

Results of 4th Quarter National Survey 2002 (NS4)

European Commission Co-ordinated programme for the Official Control of foodstuffs for 2002

- Bacteriological Safety of Pre-cut fruit & vegetables, Sprouted seeds and Unpasteurised fruit & vegetable juices from Processing and Retail Premises
- Assessment of Compliance with the HACCP element (Regulation 4.2) of Council Directive 93/43/EEC

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Summary

This survey (September to December 2002 inclusive) was undertaken as part of the EU coordinated programme for 2002 ⁽¹⁾. There were 2 aspects to this survey:

- 1) assessment of the bacteriological safety (*Salmonella* spp., *Escherichia coli* O157 and *Listeria monocytogenes*) of pre-cut fruit & vegetables, sprouted seeds and unpasteurised fruit & vegetable juices from both production and retail establishments and
- 2) assessment for compliance with the HACCP element (Regulation 4.2) of Council Directive 93/43/EEC in these premises.

The following are the main findings of the bacteriological study:

- 99.8% (528/529), 100% (148/148) and 99.4% (342/344) of pre-cut fruit and vegetable samples were satisfactory for *Salmonella* spp., *E. coli* O157 and *L. monocytogenes* respectively.
- All of the sprouted seed samples were satisfactory for *Salmonella* spp., *E. coli* O157 and *L. monocytogenes*.
- All of the unpasteurised fruit juices samples were satisfactory for *Salmonella* spp., *E. coli* O157 and *L. monocytogenes*

Assessment for compliance with HACCP was carried out in 217 premises. 53% (115/217) of premises were fully compliant.

1. Introduction

The EC Scientific Committee for Food (SCF) in its *Risk Profile on the Microbiological Contamination of Fruits and Vegetables Eaten Raw* ⁽²⁾ reported that the incidence of foodborne illnesses associated with fruit and vegetables is increasing (however it is still low compared with foods of animal origin ^(2, 3)). Reasons cited for this increase include improved reporting, increased consumption, new commodities and changes in production practices ⁽²⁾.

One of the largest outbreaks associated with fresh produce occurred in Japan in 1996. This outbreak which was caused by *E. coli* O157 in radish sprouts resulted in the death of three children (11,000 people were affected and approximately 6,000 were culture confirmed) ⁽⁴⁾. In England and Wales, 5.5% of all foodborne outbreaks between 1992 and 2000 have been associated with salad vegetables and fruit ⁽⁵⁾. In Ireland there have been no reported foodborne outbreaks due to fresh produce, however, in 2001 salmonellae were detected in Irish mushrooms (no illnesses were reported)⁽⁶⁾.

Fruit and vegetables carry a natural non-pathogenic microflora, however, contamination with pathogens from human and/or animal sources can occur at various stages during growth, harvest, processing, handling, storage and transportation ⁽²⁾. It is well documented that microbiological hazards are associated with:

- the use of un-treated, improperly treated or re-contaminated manure during growth,
- the use of a contaminated water supply and
- poor hygiene practices throughout the fresh produce chain ⁽⁷⁾.

There are additional food safety concerns associated with processed (e.g pre-cut) fruit and vegetables. Cutting, slicing, skinning and shredding removes or damages the protective surfaces of the plant or fruit and thus increases the surface area which may become contaminated. It has been shown that exposing vegetables to various types of cutting can increase the microbial numbers six to seven fold ⁽⁸⁾.

Unpasteurised fruit juices and sprouted seeds have been identified by the European Commission Scientific Committee on Food (SCF) as products of microbiological concern ⁽²⁾. There is no microbial reduction step in the production process for unpasteurised juices and although both the acid concentration and the low pH of juices may be antagonistic towards the growth of most pathogenic bacteria, these factors alone do not ensure product safety. Some pathogens are acid tolerant ⁽⁹⁾ and their ability to survive has public health implications when their infective dose is low. Sprouted seeds are of microbiological concern because of the potential for pathogen growth during the sprouting process. If pathogens are present in or on the seed, the sprouting conditions (time, temperature, water activity, pH and nutrients) may encourage their growth and multiplication ⁽¹⁰⁾. Contaminated seed has been implicated as the most likely source for sprout associated outbreaks.

To date there is no Community legislation fixing specific microbiological criteria for fresh fruit and vegetables, although guidelines exist at national level ⁽¹¹⁾. However, under Council Directive 93/43/EEC ⁽¹²⁾ food business operators are required to produce food in a hygienic manner and to apply the principles of HACCP to ensure product safety (i.e. Regulation 4.2)^Y. Compliance with Regulation 4.2. of Council Directive 93/43/EEC was assessed in this survey.

This survey was undertaken as part of the EU coordinated programme for the official control of foodstuffs 2002 (Commission Recommendation 2002/66/EC ⁽¹⁾).

^Y Statutory Instrument No. 165 of 2000 ⁽¹³⁾ gives effect to Council Directive 93/43/EC

2. Specific Objectives

The objectives of this survey were two-fold:

- 1) To examine the bacteriological safety of
 - a) pre-cut fresh fruits & vegetables
 - b) sprouted seeds and
 - c) unpasteurised fruit & vegetable juices and
- 2) To assess compliance with the HACCP element (Regulation 4.2) of Council Directive 93/43/EEC (i.e. S.I. No. 165 of 2000) ⁽¹³⁾ in premises where the sampling took place.

