is exercised by an independent Bord Bia Certification Committee. Membership of the scheme is voluntary and is open to all chicken producers and processors. Participating farms are independently audited for compliance, with the code of practice set out in the scheme covering key aspects of production. They include the site, housing and environment, house preparation, chicken sourcing, flock health, feed and water, flock welfare, site hygiene and biosecurity, catching and transport, health and safety on the farm, environmental protection, and also a section on free range chickens.

Processors participating in the scheme must meet certain requirements relating to a number of issues including: quality systems; animal welfare and transport; product identification and traceability; process control; inspection and testing; hygiene and good manufacturing practices; and training. The percentages of meat facings and stock-keeping units (SKUs) carrying the Bord Bia Quality Assurance Mark in ROI during the first three quarters of 2011 can be seen in figures 5.1 and 5.2.⁶

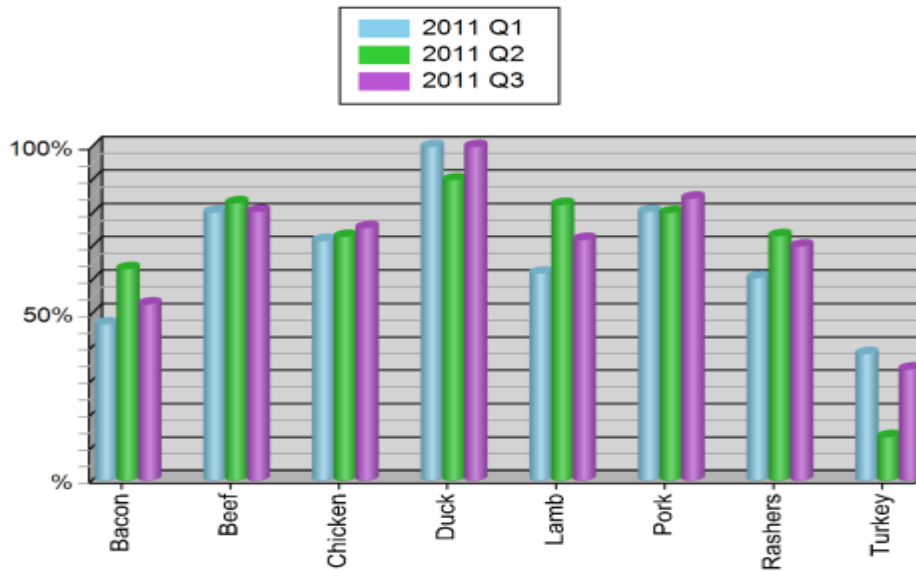
⁶ Personal communication, Bord Bia, October 2011

Figure 5.1 Percentage of facings carrying the Bord Bia Quality Assurance Mark in ROI



Chicken producers and processors outside ROI can participate in the scheme, provided that they adhere to an equivalent standard which is approved by the Bord Bia Certification Committee. In this case the label must indicate the exact country of origin of the chicken.

Figure 5.2 Percentage of stock-keeping units carrying the Bord Bia Quality Mark across retailers in ROI



The European Commission adopted the 'Quality Package' for food and agricultural products in December 2010. The Quality Package put in place for the first time a comprehensive policy on certification schemes, value-adding terms for agricultural product qualities, and product standards, covering the different facets of quality, from the compliance with minimum standards to the production of highly specific products. The Package comprises a new Agricultural Product Quality Schemes Regulation, a new general base-line Marketing Standard for all agricultural products and new guidelines of best practices on voluntary certification schemes. In addition, voluntary [guidelines on the labelling of foodstuffs using protected designations of origin \(PDOs\) or protected geographical indications \(PGIs\) as ingredients](#), directed towards operators, have been adopted.

5.6 Conclusions

Under general EU legislation, the labelling, presentation and advertising of foodstuffs must be clear, unambiguous and must not mislead the consumer to a material degree. As well as general labelling requirements set out in [Directive 2000/13/EC](#), prepackaged meat is also subject to specific requirements relating to fresh meat. Furthermore, fresh, chilled or frozen chicken carcasses must comply with the marketing standards for poultrymeat. In July 2011 the European Parliament agreed to extend mandatory labelling regarding [country of origin](#) to fresh meat from poultry, giving consumers clear and honest information about the origins of their food.

EU legislation sets out the welfare standards that must be met for the protection of chickens kept for meat production. Research has shown that consumers are becoming increasingly concerned about welfare issues relating to broiler production. Rearing birds to higher welfare standards can benefit the chicken, producer, retailer and consumer.

Good food safety and hygiene practices are an essential component of any food business in order to protect the health of consumers. It is a legal requirement that staff members involved in a food environment are trained and/or supervised, commensurate with their work activity. Staff responsible for the development and maintenance of the HACCP system in the food business must have received adequate training in the application of the HACCP principles.

Quality assurance schemes, such as the Red Tractor Farm Assurance Poultry Scheme and the Bord Bia Chicken Quality Assurance Scheme, provide the consumer with further assurance that chicken is produced to a set of standards and that the producer/processor is audited to ensure that production is in accordance with those standards.

6 SUMMARY & CONCLUSIONS

Chicken is the protein source of choice for many consumers, both from a nutritional and cost perspective.

The chicken industry is highly integrated with a small number of companies owning the majority of the market share on IOI. This integration enables the industry and the companies involved to have great control and to introduce new protocols, including food safety measures, with efficiency. High costs and increasing imports from other EU and Third Countries have placed extra economic pressures on the indigenous industry, forcing the closure of some processing companies and redundancies in others.

While the chicken industry must contend with the growing level of imports, it must also concern itself with other challenges such as the human and economic significance of *Campylobacter*. Evidence indicates that chicken is the single most significant carrier of food poisoning micro-organisms causing illness in humans. According to EFSA, the handling, preparation and consumption of chicken meat may account for 20% to 30% of human campylobacteriosis cases, while 50% to 80% may be attributed to the chicken reservoir as a whole. The risk of illness through the contamination of chicken with *Campylobacter* should be a concern for all parties from farm to fork.

Evidence suggests that the Irish consumer is significantly exposed to *Campylobacter* species from broiler chickens. An EFSA baseline survey carried out in the EU during 2008 found that, in ROI, the prevalence of *Campylobacter* in broiler batches was 83.1% and in carcasses was 98.3%. In the UK the prevalence of *Campylobacter* in broiler batches was 75.3% and in carcasses was 86.3%.

While excellent efforts have been made throughout the chicken food chain in controlling *Salmonella* spp., particularly through the heat treatment of feed and on-going surveillance, the control of *Campylobacter* spp. presents a different set of challenges.

At farm level, there appears to be a relationship between aspects of bird husbandry and *Campylobacter* infection. In general terms, two strategies for the control of *Campylobacter* can be identified: preventing the entry of the bacterium into the flock and improving the resistance of the birds to colonisation. At the moment there are no viable alternatives to proper and sustained biosecurity. Once *Campylobacter* has infected at farm level there is limited scope for further control efforts through subsequent stages in production and the supply chain.

Both the FSA and FSAI have recognised the significance of *Campylobacter*, and are currently implementing strategies to reduce the level of infection along the food chain. The FSA proposes to reduce the level of *Campylobacter* in UK produced chickens on retail sale by 30% by 2015. The focus of this strategy is on the broiler farm, specifically through biosecurity measures, in addition to potential options for control at the slaughterhouse. In its 2011 Scientific Committee Report on *Campylobacter* Control the FSAI made several recommendations relating to partial depopulation, risk management and good hygiene practices.

Both qualitative and quantitative research conducted with consumers indicates that, alongside food safety, the other issue that consumers considered to be of importance was labelling, and specifically country of origin.

The issue of country of origin is contentious. Statistics from 2010 indicate that 85,000 tonnes of poultrymeat was imported into ROI (figures from NI unavailable), and this is expected to increase substantially in the future. The growth in imports is sustained by the increase in demand on IOI for chicken, outstripping indigenous production, and the preference of consumers for white chicken meat.

Consumers tend to identify country of origin with food safety, in the belief that locally produced chicken is safer than imported.

To assuage consumer concerns with regard to imported poultrymeat from Third Countries, it is important to recognise the role of the EU Food and Veterinary Office and Border Inspection Posts in the food chain. However, currently the frequency of sampling is still relatively low, suggesting that

the opportunity may exist for non-compliant food to enter the food chain. In 2008 the FVO highlighted a number of deficiencies in the operation and management of BIPs.

