Food Safety
AUTHORITY OF IRELAND

MICROBIOLOGY

MONITORING & SURVEILLANCE SERIES

Microbiological quality of raw chicken fillets that are sold loose, but were previously distributed in gas flushed packaging (10NS3)

NOVEMBER 2010

SUMMARY

This survey assessed the microbiological quality of chicken fillets that were supplied to butchers in gas flushed bulk packs, but sold loose. In total, 15% of the chicken fillets were unsatisfactory for aerobic colony count (ACC) and 5% were unsatisfactory for *Pseudomonas* spp. at the point of retail sale.

Unsatisfactory levels of these bacteria indicate that the fillets may be a concern with respect to spoilage rather than safety. Spoilage can occur when the growth of spoilage bacteria reach levels that affect the appearance, smell and/or taste of the food. Given that the fillets may then be stored at home by the consumer prior to consumption, there is a strong possibility that some of the fillets found to be unsatisfactory at the point of sale would show some degree of physical spoilage, either via smell, taste or appearance, at the point of preparation and consumption.

The Food Safety Authority of Ireland (FSAI) produced a factsheet on the Retail Display of Poultry from Opened Gas Flushed Packs, which covers opening of gas flushed packs, storage temperature and how to apply use-by dates. The majority of butchers (92%) stored chicken fillets at the recommended temperature of 5°C or cooler. However, 8% percent of butchers did not provide a use-by date, as required by law[a] and 23% of butchers 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.

Butchers should follow the advice in the FSAI's factsheet for opening gas flushed packs, storage temperature and applying use-by dates, or similar advice carried on the labels of the gas flushed chicken fillets. Enforcement officers should verify that butchers follow this advice.

ACKNOWLEDGEMENTS

The Food Safety Authority of Ireland thanks the environmental health officers and the laboratory staff of the food microbiology laboratories of the Health Service Executive who participated in this survey.

ABBREVIATIONS

ACC	Aerobic colony count
cfu/g	colony forming units per gram
CO_2	Carbon dioxide
EHO	Environmental health officer
FSAI	Food Safety Authority of Ireland
N_2	Nitrogen

[a] European Communities (Labelling and Marketing Standards for Poultrymeat) Regulations, 2010 (S.I. No 328 of 2010)

INTRODUCTION

Although meat (muscle) is usually sterile inside an animal's body, it can become contaminated with microorganisms during slaughter and processing. As spoilage microorganisms grow, they produce volatile compounds, which result in an off-odour, gas and slime. Meat spoilage is not a safety issue and the level of spoilage microorganisms is not an indicator of the presence of pathogens. However, it means that the meat is not of the quality that the consumer expects and may be unfit for consumption.

When a manufacturer applies a shelf life (use-by or best-before date) to a food, they take into account the growth of both spoilage microorganisms and pathogens. The shelf life of fresh poultry can be extended using storage and packaging conditions that inhibit the growth of microorganisms. With gas flushed packaging, the oxygen content is reduced or removed from the headspace (the area of the package not occupied by the food) by the addition of N_2, CO_2 or a mixture of these two gasses.

Levels of *Pseudomonas* spp. and aerobic colony count (ACC) can be used as indicators of the microbiological quality of raw poultry. *Pseudomonas* species are the predominant spoilage bacteria on poultry meat stored aerobically under refrigeration conditions (Forsythe, 2000; Mead, 2004). ACC indicates the general microbiological load of a food product and can so be used to help determine the shelf-life (Forsythe, 2000). For both tests, 10^7 cfu/g is considered the maximum acceptable level at any point in the shelf-life (Betts, 2007; IFST, 1999). At higher levels the chances of physical spoilage of the meat increases as the microbiological load increases. However, chicken fillets can only be considered unfit for consumption if their taste, smell or appearance is unacceptable. There is no clear level of spoilage bacteria that can confidently be associated with such changes in organoleptic properties of the food. Consequently, 10^7 cfu/g is only a guideline above which there is an increased probability of spoilage.

Butchers may receive chicken fillets in gas flushed bulk packs, which they then open for retail sale. Although the gas flushed bulk pack is labelled with a use-by date, as required by law, once the pack is opened the use-by date is invalidated because the protective atmosphere has been released. Butchers are required by law to provide a valid use-by date for chicken fillets they sell loose or re-wrapped. A factsheet produced by the Food Safety Authority of Ireland (FSAI) gives advice on how butchers should determine this new use-by date (Appendix 1).