3. Method

3.1 Microbiological Analysis

3.1.1 Sample Source

Samples were collected from both production establishments and retail premises. Retail premises included stalls and other temporary premises. In some cases the retail premises was also the site of production.

3.1.2 Sample Description

Samples for analysis included:

- a) Packaged ready-to-eat fresh fruits & vegetables that had been peeled, cut or otherwise physically altered from their original form and that were intended to be consumed raw.
- b) Sprouted seeds such as cress, mustard, alfalfa etc.
(Samples which contained a mixture of a) and b) were also accepted).
- c) Unpasteurised fruit & vegetable juices, in particular, apple and citrus juices.

The following products were specifically excluded:

- a) Fruits and vegetables which had not been physically altered (e.g. head of iceberg lettuce).
- b) Ready-to-eat fresh fruits and vegetables that had been mixed with a salad dressing,
- c) Fruit and vegetable smoothies (i.e. containing a yoghurt) and pasteurised fruit and vegetable juices.

3.1.3 Sample Collection and Analysis

Sampling was carried out by Environmental Health Officers (EHOs) from the 10 health boards (Appendix 1) from September to December 2002 inclusive. Samples were analysed in one of the seven Official Food Microbiology Laboratories (OFMLs – Appendix 2) using an approved/standard method. The bacteriological safety of the samples was determined using the guidelines specified in Table 1:

Table 1: Interpretation of results based on the Irish microbiological guidelines ⁽¹¹⁾

Parameter	Microbiological safety (cfu/g)			
	Satisfactory	Acceptable	Unsatisfactory	Unacceptable potentially hazardous
<i>Salmonella</i> spp.	Not detected in 25g	N/A	N/A	Detected in 25g
<i>E. coli</i> O157	Not detected in 25g	N/A	N/A	Detected in 25g
<i>L. monocytogenes</i> -Quantitative	<20	20-<100	N/A	≥100
<i>L. monocytogenes</i> -Qualitative	Not detected in 25g**			

** If *L. monocytogenes* is detected in 25g a quantitative test should be carried out to determine the microbiological quality of the sample

N/A: Not Applicable

3.2 Assessment of Compliance with the HACCP element (Regulation 4.2) of Council Directive 93/43/EEC

Regulation 4.2 of the European Communities (Hygiene of Foodstuffs) Regulations 2000 (S.I. 165 of 2000) ⁽¹³⁾ requires all food businesses to implement a food safety management system based on the principles of HACCP.

In this survey compliance with HACCP was assessed in 217 of the premises from which samples were obtained for bacteriological analysis. Information was captured by means of a questionnaire.

For the purposes of assessment, HACCP was divided into 3 sections as outlined in the FSAI guidance note on *Compliance with Regulation 4.2 of the European Communities (Hygiene of Foodstuffs) Regulations 2000* ⁽¹⁴⁾ :

- 1) identifying points critical to food safety (hazard analysis)
- 2) identifying and implementing food safety procedures (controlling CCPs)
- 3) review (verification)

The level of compliance (no evidence of compliance, commenced compliance, compliant) was determined for each section. Compliance in all three sections is necessary for total compliance with Regulation 4.2.

In premises compliant with HACCP, premises were also monitored to investigate if they had a documented hazard analysis system and a documented system for controlling CCPs (although such documentation is not required in the legislation). The availability of approved guides in these premises was also monitored.

4. Results and Discussion

4.1 Bacteriological Safety

4.1.1 General Survey Data

A total of 623 samples from the 10 health boards were analysed for one or more microbiological parameter (i.e. *Salmonella* spp., *E. coli* O157 or *L. monocytogenes*). The sample submission data from each health board is provided in Appendix 3.

Samples were obtained for each of the three categories – i.e. pre-cut fresh fruit & vegetables, sprouted seeds and unpasteurised fruit & vegetable juices (Table 2). Pre-cut fresh fruit & vegetables accounted for 84.9 % (n=529) of the samples, while unpasteurised fruit & vegetable juices accounted for only 10.8% (n=67) of the samples (unpasteurised fruit and vegetable juices are not common products in Ireland).

Table 2: Numbers of samples analysed in each category

Sample type	Number of samples analysed for one or more microbiological parameter (%)
Pre-cut fresh fruit & vegetables	529 (84.9) [♦]
Sprouted seeds	27 (4.3)
Unpasteurised fruit & vegetable juices	67 (10.8)
Total	623

[♦] One sample which contained both pre-cut fresh fruit & vegetables and sprouted seeds was included in this category.

Information on sample source (i.e. production/retail) was not required for this part of the survey; therefore no correlation could be made between sample type and source.

4.1.2 Bacteriological Safety of Pre-cut Fresh Fruit & Vegetables

A total of 529 samples of pre-cut fresh fruit & vegetables were analysed for 1 or more microbiological parameter. 529, 148 and 513 samples were analysed for the presence of *Salmonella* spp., *E. coli* O157 and *L. monocytogenes* respectively (Table 3).