From an industry perspective the main concern with regard to country of origin is economic. Production costs in Third Countries are significantly lower than on IOI, and the long-term concern is that the lower unit cost of chicken emanating from these countries will force prices down overall, and have major repercussions for the IOI industry.

Approximately 90% of all chicken meat used in the catering industry is sourced from Third Countries; much of this imported as cooked meat from Thailand. Thus, while consumers give much time and effort to ensuring that they purchase IOI chicken from their retailer, there is no information provided to them (or onus put on the caterer to provide it) of the source of the chicken that they may eat in their sandwich or in a restaurant. This is compounded by the lack of labelling requirements at the catering stage of the food chain.

Substantial transformation is an issue of concern to consumers. Regulatory bodies consider this is a Customs issue and not a food safety one. Consumers do not understand this contentious trade issue and may be confused with regard to the country of origin of the chicken they purchase.

From an international trading perspective, country of origin is seen as a barrier to trade and not widely endorsed.

6.1 Conclusions

6.1.1 At farm level

- Much effort has been made in ensuring that the grandparent stock and their offspring are disease free. The industry has also been proactive in identifying the potential risks to its business and the safety of the food chain. However, there remain a number of critical issues.
- Biosecurity on farms is at the cornerstone of food safety along the food chain. The cessation of the practice of thinning may be a prudent step towards minimising the risks of *Campylobacter* at farm level. However, many flocks are colonised before this partial depopulation step takes place and therefore other interventions are required. Standard biosecurity measures have not, so far,

been very successful at reducing *Campylobacter* colonisation of chickens on IOI and control strategies are now focussing on reducing the concentration of *Campylobacter* on chicken carcasses.

- The heat treatment of feed has been shown to be an effective step in the control of *Salmonella* and levels of animal infection and human salmonellosis have been on the decrease in recent years. There is merit in the introduction of mandatory heat treatment in NI. Best practice evidence from countries such as Denmark and Sweden suggest that the decrease in human salmonellosis is the direct result of the control programmes put in place at farm level.
- Surveillance of both *Campylobacter* and *Salmonella* is essential in the control of these micro-organisms.
- The issue of the GM status of feed is of concern to producers, particularly those involved in organic chicken production. This is also an area where the consumer is often provided with very little information.

6.1.2 Transport from farm to slaughterhouse

- The high integration of the industry on IOI means that most slaughterhouses are within close proximity of broiler farms. However, this remains a stressful process for the birds, leading to a potentially high cross-contamination situation. Evidence suggests that current washing procedures used for crates are not adequate in removing pathogenic micro-organisms. This is a step which could improve the microbiological load of animals entering the processing plants, and efforts would be well spent trying to reduce potential contamination.

6.1.3 Primary processing

- The processing industry is highly efficient. In modern processing plants the time that it takes from when the chicken is stunned and slaughtered, to the time that chicken meat is packed and placed in storage for distribution, can be less than 2 hours.
- In an ideal world, pathogen free chickens should be presented for slaughter. However the reality is somewhat different, and the processing environment is highly susceptible to cross-contamination from infected birds.
- Even when steps are taken to reduce the pathogenic load of chickens coming from broiler farms, protocols within the processing plant can undo this. The slaughtering and processing of organic

chickens, (where there may be potentially higher *Campylobacter* levels),without subsequent decontamination of the line poses a potentially serious risk of cross-contamination within the plant. This area warrants further investigation.

- The acceptability amongst consumers of the use of antimicrobial procedures, such as irradiation, should be investigated.
- The importance of HACCP and training within the processing environment is critical to the successful containment and eventual elimination of potentially pathogenic micro-organisms.

6.1.4 Retail and catering

- The retailer and caterer represent the front line of the food industry to consumers. Therefore both sectors must do all within their powers to take the appropriate steps in ensuring food safety.
- As with the processing industry, HACCP and training are at the core of good food safety practice. The influx of non-nationals into IOI, and their uptake in large numbers of employment within the food sector, has put even more emphasis on the need for training, including in their native languages. The FSA and FSAI, and some members of the food sector, are to be commended for their proactive work in this respect.
- Surveillance of chicken and chicken products within the sectors over recent years has indicated that the levels of *Salmonella* positive samples are declining, while the numbers of *Campylobacter* positive samples has remained static. There is little that the catering and retail sectors can do once presented with raw chicken which is positive for pathogenic micro-organisms, other than ensure that all steps are taken to prevent cross-contamination and that foods are properly cooked.
- Current legislation states that all raw poultrymeat for sale at retail level must be labelled to include information in respect of class, price per weight, country of origin, etc. In butchers' shops and butcher counters in ROI, where loose produce is sold, this information must also be made available to the consumer. Anecdotal evidence suggests that this information is not always available. In NI the only requirement for poultrymeat sold loose is that the name of the product is displayed.
- There is currently no legislative onus on caterers to label their produce. Approximately 90% of all chicken meat used in the catering trade is sourced from Third Countries. Consumers have identified country of origin as a major concern. The lack of information emanating from the catering sector on this and other information with respect to the product, such as ingredient

listing and nutrition information, serves only to prohibit consumers from making informed choices.

- There is an onus on the industry and enforcement agencies to ensure not only that meat coming from Third Countries is safe, but also that the consumer is not misled about the source of this meat through loopholes in the system, such as substantial transformation.

6.1.5 In the home

- The consumer may be described as an important link in the chicken food chain. All other steps in the chain are regulated by legislation and industry codes of practice and are monitored and audited on a regular basis.
- Consumers should be advised about the correct handling, storage and preparation of foods. This extends to steps taken to eliminate the potential risk of cross-contamination from raw to ready-to-eat foods. This advice should include information with respect to the following points:
 - Research suggests that consumers have significant understanding and awareness of the potential levels of *Salmonella* in chicken and its consequences. An education campaign should be undertaken to raise consumer awareness of *Campylobacter*.
 - Research has shown that packaging of chicken products can be contaminated with *Salmonella* and *Campylobacter*, so consumers should make sure that all surfaces, including hands and utensils, are cleaned to prevent cross-contamination.
 - The common practice of washing chicken breast fillets and whole chickens, identified in focus groups, should be discouraged. Such products, prepared for direct sale to consumers, are 'oven ready' and do not require further washing. Washing of such poultry creates aerosols, increasing the risk of cross-contamination.
 - The proper and adequate cooking of foods will eliminate the risk of illness from contaminated chicken. This involves cooking chicken until the food is piping hot throughout, ensuring that there is no pink meat remaining and that the juices run clear. Practices such as 'relying on taste' should be discouraged.
 - The use of food thermometers is not widespread on IOI. Consumers should be advised that they are the most reliable method to check that foods, including chicken, are cooked properly.

- All foods should be stored in a refrigerator at less than 5°C.
- Growth of pathogenic bacteria can be increased by a significant time delay in the transport of perishable foods to and/or from the home and also by incorrect storage during this time. Raw poultry should be packed in separate bags or containers away from others to avoid potential cross-contamination. The use of insulated bags or freezer bags is recommended during transportation. Food should be refrigerated, cooked or frozen, as soon as possible following purchase.
- The nutritional benefits of chicken may be compromised by the ingredients and methods employed in the manufacturing/cooking process. An emphasis should be placed on the importance of reading labels on commercially processed foods, cooking methods and the incorporation of fresh vegetables and fibre-rich starchy foods in meals prepared in the home.

6.1.6 Surveillance and controls

- The introduction of the Zoonoses Directive and the Hygiene Package has resulted in increased public health protection. To further enhance the understanding of *Campylobacter* infection detailed typing data of human isolates, as well as those from food and animals, is needed.
- In some instances little scientific significance can be drawn from surveillance data due to the low number of samples. This is both from a microbiological and toxicological perspective.

As mentioned at the beginning of this chapter, chicken is the protein source of choice for consumers. Each sector of the food chain has responsibilities in relation to food safety and must ensure these responsibilities are fulfilled. It is important that consumers are made aware of the risks associated with chicken, so that they may take the necessary preventative steps to reduce the risk of foodborne illness from this otherwise healthy commodity.