OBJECTIVES

To examine the microbiological quality of raw chicken fillets (from opened gas flushed packs) sold loose at retail level, with respect to ACC and *Pseudomonas* spp.

To determine if the advice given in the FSAI's factsheet on the Retail Display of Poultry from Opened Gas Flushed Packs is being used by butchers and if the best practice advice in the factsheet is appropriate.

METHOD

Sample Collection

In February 2010, environmental health officers (EHOs) collected samples of raw chicken breast fillets (one sample = 2 fillets), which were sold loose but had previously been supplied in gas flushed bulk packs. Samples were collected from stand-alone butcher shops or from the butcher counter in supermarkets in the Republic of Ireland. Raw chicken breast fillets (without bones and skin) were examined for this survey. Excluded was:

- Chicken not previously distributed in gas flushed bulk packs
- Chicken sold to the consumer pre-packaged
- Cooked chicken
- Chicken on the bone or part-boned
- Chicken with skin remaining
- Chicken with added ingredients (for example, sauce, spices, marinade, coating, stuffing)

At the time of sampling, EHOs were asked to complete a questionnaire to provide information, such as the storage temperature, use-by date and country of origin of the chicken fillets (Appendix 2). The samples were transported to the laboratory for analysis in a cool box with ice-packs.

Sample Analysis and Classification of Results

Microbiological analysis for ACC and *Pseudomonas* spp. was carried out in food microbiology laboratories of the Health Service Executive. As *Pseudomonas* is a psychrotroph (can grow at refrigeration temperatures), laboratory analysis for both *Pseudomonas* spp. and ACC was started on the same day the sample was collected.

Regulation (EC) No 2073/2005 on microbiological criteria for foodstuffs does not specify a process hygiene criteria for raw chicken fillets, so guideline (non-statutory) criteria were applied (Table 1). These criteria are based on guidelines by the Institute of Food Science and Technology (IFST, 1999).

Table 1: Guideline microbiological criteria applied in this survey

Parameter	Method	Microbiological quality (cfu/g)[a]		
		Satisfactory	Acceptable	Unsatisfactory
ACC	(30°C, 48h)	$<10^5$	10^5 - $\leq 10^7$	$>10^7$
Pseudomonas spp.	(ISO 13720:2010)	$<10^5$	10^5 - $\leq 10^7$	$>10^7$

[a] Institute of Food Science and Technology (IFST, 1999)

Statistical Analysis

Fisher's Exact Test analysis was performed using SPSS version 18.0, with significance defined at the $p<0.05$ level.

RESULTS AND DISCUSSION

Microbiological Classification

In total, 138 samples were collected and analysed for this survey: 100 (72%) from stand-alone butcher shops and 38 (28%) from the butcher's counter in supermarkets. Overall, 15% (n=21) of samples were unsatisfactory for ACC, while 5% (n=7) were unsatisfactory for *Pseudomonas* spp. (Figure 1).

There was no statistically significant difference in the microbiological quality of samples collected from stand-alone butcher shops, compared to those collected from the butcher counter in supermarkets (Table 2).

Figure 1: Microbiological classification of samples (n=138)