Table 3: Incidence of pathogens in pre-cut fruit & vegetables ♦

Pathogens	No. of samples tested	Detected in 25g (%)	Not detected in 25g (%)
<i>Salmonella</i> spp. •	529	1 (0.2)	528 (99.8)
<i>E. coli</i> O157*	148	0 (0)	148 (100)
<i>L. monocytogenes</i>	513	21 (4.1)	492 (95.9)

♦ One sample which contained both pre-cut fresh fruit & vegetables and sprouted seeds was included in this category. This sample was analysed for each microbiological parameter.

• *S. diarizonae* was detected in spinach which was sampled in a retail premises in the SWAHB.

* *E. coli* O157 was analysed in labs with a level 3 containment facility – further details in Appendix 4.

E. coli O157 was not detected in any sample, *Salmonella* spp. (*S. diarizonae*) was detected in 0.2% (n=1/529) of samples and *L. monocytogenes* was detected in 4.1% (n=21/513) of samples. No more than 1 type of pathogen was detected in any sample.

L. monocytogenes was quantified in 344 of the 513 samples which were examined quantitatively (Table 4). Counts of <20cfu/g were recorded for 99.4% (n=342/344) of samples, counts in the range 20-<100cfu/g were recorded for 0.3% (n=1/344) of samples and a count ≥ 100cfu/g was also recorded for 0.3% (n=1/344) of samples (Table 4).

Table 4: Quantification of *L. monocytogenes*

No. of samples quantified (5)	cfu/g (%)		
	< 20	20 - < 100	≥ 100
344 (100)*	342 (99.4)	1 (0.3)	1 (0.3)♦

* These sample included 19 of the 21 samples in which *L. monocytogenes* was detected qualitatively [<20cfu/g (n=18); 20-<100cfu/g (n=1)]. Quantitative testes were not carried out on 2 samples in which *L. monocytogenes* was detected qualitatively.

♦ *L. monocytogenes* was detected at a level of 160cfu/g in a retail sample in the SHB.

Applying the FSAI microbiological guidelines for RTE foods (Table 1) ⁽¹¹⁾ to these data shows that 99.8% (n=528/529), 100% (n=148/148) and 99.4% (n=342/344) of samples were satisfactory for *Salmonella* spp., *E. coli* O157 and *L. monocytogenes* respectively (Table 5).

Table 5: Microbiological safety of pre-cut fresh fruit & vegetable samples

Pathogens	No. tested	Microbiological Safety		
		Satisfactory (%)	Acceptable (%)	Unacceptable/Potentially hazardous (%)
<i>Salmonella</i> spp.	529	528 (99.8)	N/A	1 (0.2)
<i>E. coli</i> O157	148	148 (100)	N/A	0 (0)
<i>L. monocytogenes</i>	344	342 (99.4)	1 (0.3)	1 (0.3)

N/A: Not Applicable

The presence of *Salmonella* spp. and *L. monocytogenes* at unacceptable/potentially hazardous levels is of concern as salmonellosis[∞] and listeriosis[♦] have serious implications for susceptible members of the population. The presence of *L. monocytogenes* is of particular concern as this pathogen is capable of growing under refrigerated conditions (i.e typical storage conditions).

The results of the UK study ⁽¹⁵⁾ which was carried out as part of this EU coordinated programme are presented in Table 6 and are compared with the Irish data. *Salmonella* spp. and *E. coli* O157 were not detected in samples tested in the UK. There was no significant difference (p<0.05) in the salmonellae results between the Irish and UK studies, however there was a significant difference (p<0.05) in the *L. monocytogenes* qualitative results (prevalence was lower in the Irish study).

Table 6: A comparison of UK and Irish studies

Pathogens	Study	Qualitative test (%)			Quantitative test cfu/g (%)			
		No. tested	D	ND	No	<20	20- <100	≥100
<i>Salmonella</i> spp.	Irish	529	1 (0.2)	528 (99.8)	N/A	N/A	N/A	N/A
	UK ⁽¹⁵⁾	997	0 (0)	997 (100)	N/A	N/A	N/A	N/A
<i>E. coli</i> O157	Irish	148	0 (0)	148 (100)	N/A	N/A	N/A	N/A
	UK ⁽¹⁵⁾	997	0 (0)	997 (100)	N/A	N/A	N/A	N/A
<i>L. monocytogenes</i>	Irish	513	21 (4.1)	492 (95.9)	344	342 (99.4)	1 (0.3)	1 (0.3)
	UK ⁽¹⁵⁾	997	78 (7.8)	833 (83.5)	78	76 (97.4)	1 (1.3)	1 (1.3)

D = Detected; ND = Not Detected; N/A = Not Applicable

[∞] Salmonellosis is the disease caused by *Salmonella* spp.

[♦] Listeriosis is the disease caused by *L. monocytogenes*

Similar results were obtained in an earlier UK study (2001) on the microbiological analysis of open ready-to-eat prepared salad vegetables from retail and catering premises. In that survey *Salmonella* spp. was not detected in any sample (n=2943), *E. coli* O157 was not detected in any sample (n=2820) and *L. monocytogenes* was quantified at a level > 100cfu/g in 0.03% (1/2807) of samples ⁽¹⁶⁾.

L. monocytogenes has also been detected in other studies on processed vegetables. An Australian study on psychrotrophic bacterial pathogens in minimally processed lettuce found *L. monocytogenes* to be present in 2.5% of samples (3/120), however enumerative studies were not carried out ⁽¹⁷⁾.