References

1. DARD NI. Statistical Review Of Northern Ireland Agriculture 2010. Belfast: Department of Agriculture and Rural Development 2011.
2. CSO. Meat Supply Balance 2010. Cork: Central Statistics Office 2011.
3. CSO. 2011; Available from: www.cso.ie.
4. TNS. 2011 [cited 2011 07/10/2011]; Available from: www.tnsglobal.com.
5. FAO. 2011; Available from: www.faostat.fao.org.
6. Pires SM, Vigre H, Makela P, Hald T. Using outbreak data for source attribution of human salmonellosis and campylobacteriosis in Europe. *Foodborne Pathog Dis*. 2010 Nov;7(11):1351-61.
7. Danis K, Di Renzi M, O'Neill W, Smyth B, McKeown P, Foley B, et al. Risk factors for sporadic *Campylobacter* infection: an all-Ireland case control study. *Eurosurveillance*, 2009;14(7).
8. HPA. Health Protection Report: *Campylobacter* now the leading cause of general food outbreaks in England and Wales. London: Health Protection Agency, 2011.
9. CSO. Population and Migration Estimates. Cork: Central Statistics Office, 2010.
10. HPSC. Annual reports on Campylobacteriosis. Dublin: Health Promotion Surveillance Centre, 2004-2009.
11. Population Statistics- 1901-2010 [database on the Internet]. Northern Ireland and Statistics Research Agency, 2011. Available from: <http://www.nisra.gov.uk/demography/default.asp3.htm>.
12. Gastrointestinal Infections in Northern Ireland - *Campylobacter* 1992 to 2009 [database on the Internet]. Public Health Agency Northern Ireland. 2010. Available from: <http://www.publichealth.hscni.net/directorate-public-health/health-protection/gastrointestinal-infections>.
13. *Campylobacter* infections reported by month in England and Wales [database on the Internet]. Health Protection Agency, 2000-2010 [cited 08/09/2011]. Available from: <http://www.hpa.org.uk/Topics/InfectiousDiseases/InfectionsAZ/Campylobacter/EpidemiologicalData/campyDataEwMonth1989to2008/>.
14. FSAI. Control of *Campylobacter* Species in the Food Chain. Dublin: Food Safety Authority Ireland, 2002.
15. ECDC. Annual epidemiology report on communicable diseases in Europe. Stockholm: European Centre for Disease Prevention and Control, 2009.

16. European Food Safety Authority. Scientific opinion of the Panel on Biological Hazards on a request from the Health and Consumer Protection, Directorate General, European Commission on Microbiological Risk Assessment in feeding stuffs for food producing animals. The EFSA Journal 2008; 720:1-84.
17. Cox NA, Berrang ME, Stern NJ, Musgrove MT. Difficulty in recovering inoculated *Campylobacter jejuni* from dry poultry-associated samples. J Food Prot. 2001; 64(2):252-4.
18. DEFRA. Code of Practice for the Prevention and Control of *Salmonella* in Chickens reared for meat on farm. London: Department for Environment, Food and Rural Affairs, 2002.
19. Assured Food Standards. Poultry Standards - Broilers & Poussin Version 2.0. Red Tractor Assurance for Farms; 2011.
20. Fonseca BB, Beletti ME, Melo RT, Mendonça EP, Vieira CU, Levenhagen MA, et al. Transfer, viability and colonisation of *Campylobacter jejuni* in the chicken vitellus and in embryos. British Poultry Science, 2011;52(3):279-86.
21. Elvers KT, Morris VK, Newell DG, Allen VM. The molecular tracking, through processing, of *Campylobacter* strains colonising broiler flocks. Appl Environ Microbiol, 2011.
22. FSA. Biosecurity for Housed Broilers - Cleaner Farms, Better Flocks. London: Food Standards Agency; 2006; Available from: <http://www.food.gov.uk/safereating/microbiology/flocks/>.
23. FSAI. Recommendations for a Practical Control Programme for *Campylobacter* in the Poultry Production and Slaughter Chain. Dublin: Food Safety Authority of Ireland, 2011.
24. European Food Safety Authority. Analysis of the baseline survey on the prevalence of *Campylobacter* in broiler batches and of *Campylobacter* and *Salmonella* on broiler carcasses in the EU, 2008, Part A: *Campylobacter* and *Salmonella* prevalence estimates. EFSA Journal. 2010;8(03):1503.
25. Patriarchi A, Fox A, Maunsell B, Fanning S, Bolton D. Molecular Characterisation and Environmental Mapping of *Campylobacter* Isolates in a subset of intensive Poultry Flocks in Ireland. Foodborne Paths and Dis. 2011;8(1):99-108.
26. Wilson DJ, Gabriel E, Leatherbarrow AJH, Cheesbrough J, Gee S, Botlen E, et al. Tracing the Source of Campylobacteriosis. PLoS Genetics. 2008;4(9):1-9.
27. Hakkinen M, Heiska H, Hanninen M-L. Prevalence of *Campylobacter* spp. in Cattle in Finland and Antimicrobial Susceptibilities of Bovine *Campylobacter jejuni* Strains. Appl Environ Microbiol, 2007;73 (10):3232-8.
28. Sopwith W, Birtles A, Matthews M, Fox A, Gee S, Painter M, et al. Identification of Potential Environmentally Adapted *Campylobacter jejuni* Strain, United Kingdom. Emerg Infect Dis. 2008;14(11).

29. Nauta M, Hill A, Rosenquist H, Brynestad S, Fetsch A, van der Logt P, et al. Review: A comparison of risk assessments on *Campylobacter* in broiler meat. *Int J of Food Microbiol*, 2009;129:107-23.
30. Ekdahl K, Normann B, Andersson Y. Could flies explain the elusive epidemiology of campylobacteriosis? *BMC Infect Dis*. 2005;5(11).
31. EFSA. Analysis of the baseline survey on the prevalence of *Campylobacter* in broiler batches and of *Campylobacter* and *Salmonella* on broiler carcasses in the EU, 2008, Part A: *Campylobacter* and *Salmonella* prevalence estimates. *EFSA Journal*, 2010;8(03):1503.
32. Madden R. Control of *Campylobacter* in poultry: Development of a Dissemination Programme for Lessons for Farmers on the Island of Ireland. Cork: **safefood**, 2009.
33. Rosenquist H, Boysen L, Galliano C, Nordentoft S, Ethelberg S, Borck B. Danish strategies to control *Campylobacter* in broilers and broiler meat: facts and effects. *Epidemiol Infect*. 2009;137:1742-50.
34. FSA, editor. *Campylobacter* reduction in chicken. International Meeting on *Campylobacter* reduction in chicken; 2010 Tuesday 30 and Wednesday 31 March, London, UK.
35. Wagenaar JA, D.J. Mevius DJ, Havelaar AH. *Campylobacter* in primary animal production and control strategies to reduce the burden of human campylobacteriosis. *Rev sci tech Off int Epiz*. 2006;25 (2):581-94.
36. Reich F, Atanassova V, Haunhorst E, Klein G. The effects of *Campylobacter* numbers in caeca on the contamination of broiler carcasses with *Campylobacter*. *Int J of Food Microbiol*. 2008;127:116-20.
37. Davies R, Breslin M, Corry JEL, Hudson W, Allen VM. Observations on the distribution and control of *Salmonella* species in two integrated broiler companies. *Veterinary Record*, 2001;149(8):227-32.
38. Bilgili SF. Slaughter quality as influenced by feed withdrawal. *World's Poultry Science Journal*, 2002;58(02):123-30.
39. Kim C, Hung Y-C, Russell SM. Efficacy of electrolysed water in the prevention and removal of fecal material attachment and its microbiocidal effectiveness during simulated industrial poultry processing. *Poultry Science*, 2005;84:1778-84.
40. Riedel CT, Brondsted L, Rosenquist H, Haxgart SN, Christensen B. Chemical decontamination of *Campylobacter jejuni* on chicken skin and meat. *J Food Protect*. 2009;72:1173-80.
41. Farkas J, Mohacsi-Farkas C. History and future of food irradiation. *Trends in Food Sci & Tech*. 2011;22:121-6.
42. Guerin MT, Sir C, Sargeant JM, Waddell L, O'Connor AM, Wills RW, et al. The change in prevalence of *Campylobacter* on chicken carcasses during processing: A systematic review. *Poult Sci*. May 1, 2010;89(5):1070-84.