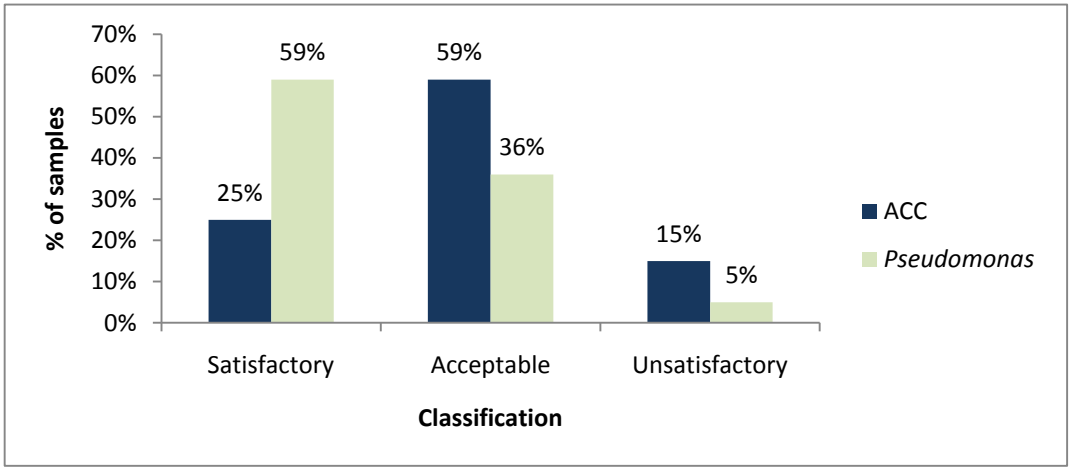


Table 2: Microbiological quality of samples by butcher type

Test	Butcher type	% unsatisfactory (number/total)	Statistically significant difference? (p<0.05)
ACC	Stand-alone	15 (15/100)	No
	Supermarket	16 (6/38)	
Pseudomonas spp.	Stand-alone	5 (5/100)	No
	Supermarket	5 (2/38)	

Storage Temperature

At the time the samples were collected, EHOs measured the temperature of the storage or display unit. Although 92% (n=125) of samples were stored at the recommended temperature of 5°C or cooler, 8% (n=11) were stored above 5°C, at temperatures ranging from 5.2-15°C (median, 6°C)[b]. There was no statistically significant difference in the temperature of storage depending on butcher type. For each butcher type, 8% of samples were stored at temperatures >5°C: 8/99 samples from stand-alone butchers and 3/37 samples from the butcher counter in supermarkets.

In this study, there was no statistically significant difference in the microbiological quality of samples stored below 5°C, compared to those stored at temperatures >5°C (Table 3). However, sample numbers were low for product stored above 5°C, which reduces the statistical power of the test, making meaningful comparisons difficult. Although this study did not show a significant difference in the microbiological quality of samples stored at temperatures >5°C, compared to those stored at ≤5°C, the microbiological safety of the samples (not assessed in this study) will be affected by storage at higher temperatures. Butchers should ensure raw chicken fillets are stored at 5°C or cooler, because storage at higher temperatures would allow the growth of pathogens (e.g. *Campylobacter* or *Salmonella)* that may be present on the raw chicken.

Table 3: Microbiological quality of samples by storage temperature

Test	Storage temperature	% unsatisfactory (number/total)	Statistically significant difference? (p<0.05)
ACC	≤5°C	15 (19/125)	No
	>5°C	18 (2/11)	
Pseudomonas spp.	≤5°C	6 (7/125)	No
	>5°C	0 (0/11)	