Currently there are no microbiological criteria for *L. monocytogenes* in RTE foods, however the European Commission is in the process of revising the existing criteria. The European Commission on Veterinary Measures relating to Public Health (SCVMPH) have indicated that a concentration of *L. monocytogenes* <100cfu/g at point of consumption could be considered to represent a low risk to consumers ⁽¹⁸⁾. In Ireland, the guidelines for *L. monocytogenes* in ready-to-eat food indicate that the presence of *L. monocytogenes* at a level >100cfu/g is unacceptable/potentially hazardous ⁽¹¹⁾. Risk studies on *L. monocytogenes* in ready-to-eat foods have been carried out by both the FDA/USDA ⁽¹⁹⁾ and the FAO/WHO ⁽²⁰⁾.

4.1.3 Bacteriological Safety of Sprouted Seeds

A total of 27 samples of sprouted seeds were analysed for 1 or more microbiological parameter. 27, 13 and 26 samples were analysed for the presence of *Salmonella* spp., *E. coli* O157 and *Listeria* spp. respectively (Table 7).

Table 7: Incidence of pathogens in sprouted seeds

Pathogens	No. of samples tested	Detected in 25g (%)	Not detected in 25g (%)
<i>Salmonella</i> spp.	27	0 (0)	27 (100)
<i>E. coli</i> O157	13	0 (0)	13 (100)
<i>L. monocytogenes</i>	26	1 (3.8)	25 (96.2)

L. monocytogenes was the only pathogen detected in sprouted seeds. This pathogen was detected in 3.8% of all samples tested (1/26). *L. monocytogenes* was quantified in 17 of the 26 samples examined qualitatively. The results are presented in Table 8. All samples quantified had a count < 20 cfu/g.

Table 8: Quantification of *L. monocytogenes*

No. of samples quantified	cfu/g (%)		
	< 20	20 - < 100	≥ 100
17*	17 (100)	0 (0)	0 (0)

* This included enumeration of the 1 sample in which *L. monocytogenes* was detected qualitatively.

Applying the FSAI microbiological guidelines for RTE foods (Table 1) ⁽¹¹⁾ to these data; shows that all samples tested were satisfactory for *Salmonella* spp., *E. coli* O157 and *L. monocytogenes* respectively (Table 9).

Table 9: Microbiological safety of sprouted seeds

Pathogens	No. tested	Microbiological safety		
		Satisfactory (%)	Acceptable (%)	Unacceptable/Potentially hazardous (%)
<i>Salmonella</i> spp.	27	27 (100)	N/A	0 (0)
<i>E. coli</i> O157	13	13 (100)	N/A	0 (0)
<i>L. monocytogenes</i>	17	17 (100)	0 (0)	0 (0)

N/A: Not Applicable

These results are quite encouraging considering the unique microbial food safety concern this product poses due to the ability of certain pathogens to multiply during germination and sprouting. Both *Salmonella* spp. and *E. coli* O157 have been shown to multiply rapidly during the sprouting process and both pathogens have been implicated in outbreaks of food poisoning associated with sprouted seeds ⁽¹⁰⁾. Regarding *L. monocytogenes*, the growth kinetics of the pathogen during the sprouting process are unknown, therefore it is not clear if the risk associated with sprouted seeds is greater than that associated with other fresh produce ⁽¹⁰⁾. Also no cases of listeriosis have been associated with sprouted seeds ⁽¹⁰⁾. However, the importance of *L. monocytogenes* as a pathogen cannot be dismissed due to its ubiquitous nature (it is widespread in nature and can be found in soil, foliage and the faeces of animals and human) and its ability to grow at refrigeration temperatures on a variety of produce.

The results of this survey are statistically comparable ($p < 0.05$) to the results of the UK study ⁽¹⁵⁾ which was carried out as part of this EU coordinated programme (Table 10).

Table 10: A comparison of UK and Irish studies

Pathogens	Study	Qualitative test (%)			Quantitative test cfu/g (%)			
		No. tested	D	ND	No tested	<20	20-<100	≥100
<i>Salmonella</i> spp.	Irish	27	0 (0)	27 (100)	N/A	N/A	N/A	N/A
	UK ⁽¹⁵⁾	808	0 (0)	808 (100)	N/A	N/A	N/A	N/A
<i>E. coli</i> O157	Irish	13	0 (0)	13 (100)	N/A	N/A	N/A	N/A
	UK ⁽¹⁵⁾	808	0 (0)	808 (100)	N/A	N/A	N/A	N/A
<i>L. monocytogenes</i>	Irish	26	1 (3.8)	25 (96.2)	17	17 (100)	0 (0)	0 (0)
	UK ⁽¹⁵⁾	808	28 (3.46)	780 (96.53)	28	27 (96.4)	0 (0)	1 (3.6)

D = Detected; ND = Not Detected; N/A = Not Applicable

4.1.4 Bacteriological Safety of unpasteurised fruit & vegetable juices

A total of 67 samples of unpasteurised fruit & vegetable juices were analysed for 1 or more microbiological parameter. All 67 samples were tested for both the presence of *Salmonella* spp. and *L. monocytogenes*, while 29 samples were tested for the presence of *E. coli* O157 (Table 11).