43. European Food Safety Authority. Scientific Panel on Biological Hazards Opinion of the Scientific Panel on Biological Hazards on the request from the Commission related to *Campylobacter* in animals and foodstuffs. EFSA Journal, 2004;177:1-10.
44. Advisory Committee on the Microbiological Safety of Food. Second Report on *Campylobacter*. London: Food Standards Agency, 2005.
45. Corry JEL, Allen VM, Hudson WR, Breslin MF, Davies RH. Sources of *Salmonella* on broiler carcasses during transportation and processing: modes of contamination and methods of control. Journal of Applied Microbiology. 2002;92(3):424-32.
46. De Cesare A, Sheldon BW, Smith KS, Jaykus LA. Survival and Persistence of *Campylobacter* and *Salmonella* Species under Various Organic Loads on Food Contact Surfaces. Journal of Food Protection. 2003; 66(9):1587-94.
47. Madden R, Moran L, Scates P, McBride J, Kelly C. A survey to determine the presence of *Salmonella* spp. and *Campylobacter* spp. in retail packs of raw chicken purchases throughout the Republic of Ireland. Cork: **safefood**, 2010.
48. FSA. A UK survey of *Campylobacter* and *Salmonella* contamination of fresh chicken at retail sale. London: Food Standards Agency, 2009.
49. Bolton DJ. Food Safety Knowledge, Microbiology and Refrigeration Temperatures in Restaurant Kitchens on the island of Ireland. Cork: **safefood** 2006.
50. Pennington H. The Public Inquiry into the September 2005 Outbreak of *E.coli* O157 in South Wales. Cardiff: Welsh Government, 2009.
51. FSAI. Code of Practice No. 1 For the Health Service Executive on the Risk Categorisation of Food Businesses. Dublin: Food Safety Authority of Ireland, 2006.
52. FSAI. Safe Catering Pack: A user-friendly approach to HACCP. Dublin: Food safety Authority of Ireland, 2009 [updated 28/01/2011; cited 2011 09/09/2011]; Available from: http://www.fsai.ie/food_businesses/safe_catering.html.
53. FSA. Safe Catering; FSANI Food safety management guide. London: Food Standards Agency, 2007 [cited 2011 09/09/2011]; Available from: http://www.food.gov.uk/northernireland/safetyhygieneni/safecateringni/#h_2.
54. NDSC. Preventing foodborne disease: A focus on the infected food handler. Dublin: National Disease Surveillance Centre, 2004.
55. McDowell D. Persistence and dissemination of *Salmonella*, *E. coli* and *Campylobacter* in domestic kitchen environments. In Press, 2011.
56. Kennedy J, Gibney S, Nolan A, O'Brien S, McMahon MAS, McDowell D, et al. Identification of critical points during domestic food preparation: an observational study. British Food Journal, 2011;113(6):766-83.

57. Waters AE, Contente-Cuomo T, Buchhagen J, Liu CM, Watson L, Pearce K, et al. Multidrug-Resistant *Staphylococcus aureus* in US Meat and Poultry. *Clinical Infectious Diseases*, 2011 April 15, 2011.
58. FSAI. 2nd Quarter National Survey 2001 (NS2): Refrigerated Cooked Chicken Pieces. Dublin: Food Safety Authority of Ireland; 2002; Available from: http://www.fsai.ie/uploadedFiles/Monitoring_and_Enforcement/Monitoring/Surveillance/2ndQuarter.pdf.
59. Lawrence LM, Gilmour A. Incidence of *Listeria* spp. and *Listeria monocytogenes* in a poultry processing environment and in poultry products and their rapid confirmation by multiplex PCR. *Applied and Environmental Microbiology*, 1995; 60(12):4600-4.
60. Soutos N, Koidis P, Madden RH. Presence of *Listeria* and *Salmonella* spp. in retail chicken in Northern Ireland. *Letters in Applied Microbiology*, 2003; 37(5):421-3.
61. Wilson IG. Occurrence of *Listeria* species in ready to eat foods. *Epidemiology and Infection*, 1995;115(3):519-26.
62. EFSA. Scientific Opinion of the Panel on Biological Hazards on a request from the European Food Safety Authority on foodborne antimicrobial resistance as a biological hazard. *The EFSA Journal* 2008; 765:1-87.
63. Boyle F, Morris D, O'Connor J, Delappe N, Ward J, Cormican M. First report of extended-spectrum-beta-lactamase-producing *Salmonella enterica* serovar Kentucky isolated from poultry in Ireland. *Antimicrob Agents Chemother*. 2010 Jan; 54(1):551-3.
64. Houghton PN, Lyng JG, Morgan DJ, Cronin DA, Fanning S, Whyte P. Efficacy of high-intensity pulsed light for the microbiological decontamination of chicken, associated packaging, and contact surfaces. *Foodborne Pathog Dis*. 2011 Jan; 8(1):109-17.
65. Whyte P, McGill K, Collins JD. An assessment of steam pasteurisation and hot water immersion treatments for the microbiological decontamination of broiler carcasses. *Food Microbiology*. [doi: 10.1016/S0740-0020(02)00084-9]. 2003; 20(1):111-7.
66. Stern NJ, Rothenberg PJ, Stone JM. Enumeration and reduction of *Campylobacter jejuni* in poultry and red meats. *J Food Prot*. 1985;48:606-10.
67. Moore J, Matsuda M, editors. 15th International Workshop on *Campylobacter*, *Helicobacter* and Related Organisms, 2009; Niigata, Japan: *Emerg. Infect. Dis*.
68. O'Keefe M. A Review of Coccidiostat Residues in Poultry. Cork: **safefood**, 2005.
69. Irish Medicines Board. Veterinary Medicines Products List. Dublin: IMB. ; 2011 [updated 09/09/2011; cited 09/09/2011 09/09/2011]; Available from: <http://www.imb.ie/EN/Medicines/VeterinaryMedicines/VeterinaryMedicinesListing.aspx>.

70. Brennan J, Skinner J, Barnum DA, Wilson J. The efficacy of bacitracin methylene disalicylate when fed in combination with narasin in the management of necrotic enteritis in broiler chickens. *Poult Sci.* 2003 Mar; 82(3):360-3.
71. Dalloul RA, Lillehoj HS, Shellem TA, Doerr JA. Effect of vitamin A deficiency on host intestinal immune response to *Eimeria acervulina* in broiler chickens. *Poult Sci.* 2002 Oct; 81(10):1509-15.
72. Ryley JF, Hardman L. The use of vitamin K deficient diets in the screening and evaluation of anticoccidial drugs. *Parasitology.* 1978 Feb;76(1):11-20.
73. Veterinary Residues Committee. Annual report on surveillance for veterinary residues in food in the UK, 2007. Surrey: Veterinary Residues Committee 2008.
74. Veterinary Residues Committee. Annual report on surveillance for veterinary residues in food in the UK, 2008. Surrey: Veterinary Residues Committee 2009.
75. Irish Medicines Board. Dublin 2011 [updated 09/09/2011; cited 2011 09/09/2011]; Available from: <http://www.imb.ie/>.
76. European Commission, Brussels: Food and Veterinary Office; [cited 2011 09/09/2011]; Available from: http://ec.europa.eu/food/fvo/index_en.cfm.
77. FVO. Annual Report 2008. Brussels: Food and Veterinary Office, 2009.
78. FSAI. Guidance Note No. 10: Product recall and traceability. Dublin: Food Safety Authority of Ireland, 2002.
79. FSAI. Code of Practice No. 5: Food incidents and food alerts. Dublin: Food Safety Authority of Ireland, 2004.
80. FSA. Guidance Notes for Food Business Operators on Food Safety, Traceability, Product Withdrawal and Recall: A guide to compliance with Articles 14, 16, 18 and 19 of General Food Law Regulation London: Food Standards Agency, 2007.
81. Food Agency Co-operation Council. A National Food Incident Management Plan. Dublin: Food Safety Authority of Ireland, 2002.
82. FSA. Food incidents taskforce. London: Food Standards Agency; 2006 [27 June 2006]; Available from: <http://www.food.gov.uk/foodindustry/industrycommittees/taskforcebranch/>.
83. Irish Nutrition and Dietetic Association. Fact Sheets- The Food Pyramid, 2005.
84. Food Standards Agency. The Eatwell Plate. 2011 [updated 15/04/2011; cited 2011 12/08/2011]; Available from: <http://www.eatwell.gov.uk/healthydiet/eatwellplate/>.
85. Food Standards Agency. McCance and Widdowson's The Composition of Foods. 6th Edition. ed. Cambridge: Royal Society of Chemistry; 2002.
86. Food Safety Authority of Ireland. Trans Fatty Acids and Hydrogenated Vegetable Oils, 2011.
87. Food standards Agency. Food Portion Size. 3rd ed. London: TSO; 2002.
88. Chicken & Potato: Nutritional content of chicken & potato products in deli counters and takeaway outlets. *Safefood*, 2009:1-22.