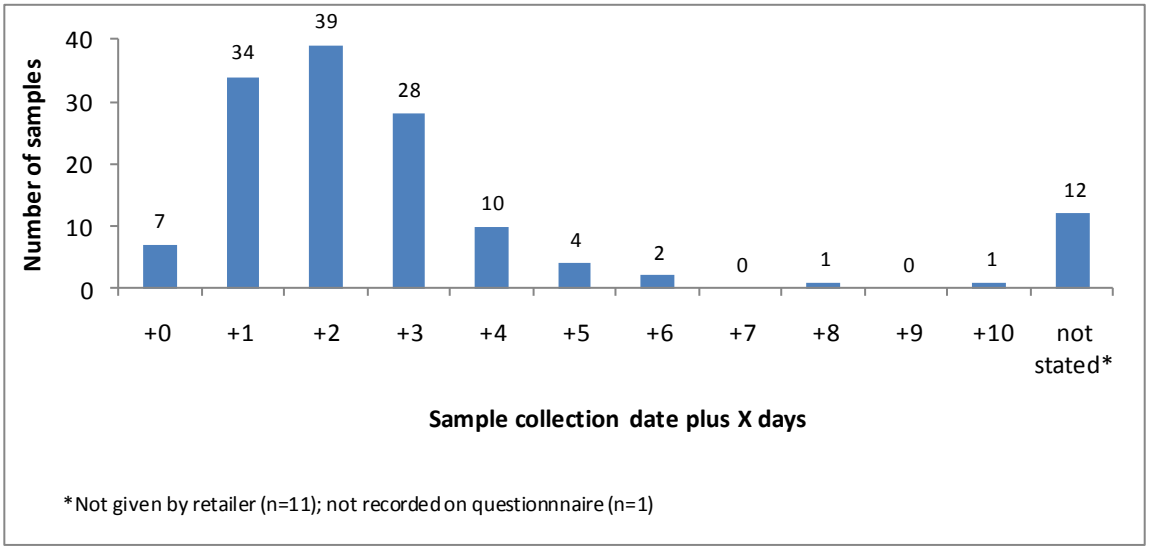
Use-by Date

In total, 92% (n=127) of butchers provided a use-by date, but 8% (n=11) did not. There was no statistically significant difference in the provision of use-by date by butcher type: 91% (91/100) of stand-alone butchers provided a use-by date compared to 94% (36/38) of butcher counters in supermarkets.

The use-by date given by butchers ranged from the day of sample collection, up to ten days after sample collection (Figure 2).

[b] The storage temperature was not recorded for two samples

Figure 2: Use-by date given by butchers (n=138)



According to the FSAI's factsheet on the retail display of poultry from opened gas flushed packs, when setting a new use-by date for chicken from opened gas flushed bulk packs, butchers should:

1. Follow the instructions on the gas flushed bulk pack for applying a new use-by date, or
2. Use the best practice advice given in the FSAI's factsheet, or
3. Carry out their own validation studies to determine the use-by date

The FSAI's best practice advice is that gas flushed packs of poultry may only be opened for retail sale, either loose or rewrapped, up to and including seven days after the kill date or date of production indicated on the pack. Poultry from the opened pack should then be stored at ≤5^{o}C and sold with a two day use-by date from date of pack opening. Because packaging from opened gas flushed packs was likely to have been discarded once opened, this study could not establish the original kill or production date of the poultry, or the date the gas flushed packs were opened. Therefore, it is not possible to determine a relationship between the microbiological quality of the samples collected and the length of the use-by date provided by the butcher.

Information on how the butcher obtained the use-by date was recorded for 120 samples. Of these, 52% (n=62) of butchers said they used the best practice advice, 24% (n=29) said they used instructions given on the bulk pack and 2% (n=2) said they used their own validation study. But for 23% (n=27) of samples, the butcher had no basis for the use-by date they recommended.

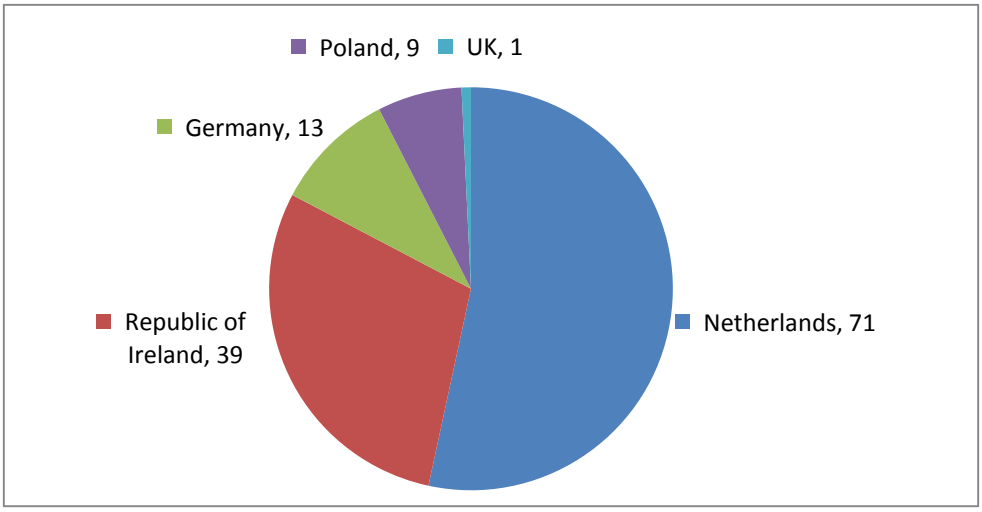
Even though 62 butchers said they used the best practice advice to determine the use-by date, it is clear that this was not the case. Taking the best case scenario that the gas flushed pack was opened on the day the sample was collected, 23% (14/61[c]) of samples, for which the butcher said they used best practice advice, were given a use-by date, three (n=11) or four (n=3) days from sample collection. Looking at all samples for which a use-by date was provided, 37% (46/126[d]), were given use-by dates longer than two days from the day of sampling.