Table 11: Incidence of pathogens in unpasteurised fruit and vegetable juice

Pathogens	No. of samples tested	Detected in 25g (%)	Not detected in 25g (%)
<i>Salmonella</i> spp	67	0 (0)	67 (100)
<i>E. coli</i> O157	29	0 (0)	29 (100)
<i>L. monocytogenes</i>	67	0 (0)	67 (100)

Salmonella spp., *E. coli* O157 and *L. monocytogenes* were not detected in any sample of unpasteurised fruit and vegetable juice (Table 11). *L. monocytogenes* was quantified in 36 of the 67 samples analysed qualitatively. Colony counts of < 20 cfu/g were recorded for all samples.

Applying the FSAI microbiological guidelines for RTE foods ⁽¹¹⁾ to these data shows that all samples tested were satisfactory for *Salmonella* spp., *E. coli* O157 and *L. monocytogenes*.

Unpasteurised juices are favoured by the consumer because of their 'fresh flavour' characteristics (this characteristic is reduced in pasteurised juices). However, as stated in the introduction there are microbial hazards associated with this product. Considering this, the bacteriological results of this survey are encouraging and suggest that food safety control strategies are in place through out the food chain.

The findings of this study are comparable to the study carried out in the UK as part of this EU coordinated programme ⁽¹⁵⁾. In the UK study *Salmonella* spp. and *E. coli* O157 were not detected in any of the 291 samples examined, while *L. monocytogenes* was detected in 0.7% (n=2/291) of samples (Table 12). There was no significant difference (p<0.05) in the listeria qualitative results between the Irish and UK surveys.

Table 12: A comparison of Irish and UK studies

Pathogens	Study	Qualitative test (%)			Quantitative test cfu/g (%)			
		No. tested	D	ND	No. samples enumerated	<20	20- <100	≥100
<i>Salmonella</i> spp.	Irish	67	0 (0)	67 (100)	N/A	N/A	N/A	N/A
	UK ⁽¹⁵⁾	291	0	291	N/A	N/A	N/A	N/A
<i>E. coli</i> O157	Irish	29	0 (0)	29 (100)	N/A	N/A	N/A	N/A
	UK ⁽¹⁵⁾	291	0	291	N/A	N/A	N/A	N/A
<i>L. monocytogenes</i>	Irish	67	0 (0)	67 (100)	36	36 (100)	0 (0)	0 (0)
	UK ⁽¹⁵⁾	291	2 (0.7)	289 (99.3)	2	2 (100)	0 (0)	0 (0)

D = Detected; ND = Not Detected; N/A = Not Applicable

Not all surveys have found such encouraging results. In 1996 a survey was carried out on unpasteurised citrus juices from several processing facilities in Florida ⁽²¹⁾. This survey found that *E. coli* was present in detectable numbers (>0.3 MPN/ml) in 8 of the 43 samples (i.e. 18.6%). All the positive samples were obtained late in the harvesting season when conditions were warm and humid. The presence of *E. coli* is indicative of faecal contamination and is of concern because it indicates that other faecal contaminants may also be present (e.g. *Salmonella* spp., *E. coli* O157), although no direct link between the presence of *E. coli* and *E. coli* O157 has ever been shown.

4.2 Assessment of Compliance with the HACCP element (Regulation 4.2) of Council Directive 93/43/EEC ⁽¹²⁾

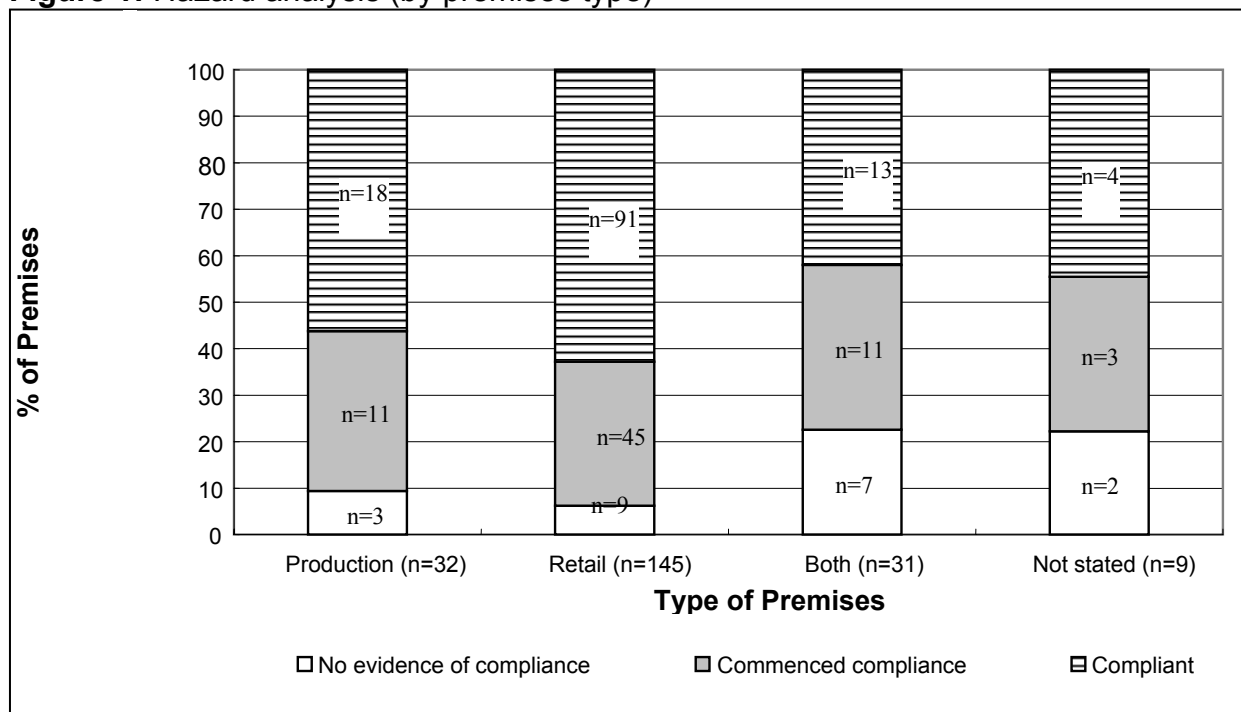
Compliance with HACCP was assessed in 217 premises where samples were obtained for bacteriological analysis (Table 13). Data on the number of assessments carried out in each health board are provided in Appendix 5.