89. Cosgrove M, Flynn A, Kiely M. Impact of disaggregation of composite foods on estimates of intakes of meat and meat products in Irish adults. *Public Health Nutr.* 2005 May; 8(3):327-37.
90. O'Brien MM, Kiely M, Galvin M, Flynn A. The importance of composite foods for estimates of vegetable and fruit intakes. *Public Health Nutrition.* 2003;6 (7):711-26.
91. Magdelaine P, Spiess MP, Valceschini E. Poultrymeat consumption trends in Europe. *World's Poultry Science Journal*, 2008; 64:53-64.
92. Teagasc, the Irish Agriculture and Food Development Authority. *The Poultry Industry in Ireland*, 2010.
93. Crane R, Davenport R, Vaughan R. *Farm Business Survey 2009/2010; Poultry Production in England*, 2011.
94. World Cancer Research Fund/American Institute for Cancer Research. *Food, nutrition, physical activity and the prevention of cancer: a global perspective*. Washington: American Institute of Cancer Research, 2007.
95. Irish Universities Nutrition Alliance. *North/South Ireland Food Consumption Survey*, Dublin 2001.
96. Irish Universities Nutrition Alliance. *National Adult Nutrition Survey*, 2011.
97. Bates B, Lennox A, Swan G. *National Diet and Nutrition Survey; Headline results from year 1 of the rolling programme*. Department of Public Health and Community Health, 2008/2009:1-19.
98. Harrington J, Perry I, Lutomski J, Morgan K, McGee H, Shelley E, et al. *SLÁN 2007: Survey of Lifestyle, Attitudes and Nutrition in Ireland. Dietary Habits of the Irish Population*. Dublin: The Stationery Office, 2008.
99. Health Promotion Agency. *Eating for Health? A survey of attitudes and eating habits among adults in Northern Ireland*, 2001.
100. Cosgrove M, Flynn A, Kiely M. Consumption of red meat, white meat and processed meat in Irish adults in relation to dietary quality. *Br J Nutr.* 2005 Jun; 93(6):933-42.
101. Devine P, Lloyd K, Gray A, M. . *University Student Food Attitudes and Behaviour Survey*, 2006.
102. Irish Universities Nutrition Alliance. *The National Children's Food Survey, 2005 [updated 3rd June 2009]*.
103. Irish Universities Nutrition Alliance. *National Teen's Food Survey. 2008 [updated 2nd June 2009]*.
104. Kiely M. Personal communication from North/ South Ireland Food Consumption Survey data, 2005.
105. Galvin MA, Kiely M, Harrington KE, Robson PJ, Moore R, Flynn A. The North/South Ireland Food Consumption Survey: the dietary fibre intake of Irish adults. *Public Health Nutr.* 2001 Oct; 4(5A):1061-8.

106. Galvin M, A., , Kiely M, Harrington KE, Robson PJ, Moore R, Flynn A. The North/ South Ireland food consumption survey: the dietary fibre intake of Irish adults. *Public Health Nutrition*. 2001;4(5A):1061-8.
107. Health Promotion Agency. Eating for health? A survey of eating habits among children and young people in Northern Ireland, 2001. Contract No.: 22 June 2006.
108. Hannon EM, Kiely M, Harrington KE, Robson PJ, Strain JJ, Flynn A. The North/South Ireland Food Consumption Survey: mineral intakes in 18-64-year-old adults. *Public Health Nutr*. 2001 Oct; 4 (5A):1081-8.
109. Fung T, Hu FB, Fuchs C, Giovannucci E, Hunter DJ, Stampfer MJ, et al. Major dietary patterns and the risk of colorectal cancer in women. *Arch Intern Med*. 2003 Feb 10; 163(3):309-14.
110. Irish Universities Nutrition Alliance. North South Ireland Food Consumption Survey, Dublin 2001.
111. Hu FB, Rimm EB, Stampfer MJ, Ascherio A, Spiegelman D, Willett WC. Prospective study of major dietary patterns and risk of coronary heart disease in men. *Am J Clin Nutr*. 2000 Oct; 72(4):912-21.
112. Van Dam RM, Grievink L, Ocke MC, Feskens EJ. Patterns of food consumption and risk factors for cardiovascular disease in the general Dutch population. *Am J Clin Nutr*. 2003 May; 77(5):1156-63.
113. Chen H, Ward MH, Graubard BI, Heineman EF, Markin RM, Potischman NA, et al. Dietary patterns and adenocarcinoma of the esophagus and distal stomach. *Am J Clin Nutr*. 2002 Jan;75(1):137-44.
114. Van Dam RM, Rimm EB, Willett WC, Stampfer MJ, Hu FB. Dietary patterns and risk for type 2 diabetes mellitus in U.S. men. *Ann Intern Med*. 2002 Feb 5;136(3):201-9.
115. Willett WC, Stampfer MJ, Colditz GA, Rosner BA, Speizer FE. Relation of meat, fat, and fiber intake to the risk of colon cancer in a prospective study among women. *N Engl J Med*. 1990 Dec 13; 323(24):1664-72.
116. Giovannucci E, Rimm EB, Stampfer MJ, Colditz GA, Ascherio A, Willett WC. Intake of fat, meat, and fiber in relation to risk of colon cancer in men. *Cancer Res*. 1994 May 1; 54(9):2390-7.
117. Sinha R, Rothman N, Brown ED, Salmon CP, Knize MG, Swanson CA, et al. High concentrations of the carcinogen 2-amino-1-methyl-6-phenylimidazo- [4,5-b]pyridine (PhIP) occur in chicken but are dependent on the cooking method. *Cancer Res*. 1995 Oct 15; 55(20):4516-9.
118. FSAI. Guidance Note No. 14:The Application of Commission Directive 2001/101/EC as Amended by Commission Directive 2002/86/EC on the Definition of Meat. In: Ireland FSAo, editor. Dublin, 2003.
119. FSA. Labelling and Composition of Meat Products Guidance Notes. In: Agency FS, editor. London, 2003.

120. FSA. Country of Origin Labelling Guidance. In: Agency FS, editor. London, 2008.
121. FSAI. Retail Display of Poultry from Opened Gas Flushed Packs. In: Ireland FSAo, editor. Dublin, 2009.

Appendix A

Questions asked in the *safefood* consumer research survey

Do you have concerns about the safety of any of these types of food?

	YES	NO
Raw pork
Raw lamb
Raw beef
Raw chicken
Other raw meat (specify)

Cooked meat/poultry
Processed meat (sausages, burgers)
Eggs
Milk
Other dairy products (specify)

Other dairy products unspecified
Fish

Shellfish

Consumer focused review of the chicken food chain

Fresh fruit	.....	.....
Fresh vegetables	.....	.....
Tinned foods	.....	.....
Frozen foods	.....	.....
Dried foods	.....	.....
Ready made meals	.....	.....
Foods with GM ingredients	.....	.....
Baby foods	.....	.....
Oils and sauces	.....	.....
Organic food	.....	.....
Irradiated food	.....	.....

Soft drinks	.....	.....
Bottled waters	.....	.....
Foods with preservatives, additives or colourings		
Other (write in		

None	.....	.....

From the following list, which issue would you be most concerned about?

Which issue would you be least concerned about?