[c] The actual use-by date was not recorded for one sample
[d] The actual use-by date not recorded for one sample

Country of Origin

The country of origin of the chicken fillets was recorded for 133 samples (Figure 3). Most chicken fillets were sourced from the Netherlands (53%, n=71), followed by the Republic of Ireland, Germany, Poland and the UK. This aim of this survey was not to investigate the microbiological quality of chicken fillets by country of origin and so the microbiological quality of the chicken fillets from unopened bulk packs was not assessed. As the samples were tested after retail storage and handling in Ireland, it is not possible to correlate microbiological quality with fillets sourced from any particular country.

Figure 3: Country of origin of chicken fillets



CONCLUSIONS

This survey found that 15% of samples tested were unsatisfactory for ACC and 5% were unsatisfactory for *Pseudomonas* spp. at the point of sale. Given that the chicken fillets may then have been stored at home by the consumer, prior to consumption; there is a strong possibility that some of these fillets would show some degree of physical spoilage, either via smell, taste or appearance at the point of preparation and consumption.

The FSAI's factsheet on the Retail Display of Poultry from Opened Gas Flushed Packs, gives advice to butchers on opening gas flushed packs, storage temperature and setting new use-by dates for chicken taken from opened gas flushed bulk packs. As 92% of samples were stored at 5°C or cooler, the advice on storage temperature was followed by most butchers. However, 11 samples were stored at higher temperatures. Although this study did not show a difference in the microbiological quality of samples stored at ≤5°C compared to those stored a >5°C, butchers should continue to store raw chicken fillets at 5°C or cooler, since storage at higher temperatures is likely to affect the microbiological safety of the chicken.

This study found that 8% of butchers did not comply with the requirement to provide a use-by date for the chicken fillets they sold loose. Although the FSAI's factsheet gives advice on setting new use-by dates, this survey found that 23% of butchers could give no basis for the use-by date they set. Also, even though 62 butchers said they used the best-practice advice in the factsheet to determine use-by date, it is clear that this advice was not always followed, as at least 23% of these butchers applied a longer use-by date than advised. Butchers are responsible for placing safe and wholesome food on the market and must advise the consumer on the use-by date for the product.

The FSAI best practice advice stipulates that gas flushed packs should not be opened for loose retail sale beyond seven days from production, unless the label specifies otherwise. It was not possible to determine at what point gas flushed packs were opened by the butchers sampled in this survey. However, if some butchers were not adhering to this advice then it could lead to the sale of fillets with poorer microbiological quality.

Most of the gas flushed packed chicken fillets tested in this survey were sourced from the Netherlands (51%) or the Republic of Ireland (29%). The microbiological quality of the fillets at the point of sale is determined by a combination of the microbiological quality of the fillets removed from the gas flushed packs, along with the handling and storage conditions in the retail premises. Consequently, from this survey, it is not possible to determine if product from certain countries results in chicken fillets with poorer microbiological quality.

RECOMMENDATIONS

Butchers should follow the advice on opening gas flushed packs, storage temperature and application of use-by dates set out in the FSAI's factsheet on Retail Display of Poultry from Opened Gas Flushed Packs. Enforcement officers should verify that butchers are adhering to the advice set out in this factsheet.