Table 13: Business type assessed for HACCP compliance

Type of business	No. of premises assessed
Production	32
Retail	145
Retail premises where product is produced and sold on the site	31
Not stated	9
Total	217

In each business the level of compliance (no evidence of compliance, commenced compliance[♦], compliant) with assessed for each section of HACCP (hazard analysis, controlling CCPs and verification) (Figures 1-3):

Figure 1: Hazard analysis (by premises type)



[♦] The classification 'commenced compliance' refers to situations where (i) businesses are in the process of designing and/or implementing a system and where (ii) businesses have an operating system which does not, in the professional judgement of the EHO, ensure the safety of the food ⁽¹⁴⁾.

Figure 2: Controlling CCPs (by premises type)

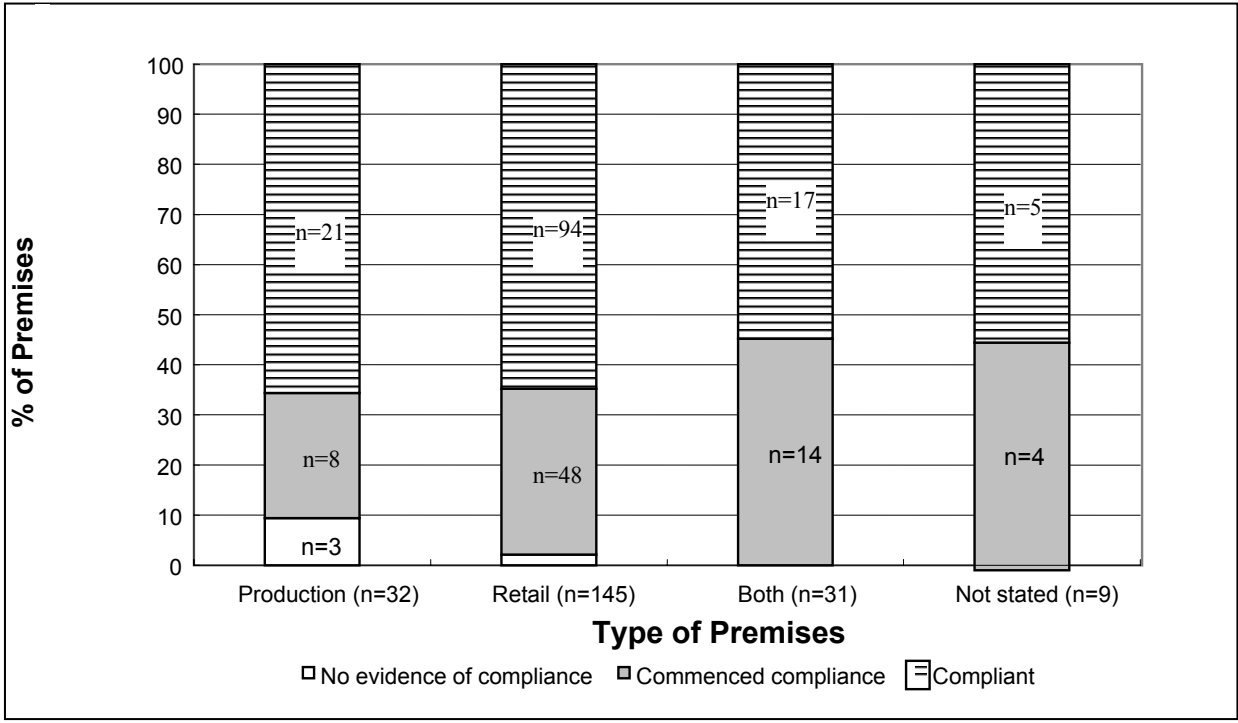
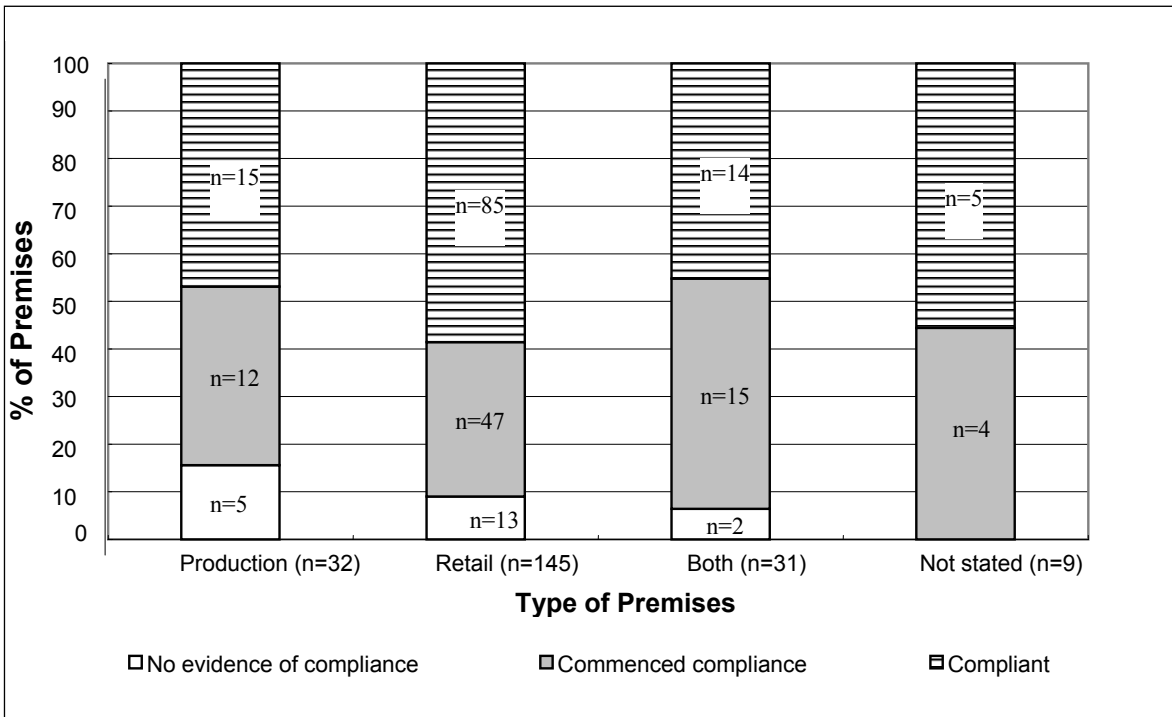