	Not at all concerned	2	3	4	Very Concerned	Don't Know	Most Concerned	Least Concerned
1. The presence of antibiotics in chicken meat/chicken products	1	2	3	4	5	6	1	1
2. The presence of campylobacter, the bacteria that causes food poisoning in chicken, chicken meat / chicken products	1	2	3	4	5	6	2	2
3. Getting food poisoning from chicken meat/chicken products	1	2	3	4	5	6	3	3
4. The way chickens are reared and produced	1	2	3	4	5	6	4	4
5. The country of origin/traceability of chicken meat/chicken products	1	2	3	4	5	6	5	5
6. The way chicken meat/chicken products are packaged	1	2	3	4	5	6	6	6
7. Being given undercooked chicken when eating out	1	2	3	4	5	6	7	7
8. Water and protein being added to artificially increase the weight of chicken meat / chicken products	1	2	3	4	5	6	8	8
9. The information available on labels of chicken meat/chicken products	1	2	3	4	5	6	9	9

When buying poultry, chicken meat or chicken products, how effective are the following at assuring you of the safety of the product, using a scale from 1 to 5, where 1 is not at all effective and 5 is very effective?

	Not at all effective	2	3	4	Very effective	Don't know
Use by date	1	2	3	4	5	6
Quality assurance symbols	1	2	3	4	5	6
Produce of Republic of Ireland / Northern Ireland	1	2	3	4	5	6
Country of origin/traceability	1	2	3	4	5	6
Price	1	2	3	4	5	6
Colour	1	2	3	4	5	6
Appearance of the chicken	1	2	3	4	5	6
Area in which the chicken is displayed	1	2	3	4	5	6
Place of purchase, e.g. butcher, supermarket, local market	1	2	3	4	5	6
Brand name	1	2	3	4	5	6
Packaging	1	2	3	4	5	6
Free Range	1	2	3	4	5	6
Organic	1	2	3	4	5	6

Appendix B

Main Points of Difference between Poultrymeat Production Systems

	Production System		
	Intensive Conventional	Extensive Free-range	Organic
Minimum age at slaughter (days)	None, generally 35-45	56	81 (if not slow growing)
Breed specification	None	None	None as such, but slow growing preferred
Max house stocking density (fixed housing)	33.0kg LW/m ²	27.5kg LW/m ²	21kg LW/m ² inside the shed, 4m ² per bird outside.
Flock Size	Unlimited	Unlimited	4800 chickens per poultry house, and max 1600m ² /unit
Access to range	Not required	Continuous daytime access required for at least half their lifetime	Weather permitting, for at least 1/3 of their life
Pasture allowance	None	1m ² /bird	Min. 4m ² /bird
Feed specification	None	Finisher contains at least 70% cereals	At least 65% cereals, no synthetic amino acids, 100% organic ingredients. However a derogation exists that allows 15% from non-organic sources.

Key: b = birds

kg = kilogram

m² = metres squared

ha = hectare

LW = live weight

N = Nitrogen

Appendix C

Organic Certification Bodies on IOI

DAFF in ROI has approved three organic organisations for certification and inspection services, namely:

- (i) Bio-dynamic Agricultural Association of Ireland ('Demeter'),
- (ii) Irish Organic Farmers and Growers Association (IOFGA), and
- (iii) Organic Trust Ltd.

DARD in NI has approved three organic organisations in addition to the above:

- (iv) Soil Association,
- (v) Organic Farmers and Growers,
- (vi) Organic Food Federation, and
- (vii) Bio-Dynamic Agricultural Association.

Appendix D

Principles of HACCP

1. Conduct a hazard analysis.
2. Determine the Critical Control Points (CCPs).
3. Establish critical limit(s).
4. Establish a system to monitor control of the CCP.
5. Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control.
6. Establish procedures for verification to confirm that the HACCP system is working effectively.
7. Establish documentation concerning all procedures and records appropriate to these principles and their application.

Appendix E

Food Hygiene Package

The new Food Hygiene Package comprises the following legislation:

- Regulation 852/2004 on the hygiene of foodstuffs.
- Regulation 853/2004 laying down specific hygiene rules for food of animal origin.
- Regulation 854/2004 laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption.
- Directive 2002/99 laying down the animal health rules governing the production, processing, distribution and introduction of products of animal origin for human consumption.
- Directive 2004/41 repealing certain directives concerning food hygiene and health conditions for the production and placing on the market of certain products of animal origin intended for human consumption and amending Council Directives 89/662 and 92/118 and amending Decision 95/408.

Appendix F

Main Provisions of the Hygiene of Foodstuffs Regulations 2006 (S.I. No. 369 of 2006) – ROI

- The obligation is on the proprietor of the food business to ensure the business is carried out in a hygienic way. This includes all aspects of the business from the storage and transport of food, to its final preparation for sale or supply. This also includes requirements for premises, equipment, personal hygiene and training.
- The proprietor is obliged to develop and implement a food safety control system based on the principles of HACCP.
- The HSE area of the food premises shall enforce the regulations through assessment of the general hazards and the controls implemented. An EHO, on behalf of the HSE, may inspect food premises at any time, in order to ensure compliance with the regulations.
- Procedures upon failure to comply with regulations along with any penalties liable are given.
- The regulations give both specific and general requirements for food premises. For example, part one of the schedule relates to the layout and design of a food business with reference to cleaning facilities, ventilation, lighting and changing facilities.
- The onus is on the proprietor to ensure food handlers are trained in food hygiene matters commensurate with their work activity.

Appendix G

Typical Composition of Chicken Feed

The feed used in the broiler industry on IOI, for conventionally-grown, free-range and organically-grown chicken, is primarily based on GM-free European wheat. Barley is added, but the proportion used is dependent on the market value at any given time. The wheat and barley fraction usually represents about 64% by weight. Free-range chickens are required by legislation to receive at least 70% cereal in their diet. The protein content of the feed is contributed by both high protein soya and full fat soya (about 22% by weight) as well as full fat rapeseed or rapeseed extract and peas (about 8% by weight). Together with animal- or vegetable-based tallow and soya oil (about 3% by weight), these products account for approximately 90% of the ingredients in broiler feed. The tallow and soya are added to improve the taste and texture of the feed. Soya is permitted to contain approved GM material. Tallow can be of animal fat origin (bovine, ovine, porcine or avian) or a blend of palm oil and mixed soft mid-oils which are themselves by-products of vegetable oil production. The remaining 10% of ingredients consists of limestone flour and dicalcium phosphate that act as calcium supplements, as well as other nutritional supplements including vitamins, minerals and amino acids.

Appendix H

Authorised Additives permitted in Broiler Feed under Article 9t (B) Of Council Directive 70/524/EEC

Technological additives

Forty eight emulsifying and stabilising agents, thickeners and gelling agents are authorised for an unlimited period including: Lecithins (E322), Alginic acid (E400), Sodium alginate (E401), Potassium alginate (E402), Ammonium alginate (E403), Calcium alginate (E404) Propane-1,2-diol alginate (Propyleneglycol alginate: E405), Agar (E406), Carrageenan (E407), Locust bean gum (Carob gum: E410), Tamarind seed flour (E411), Guar gum (E412), Tragacanth (E413), Acacia (Gum Arabic: E414), Xanthan gum (E415), Sorbitol (E420), Mannitol (E421), Glycerol (E422), Pectins (E440), Microcrystalline cellulose (E460), Cellulose powder (E460ii), Methylcellulose (E461), Ethylcellulose (E462), Hydroxypropylcellulose (E463), Hydroxypropylmethylcellulose (E464), Ethylmethylcellulose (E465), Carboxymethylcellulose (Sodium salt of carboxymethyl ether of cellulose: E466), Sodium, potassium and calcium salts of edible fatty acids, alone or in mixtures, derived either from edible fats or from distilled edible fatty acids (E470), Mono- and di-glycerides of fatty acids (E471), Mono- and di-glycerides of edible fatty acids esterified with the following acids: (a) acetic, (b) lactic, (c) citric, (d) tartaric, (e) mono- and diacetyltartaric (E472), Sucrose esters of fatty acids (esters of saccharose and edible fatty acids: E473), Sucroglycerides (mixture of esters of saccharose and mono- and di-glycerides of edible fatty acids: E474), Polyglycerol esters of non-polymerised edible fatty acids (E475), Mono-esters of propane-1,2-diol (propyleneglycol) and edible fatty acids, alone or in mixtures with diesters (E477), Stearoyl 2-lactylic acid (E480), Sodium stearoyl 2-lactylate (E481), Calcium stearoyl 2-lactylate (E482), Stearyl tartrate (E483), Glyceryl polyethyleneglycol ricinoleate (E484), Dextrans (E486), Propane-1,2-diol (E490), Sorbitan monostearate (E491), Sorbitan tristearate (E492), Sorbitan monolaurate (E493), Sorbitan monooleate (E494), Sorbitan monopalmitate (E495), Polyethyleneglycol 6 000 (E496) and Polyoxypropylene-polyoxyethylene polymers of molecular weight 6 800-9 000 (E497).