REFERENCES

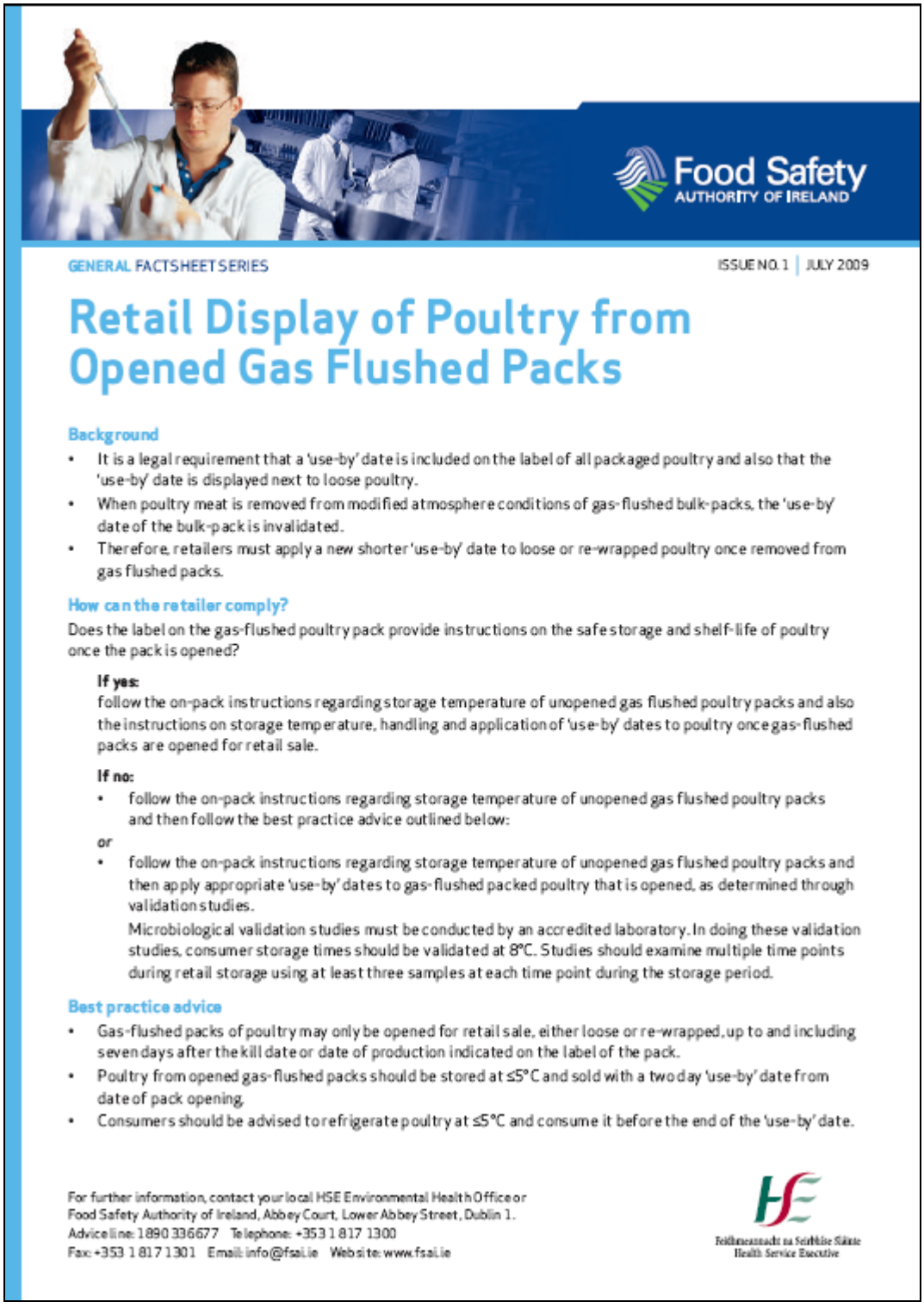
Betts, G. and Everis, L. (2007). Microbiological spoilage of foods: a review. Campden and Chorley Food Research Association Group. ISBN: 978 0 905942 92 6.

Forsythe, S. (2000). The Microbiological Flora of Food. *In* The Microbiological Flora of Food. Blackwell Science, UK. ISBN 0 632 05487 5.

IFST (1999). Development and use of microbiological criteria for foods. ISBN 0 905367.

Mead, G.C. (2004). Microbiological quality of poultry meat: a review. Brazilian Journal of Poultry Science, 6 (3), 135-142.

APPENDIX 1: FACTSHEET ON RETAIL DISPLAY OF POULTRY FROM OPENED GAS FLUSHED PACKS (available from www.fsai.ie)



GENERAL FACTSHEET SERIES

ISSUE NO. 1 | JULY 2009

Retail Display of Poultry from Opened Gas Flushed Packs

Background

- It is a legal requirement that a 'use-by' date is included on the label of all packaged poultry and also that the 'use-by' date is displayed next to loose poultry.
- When poultry meat is removed from modified atmosphere conditions of gas-flushed bulk-packs, the 'use-by' date of the bulk-pack is invalidated.
- Therefore, retailers must apply a new shorter 'use-by' date to loose or re-wrapped poultry once removed from gas flushed packs.