Figure 3: Verification (by premises type)



The overall level of compliance was determined for each premise. Of the 217 premises assessed for HACCP; 53% (n=115) were compliant with all 3 sections (Table 14).

Table 14: Overall level of compliance with HACCP (by premises type)

Premises Type	No. Assessed	Compliant* (%)
Production	32	14 (43.8)
Retail	145	84 (57.9)
Both	31	13 (41.9)
Not stated	9	4 (44.4)
Total	217	115 (53.0)

* Premises were categorised as 'compliant' if they were compliant with all 3 sections ⁽¹⁴⁾

It is worth noting that no correlation was made between compliance with HACCP and the bacteriological results as most of the samples tested were of a satisfactory quality.

Of the 115 premises compliant with HACCP, 94% (108/115) had a documented hazard analysis system in place, 96.5% (111/115) had documentation relating to the monitoring of critical control points and 92.2% (106/115) of premises had both sets of documents (Table 15).

Table 15: Documentation in premises compliant with HACCP (n=115)

Documentation	Number of premises with documentation (%)
Documents relating to Hazard Analysis	108 (94)
Documents relating to the monitoring of Critical Control Points	111 (96.5)
Documents relating to Hazard Analysis <i>and</i> Critical Control Points	106* (92.2)
Not stated	2 (1.7)

* Production premises (n=14), Retail premises (n=78), Retail & production premises (n=12) , Not stated (n=2)

Voluntary guides/standards are available to assist businesses in their legal obligation to comply with the HACCP element (Regulation 4.2) of Council Directive 93/43/EEC. The National Standards Authority of Ireland (NSAI) has published a number of these. Standards of relevance to the businesses assessed in this survey include IS341 ⁽²²⁾ which deals with hygiene in the food retailing and wholesaling industries and IS 342 ⁽²³⁾ which is a guide to good hygiene practice in the food

processing industry. Compliance with these standards is voluntary, but strongly recommended (compliance with the standards ensures compliance with Regulation 4.2 of Council Directive 93/43/EEC). In addition, the FSAI has published a code of practice for food safety in the fresh produce supply chain in Ireland ⁽⁷⁾. This is a guide to best practice in all sectors of the Irish fruit and vegetable industry which is designed to minimise the risk of food-borne illness resulting from the consumption of fresh fruit and vegetables.

The use of these guides/standards by the premises compliant with HACCP (n=115) was monitored. 64% (n=74/115) of premises had 1 or more guide available. IS 341, IS 342 and COP No. 4 were present in 51.3%, 13% and 10.4% of premises respectively (Table 16). IS 341 which is the standard relevant to the retail industry was available in 62% (52/84) of retail premises; in contrast IS 342 which is the standard relevant to the processing industry was only available in 14% (2/14) of production premises.