Thirty two preservatives are authorised for an unlimited period including: Sorbic acid (E200), Sodium sorbate (E201), Potassium sorbate (E202), Calcium sorbate (E203), Formic acid (E236), Sodium formate (E237), Calcium formate (E238), Acetic acid (E260), Potassium acetate (E261), Sodium diacetate (E262), Calcium acetate (E263), Lactic acid (E270), Propionic acid (E280), Sodium propionate (E281), Calcium propionate (E282), Potassium propionate (E283), Ammonium propionate (E284), Ammonium formate (E295), DL-Malic acid (E296), Fumaric acid (E297), Sodium lactate (E325), Potassium lactate (E326), Calcium lactate (E327), Citric acid (E330), Sodium citrates (E331), Potassium citrates (E332), Calcium

citrates (E333), L-tartaric acid (E334), Sodium L-tartrates (E335), Potassium L-tartrates (E336), Potassium sodium L-tartrate (E337), and Orthophosphoric acid (E338)

Eighteen binders, anti-caking agents and coagulants are authorised for an unlimited period including: Citric acid (E330), Sodium, potassium and calcium stearates (E470), Calcium sulphate, dehydrate (E516), Silicic acid, precipitated and dried (E551a), Colloidal silica (E551b), Kieselgur (E551c), Calcium silicate, synthetic (E552), Sodium aluminosilicate, synthetic (E554), Bentonite-montmorillonite (E558), Kaolinitic clays, free of asbestos (E559), Natural mixtures of steatites and chlorite (E560), Vermiculite (E561), Sepiolite (E562), Sepiolitic clay (E563), Lignosulphonates (E565), Natrolite-phonolite (E566), Synthetic calcium aluminates (E598) and Perlite (E599).

The mixing of E558 (Bentonite-montmorillonite) with additives from the 'antibiotics,' 'growth promoters,' 'coccidiostats and other medical substances' groups is prohibited, except in the case of: monensin-sodium, narasin, lasalocid-sodium, flavophospholipol, salinomycin sodium and robenidine. Authorisations for two compounds – Clinoptilolite of volcanic or sedimentary origin – expired in 2004, while authorisation of Sodium Ferrocyanide (E535) and Potassium Ferrocyanide (E536) expired in 2006.

Sensory additives

All natural flavouring and appetising products and corresponding synthetic flavouring and appetising products are authorised for an unlimited period. Colourants, including pigments authorised for an unlimited period, include: Capsanthin (E160c), Beta-apo-8 β -carotenal (E160e), Ethyl ester of beta-apo-8 β -carotenoic acid (E160f), Lutein (E161b), Cryptoxanthin (E161c), Canthaxanthin (E161g) and Zeaxanthin (E161h), Patent blue V (E131), Acid brilliant green BS (Lissamine green: E142) and those colouring agents authorised for colouring foodstuffs by Community rules, other than Patent blue V, Acid brilliant green BS, and Canthaxanthin, as well as Canthaxanthin authorised for colouring foodstuffs by Community rules.

Nutritional additives

Antioxidant substances which are authorised for an unlimited period include: L-Ascorbic acid (E300), Sodium L-ascorbate (E301), Calcium L-ascorbate (E302), 5,6-Diacetyl-L-ascorbic acid (E303), 6-Palmitoyl-L-ascorbic acid (E304), Tocopherol-rich extracts of natural origin (E306), Synthetic alpha-tocopherol (E307), Synthetic gamma-tocopherol (E308), Synthetic delta-tocopherol (E309), Propyl gallate (E310), Octyl gallate (E311), Dodecyl gallate (E312), Butylated hydroxyanisole (BHA: E320), Butylated hydroxytoluene (BHT: E321) and Ethoxyquin (E324).

Two vitamins - Vitamin A (E672) and Vitamin D₃ (E671) – are authorised for use with defined upper limits of addition in the category 'vitamins, provitamins and chemically well-defined substances

having similar effect.’ All other substances in this group in addition to vitamins A and D are also authorised. These are authorised for an unlimited period, as are the trace elements iron (E1), iodine (E2), cobalt (E3), copper (E4), manganese (E5), zinc (E6), molybdenum (E7) and selenium (E8), for which the maximum content for the complete feedingstuff is specified.

Zootechnical additives

A total of ten enzymes, produced by a variety of micro-organisms, are authorised for use as feed additives, either singly or in various combinations. These include: Alpha-amylase (EC 3.2.1.1), 3 Alpha-galactosidase (EC 3.2.1.22), Bacillolysin (EC 3.4.24.28), Endo-1,3(4)-betaglucanase (EC 3.2.1.6), Endo-1,4-betaglucanase (EC 3.2.1.4), Endo-1,4-beta-xylanase (EC 3.2.1.8), 3-Phytase (EC 3.1.3.8), 6-Phytase (EC 3.1.3.26), Polygalacturonase (EC 3.2.1.15) and Subtilisin (EC 3.4.21.62). The authorisation period for most combinations expired in 2004 / 2005 with the exception of one 3-Phytase and one Endo-1,3(4)-betaglucanase / Endo-1,4-beta-xylanase combination which are authorised for use under specific conditions for an unlimited period.

Enzymes act as digestive aids and are beneficial in the case of wheat-based diets where the risk of necrotic enteritis is enhanced. The addition of enzymes can also serve to negate any differences in apparent metabolisable energy that can exist between different batches of wheat thereby improving broiler body weight uniformity. Xylanase has been shown to have a bacteriostatic effect, especially with regard to *Campylobacter* while phytase can reduce phosphorous excretion.¹⁵ Proteases, amylases and lipases can assist in the metabolism of protein, carbohydrate and fat, respectively.

A number of micro-organisms are authorised for use as feed additives and in this regard function as gut flora stabilisers. These include: *Bacillus cereus* var. *toyoii* (NCIMB 40112/CNCM 1-1012), *Enterococcus faecium* (ATCC 53519) + *Enterococcus faecium* (ATCC 55593) (1:1 ratio), *Enterococcus faecium* (NCIMB 10415), *Enterococcus faecium* (DSM 5464), *Enterococcus faecium* (DSM 10 663/ NCIMB 10 415), *Bacillus licheniformis* (DSM 5749) + *Bacillus subtilis* (DSM 5750) (1:1). These micro-organisms are not contra-indicated with coccidiostats.

Coccidiostats and histomonstats

Coccidiostats and other medicinal substances authorised for use as feed additives in chicken feed within the EU include: Maduramicin Ammonium (E770), Diclazuril (E771), and a 1:1 w/w mixture of Narasin and Nicarbazine (E772) which were authorised until 30th September 2009. Also authorised until this date was the antibiotic Avilamycin (E717). Semduramicin sodium (no E number) was authorised until June 1st 2006, while Flavophospholipol (E756), Decoquinone (E756), Monensin sodium (E757), Robenidine (E758), Lasalocid sodium (E763), Halofuginone (E764), Narasin (E765) and Salinomycin sodium (E766) were due to be phased out, as coccidiostats, by 31st December 2012.