How can the retailer comply?

Does the label on the gas-flushed poultry pack provide instructions on the safe storage and shelf-life of poultry once the pack is opened?

If yes:
follow the on-pack instructions regarding storage temperature of unopened gas flushed poultry packs and also the instructions on storage temperature, handling and application of 'use-by' dates to poultry once gas-flushed packs are opened for retail sale.

If no:

- follow the on-pack instructions regarding storage temperature of unopened gas flushed poultry packs and then follow the best practice advice outlined below:

or

- follow the on-pack instructions regarding storage temperature of unopened gas flushed poultry packs and then apply appropriate 'use-by' dates to gas-flushed packed poultry that is opened, as determined through validation studies.

  Microbiological validation studies must be conducted by an accredited laboratory. In doing these validation studies, consumer storage times should be validated at 8°C. Studies should examine multiple time points during retail storage using at least three samples at each time point during the storage period.

Best practice advice

- Gas-flushed packs of poultry may only be opened for retail sale, either loose or re-wrapped, up to and including seven days after the kill date or date of production indicated on the label of the pack.
- Poultry from opened gas-flushed packs should be stored at ≤5°C and sold with a two day 'use-by' date from date of pack opening.
- Consumers should be advised to refrigerate poultry at ≤5°C and consume it before the end of the 'use-by' date.

For further information, contact your local HSE Environmental Health Office or Food Safety Authority of Ireland, Abbey Court, Lower Abbey Street, Dublin 1.
Advice line: 1890 336677 Telephone: +353 1 817 1300
Fax: +353 1 817 1301 Email: info@fsai.ie Website: www.fsai.ie

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

APPENDIX 2: SURVEY QUESTIONNAIRE

Questionnaire for study on the quality of chicken fillets that are sold loose, but were previously distributed in gas flushed packaging (10NS3)

Please complete all sections required

1. EHO name: _____

2. Premises information:

Stand alone butcher shop ☐ Butcher counter in supermarket ☐

Name and address of premises_____

_____
_____
_____

3. Sample information

EHO Sample Reference Number *(EHO's own personal ref. number for sample)*_____

Date sample taken _ _ / _ _ / 2010

Time sample taken _____

Temperature of storage/display unit (measured, not display unit reading) _____°C

4. Information on use-by date of loose fillets provided to the consumer

What use-by date was recommended by the retailer?
Today ☐
Tomorrow ☐
Other date (specify) _ _ / _ _ / 2010
Retailer was unable to recommend a use-by date ☐

How was the use-by date determined (see Appendix 1)?
Please tick ONE of the following:
Taken from on-pack instructions on bulk pack ☐
Using best practice advice ☐
Using own validation study ☐
No basis for use-by date ☐

5. Information on bulk pack(s) – i.e. the source of the loose chicken fillets

Is information from the bulk pack(s) available: Yes ☐ No ☐

Did both chicken fillets come from the same bulk pack: Yes ☐ No ☐
If fillets came from two different bulk packs, please provide the details for both packs (see below).

Bulk pack use-by date (specify): _ _/ _ _ / _ _ _ _ or not known ☐

Country of Origin: ROI ☐ UK ☐ Germany ☐ Poland ☐ Netherlands ☐ Belgium ☐ Other (specify) _____
Plant approval number (oval mark): _____

Complete for second bulk pack, if necessary
Bulk pack use-by date (specify): _ _/ _ _ / _ _ _ _ or not known ☐

Country of Origin: ROI ☐ UK ☐ Germany ☐ Poland ☐ Netherlands ☐ Belgium ☐ Other (specify) _____
Plant approval number (oval mark): _____

Abbey Court,
Lower Abbey Street,
Dublin 1.

Advice Line: 1890 336677
Telephone: +353 1 817 1300
Facsimile: +353 1 817 1301
Email: info@fsai.ie
Website: www.fsai.ie