Table 16: Approved voluntary guides to good hygiene practice on-site at food businesses compliant with Directive 93/43/EEC (n=115)

Type of premises	No. of premises	IS 341	IS 342	COP No. 4	Other
Production	14	2	2	4	4
Retail	84	52	13	8	18
Both	13	3	0	0	2
Not stated	4	2	0	0	1
Total	115 [♦]	59 (51.3%)	15 (13%)	12 (10.4%)	25 (21.7%)

[♦] Of the 115 premises that complied with HACCP, 74 had one or more approved voluntary guides to good hygiene practices.

5. Conclusions

The success of any sector of the food chain is dependent on a number of factors including consumer confidence in product safety. The fresh produce sector plays a significant role in the Irish food industry and thus the stakes are high if consumer confidence falls. The significance of this sector is reflected at retail level where the value of fresh produce was estimated at 801.6m euro in 2002 (to December 2002). This represents an increase of 8.5% on 2001 sales figures ⁽²⁴⁾. Food safety is a shared responsibility and thus everyone involved in this food chain must play their part in safeguarding this food supply.

The findings that:

- all samples of sprouted seeds and all samples of unpasteurised fruit and vegetable juices were satisfactory for *Salmonella* spp., *E. coli* O157 and *L. monocytogenes* and that
- 99.8%, 100% and 99.4% of pre-cut fruit and vegetable samples were satisfactory for *Salmonella* spp., *E. coli* O157 and *L. monocytogenes* respectively are encouraging.

These findings suggest that food safety controls are in place in most premises, however, it is essential that industry does not become complacent about product safety as epidemiological data clearly show that food poisoning outbreaks occur if hygiene practices break down. In addition the infective dose of many of these pathogens is low.

Microbial contamination can occur at any stage from farm to fork, therefore, it is imperative that food safety controls are implemented throughout the food chain. The European Commission Scientific Committee on Food in its risk profile on the microbiological contamination of fruit and vegetables ⁽²⁾ eaten raw conclude that good agricultural practices (GAP) and good hygiene practices (GHP) are the basis for the safe production of fresh produce and that the application of HACCP is an integral part of these practices. In this survey, assessments on the implementation of HACCP showed that only 53% of premises inspected had fully implemented a HACCP plan, however, it is acknowledged that many businesses are currently in the process of HACCP implementation. Industry representatives are strongly advised to consult the voluntary industry guides which have been drawn up by a number of organisations to assist them in this role and to be particularly aware of the issues raised in the FSAI publication relating to food safety in the fresh produce supply chain in Ireland ⁽⁷⁾.

Recommended reading:

- National Standards Authority of Ireland. 1998. I.S. 341. Hygiene in Food Retailing and Wholesaling.
- National Standards Authority of Ireland. 1997. I.S. 342. Guide to Good Hygiene Practice for the Food Processing Industry in Accordance with Council Directive 93/43/EEC on the Hygiene of foodstuffs.
- National Standards Authority of Ireland. 2000. Food safety management incorporating hazard analysis and critical control point (HACCP).
- Food Safety Authority of Ireland. 2001. Code of Practice No. 4. Code of Practice for Food Safety in the Fresh Produce Supply Chain in Ireland.

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<http://www.tionestop.com/>

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Appendices

Appendix 1 List of Health Boards

Health board	Abbreviation
East-Coast Area Health Board	ECAHB
Midland Health Board	MHB
Mid-Western Health Board	MWHB
Northern Area Health Board	NAHB
North-Eastern Health Board	NEHB
North-Western Health Board	NWHB
South-Eastern Health Board	SEHB
Southern Health Board	SHB
South-Western Area Health Board	SWAHB
Western Health Board	WHB

Appendix 2 List of the Official Food Microbiology Laboratories (OFMLs)

Laboratory
Cherry Orchard Hospital
Mid-Western Regional Hospital
Public Analysts Laboratory, Dublin
Sligo General Hospital
St Finbarr's Hospital, Cork
University College Hospital, Galway
Waterford Regional Hospital

Appendix 3
Number of samples analysed from each health board for one or more microbiological parameter

Health board	No. of samples analysed for one or more microbiological parameter
ECAHB	31
NAHB	66
NEHB	41
SWAHB	63
MHB	47
SHB	95
WHB	63
MWHB	49
NWHB	83 [‡]
SEHB	85
TOTAL	623

[‡]A total of 91 samples were submitted from the NWHB, however 8 of these were unsuitable for analysis.

Appendix 4
Number of samples analysed from each health board for *E. coli* O157

Health Board	Number of samples tested for <i>E. coli</i> O157
ECAHB	15
NAHB	25
NEHB	41
SWAHB	24
SEHB	85
Total	190

Testing for *E. coli* O157 was only possible in laboratories with level 3 containment facilities, i.e. Cherry Orchard and Waterford. Samples from ECAHB, NAHB, NEHB and SWAHB were tested in Cherry Orchard. Samples from SEHB were tested in Waterford.

Appendix 5
Questionnaires returned from each health board

Health board	No. of samples	No. of questionnaires	No. of questionnaires with information on HACCP
ECAHB	31	26	15
NAHB	66	5	5
NEHB	41	26	12
SWAHB	63	33	32
MHB	47	13	11
SHB	95	34	14
WHB	63	29	13
MWHB	49	31	27
NWHB	83	40	31
SEHB	85	57	57
TOTAL	623	294	217