Appendix I

Analysis of Additives, Pre-mixtures and Compound Feedingstuffs used in the Poultry Industry (Broilers & Layers) for Undesirable Substances and Products: ROI 2008

Analytical parameter	Total samples analysed	Non-compliances		
Heavy metals	Arsenic	1	0	
	Cadmium	1	0	
	Lead	1	0	
	Mercury	1	0	
Dioxins and PCBs	Dioxins (PCDD + PCDF)	5	0	
	Dioxin-like PCBs	5	0	
	Non dioxin-like PCBs	5	0	
Pesticides	Undesir. pesticide2	1	0	
Mycotoxins	Aflatoxin B1	8	0	
	Ochratoxin A	7	0	
	Deoxynivalenol	1	0	
		1	0	
	Fumonisin	1	0	
	HT2	1	0	
	T2	1	0	
	Nivalenol	1	0	
	Other	Fluorine	4	0
	PAP	PAP terrestrial origin	72	0
PAP fish origin		72	0	
Banned Additives	Carbadox	1	0	
	Tylosin phosphate	0	0	
	Decoquate	0	0	
	Virginiamycin	0	0	
	DMZ	5	0	
	Avilamycin	0	0	
	Salinomycin	5	0	
	Nicarbazin	59	10	
	Monensin Sodium	5	1	
	TOTAL	75	11	

Results of the 2009 National Residue Monitoring Programme, Republic of Ireland

Chemical group	Poultry samples analysed	Positive samples
Group A - (Prohibited Substances) Substances having anabolic effect and unauthorised substances		
Stilbenes, stilbene derivatives, and their salts and esters	<i>71</i>	0
Antithyroid agents	<i>26</i>	0
Steroids	44	0
Resorcylic acid lactones including zeranol	<i>71</i>	0
Beta-agonists	<i>74</i>	0
Substances which have been banned because they pose a risk to human health	<i>221</i>	0
Total analysed	507	0
Group B - Veterinary Drugs and Contaminants: B1 - Antibacterial substances, including sulphonamides, quinolones		
Antibacterial substances, including sulphonamides, quinolones	358	0
Group B - Veterinary Drugs and Contaminants: B2 - Other veterinary drugs		
Anthelminitics	<i>69</i>	0
Anticoccidials, including nitroimidazoles	<i>230</i>	9
Carbamates and pyrethroids	<i>35</i>	0
Sedatives	0	0
Non-steroidal anti-inflammatory drugs (NSAIDs)	<i>18</i>	1
Other pharmacologically active substances	0	0
Total analysed	352	10
Group B - Veterinary Drugs and Contaminants: B3 - Other substances and environmental contaminants		
Organochlorine compounds	26	0
Organophosphorus compound	0	0
Chemical elements	60	0
Mycotoxins	25	0
Others	0	0
Total analysed	111	0
Overall total analyses	1328	10

USEFUL LINKS

- The Food Safety Authority of Ireland:
www.fsai.ie
- The Food Standards Agency in Northern Ireland
<http://www.food.gov.uk/northernireland/>
- The European Food Safety Authority
<http://www.efsa.europa.eu/>
- Teagasc: The poultry Industry in Ireland:
<http://www.teagasc.ie/ruraldev/progs/poultry/industry.asp?from=>
- British Poultry Council
<http://www.britishpoultry.org.uk/>
- Online portal for the global poultry system
<http://www.thepoultrysite.com/>

GLOSSARY

POULTRY CLASSIFICATION

Broiler: young chicken being raised for meat or alternatively fowl in which the tip of the sternum is flexible (not ossified).

Capon: male fowl castrated surgically before reaching sexual maturity and slaughtered at a minimum age of 140 days; after castration the capons must be fattened for at least 77 days.

Chicken: the domestic fowl, *Gallus domesticus*, family Phasianidae. Birds including chicks, broilers, hens, pullets, cockerels and cocks.

Cock: mature male chicken or other fowl.

Cock, Hen, Casserole or Boiling Fowl: fowl in which the tip of the sternum is rigid (ossified).

Cockerel: male chicken less than one year old.

Hen: mature female bird (e.g. chicken, turkey).

Poussin, Coquelet: chicken of less than 650g carcass weight (expressed without giblets, head and feet), chicken of 650g to 750g may be called 'poussin' if the age at slaughter does not exceed 28 days.

Young Cock: male chicken of laying strains in which the tip of sternum is rigid but not completely ossified and for which the age at slaughter is at least 90 days.

GENERAL

Acceptable Daily Intake: the amount of a particular chemical in food which, based on all the facts known at the time, is thought not to present any possibility for adverse health effects if ingested daily over a lifetime. $ADI = NOEL \times 10$ (Interspecies uncertainty) $\times 10$ (safety factor)

Accompanied Shop: a market researcher accompanies a member of the public on a shopping trip in order to gain some understanding of what triggers and impacts on a purchasing decision.

Air Chilling: method of chilling used in which the carcass is chilled in cold air.

Air-Spray Chilling: method of chilling used in which the carcass is chilled in cold air interspersed with a water haze or fine water spray.

Biosecurity: the prevention of disease-causing agents entering or leaving any place where they can pose a risk to farm animals, other animals, humans, or the safety and quality of a food product.

CMi: a company involved in Consulting & Technical Services and also Certification, specialising in the certification of recognised food industry standards.

Competent Authority: the central authority of a Member State competent to carry out veterinary checks or any authority to which it has delegated that competence.

Derogation: the partial taking away of the effectiveness of a law or a partial repeal or abolition of a law.

EFSIS: a third party independent inspection and certification service.

Extensive Indoor Broiler Flocks: broilers produced in a less intensive rearing system (than conventional) in a confined environment with a low stocking density. These broilers are given low protein and low energy feed and the minimum age at slaughter is 56 days.

Focus Group: a small sample group of people selected from a wider population for open discussion about a particular topic.

Food Safety: the extent to which food is safe to eat. The term is sometimes confused with that of [food security](#) which refers to the extent to which food is available - i.e. whether it is physically available and can be bought at a price that people can afford.

Fresh Poultrymeat: poultrymeat not stiffened by the cooling process, which is to be kept at a temperature not below -2°C and not higher than 4°C at any time.

Frozen Poultrymeat: poultrymeat which must be frozen as soon as possible within the constraints of normal slaughtering procedures and kept at a temperature no higher than -12°C at any time.

Immersion Chilling: method of chilling used in which the carcasses are chilled in tanks of cold water or ice and water.

HACCP: a documented food safety management system consisting of seven principles as laid out in pages 35/36 of Codex Alimentarius Food Hygiene Basic Text. It involves the systematic identification of hazards in a food processing business and the introduction of control, monitoring, and verification procedures, at chosen steps in the processing operation that are considered essential for the control of food safety hazards.

Ionophores: chemicals which facilitate a transmembrane ion flux resulting in a perturbation of transmembrane ion gradients vital for cell functioning leading to cell death.

Lethal Dose: the concentration killing 50% of exposed animals.

Maximum Residue Level: the maximum permissible concentration of a residue in a food, agricultural or animal feed commodity, as a result of permitted agricultural or veterinary chemical usage. MRLs are not safety limits for human health although these (e.g. the ADI) are taken into consideration when establishing the MRL which is invariably lower. An MRL is not a toxicological limit and a violation is not necessarily a cause of concern for public or animal health.

New York Dressed Poultry: delayed evisceration poultry which receive a 'post mortem' health inspection, at the latest 15 days after slaughter, during which period it must be stored at a temperature not exceeding +4°C (as per Council Directive 71/118/EEC).

No Observed Effect Level: the dose at which no demonstrable toxic effects are recorded.

Poultrymeat Inspectors: work on the production line alongside plant staff at various critical points, each inspector performing a specific task as the carcasses move along the line. They may also assist with ante mortem inspection. They ensure that animal welfare and hygiene standards are observed throughout the production process, under the direction of the Official Veterinary Surgeon.

Quick-frozen Poultrymeat: poultrymeat kept at a temperature no higher than -18°C at any time within the tolerances as provided for in Council Directive 89/108/EEC of 21 December 1988 relating to quick-frozen foodstuffs for human consumption.

Rendering: preparing or treating the bodies of dead animals to take out the fat and other substances that can be used in other products, e.g. pet food.

Thinning: the depletion of poultry houses in three or four stages before final depopulation in order to satisfy market requirements.

Third Country: a country other than a Member State of the European Union.

Undesirable substances: any substance or product, with the exception of pathogenic agents, present in and/or on the product intended for animal feed which presents a potential danger to human health, animal health or the environment or may adversely affect livestock production.

Zoonose: a disease of animals that can be transmitted to humans.

safefood:

7 Eastgate Avenue, Eastgate, Little Island, Co. Cork

7 Ascaill an Gheata Thoir, An tOiléan Beag, Co. Chorcaí

7 Aistyett Avenue, Aistyett, Wee Isle, Co. Cork

Tel: +353 (0)21 230 4100 ***Fax:*** +353 (0)21 230 4111

Email: info@safefood.eu

Web: www.safefood.eu

www.safefood.eu

HELPLINE

NI 0800 085 1683

ROI 1850 40 4567