

3rd Trimester National Microbiological Survey 2005 (05NS3):

EU Coordinated programme 2005

Bacteriological Safety of Pre-packaged Mixed Salads

Table of Contents

Executive Summary	3
1. Introduction	4
2. Specific Objective	
3. Methods	6
3.1 Sample Source	6
3.2 Sample Description	6
3.3 Sample Collection	6
3.4 Sample Analysis	7
3.5 Reporting of results and Follow-up/enforcement action	7
3.6 Questionnaire data	7
3.7 Statistical analysis	7
4. Results and Discussion	8
4.1 Microbiological results	8
4.1.1 <i>Listeria monocytogenes</i>	8
4.1.2 <i>Salmonella</i> spp.	11
4.2 Questionnaire data	12
4.2.1 Sample source	12
4.2.2 Location of pre-packaging	12
4.2.3 Ingredients	13
4.2.4 Salad dressing	15
4.2.5 Organic salads	16
4.2.6 Storage temperatures	16
5. Conclusions	17
6. Bibliography	18
Appendices	20

Executive Summary

This survey was undertaken (September to November 2005) as part of the EU coordinated programme for 2005. Under this programme, each Member State was required to investigate the prevalence of *Listeria monocytogenes* in pre-packaged mixed raw vegetable salads containing meat, seafood or other ingredients at retail level. The prevalence of *Salmonella* spp. was also investigated in this Irish study. The following are the main findings:

- Samples were analysed both qualitatively (i.e. presence/absence test) and quantitatively for *L. monocytogenes*. Qualitative analysis (n=714 samples) showed that the pathogen was present in 19 samples (2.7%, 19/714). Quantitative analysis (n=715 samples) showed that the pathogen was present in 2 samples (0.3%, 2/715) at levels >100cfu/g (i.e. 400 and 1200 cfu/g).
- *Salmonella* spp. was not detected in any sample (n=714).

Sample information (e.g. sample source, location of pre-packaging, type of ingredients etc.) was captured via questionnaires which were completed at the time of sampling. Questionnaires were returned for 550 samples, i.e. there was a 76.9% response rate (550/715). The following were the main findings:

- 93.6% of samples were sourced in supermarkets, 65.1% were pre-packaged in manufacturing premises, 48.7% contained meat as the added ingredient and almost 75% contained salad dressing (e.g. mayonnaise, Caesar dressing, French dressing).
- Samples were stored at temperatures ranging from -1°C to 15.9°C. Of particular concern was the finding that 23.8% (131/550) samples were stored at temperatures >5°C (salads should be stored under refrigerated conditions, i.e. at ≤ 5°C). This finding raises concern as maintenance of the cold chain is essential to prevent microbial growth (this is particularly important for pathogens such as *L. monocytogenes* which are capable of growing at low temperatures and have a low infective dose, i.e. >100cfu/g). In addition, maintenance of the cold chain is now a legal requirement under Article 4 of Regulation 852/2004 on the Hygiene of Foodstuffs.

1. Introduction

Dietary trends and consumer demand for convenience foods have led to an increase in the availability of ready-to-eat foods such as pre-packaged salads. These are diverse products which may contain both raw (e.g. salad vegetables) and cooked (e.g. meat, seafood, pasta, egg) ingredients. The raw salad vegetables play an important role in determining the microbiological status of the overall product as they are not exposed to any microbial reduction step (e.g. heat treatment) prior to consumption.

The microflora of raw fruit and vegetables may consist of both non-pathogenic and pathogenic microorganisms. Contamination with pathogens may occur during growth, harvest, handling, storage and transportation ⁽¹⁾. Additional food safety concerns are associated with processing. Cutting, slicing, skinning and shredding removes or damages the protective surfaces of fruit and vegetables thus increasing the surface area which may become contaminated. Research has shown that exposing vegetables to various types of cutting can increase the microbial numbers six to seven fold ⁽²⁾.

Strategies to control the microbiological hazards associated with fruit and vegetables must be undertaken at all stages of the food chain, i.e. from farm to fork. The European Commission Scientific Committee on Food in its risk profile on the microbiological contamination of fruit and vegetables eaten raw ⁽¹⁾ 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 some situations the inclusion of a decontamination step such as the chlorination of water is considered appropriate.

Raw salad vegetables have been implicated as vehicles of infection in many outbreaks of foodborne illness ^(3, 4, 5). Contaminated raw salad vegetables are of particular concern in salads containing cooked ingredients. These products have a high nutrient and moisture content and if temperature abused can readily support microbial growth.

Listeria monocytogenes and *Salmonella* spp. are pathogens of particular concern. *L. monocytogenes* is ubiquitous in the environment and is present in many raw foods including fruit and vegetables. The presence of this pathogen in ready-to-eat (RTE) foods raises concern as it is capable of proliferating under refrigerated temperatures (i.e. the typical storage temperatures for pre-packaged salads). Levels of *L. monocytogenes* >100cfu/g at the point of consumption is considered to represent a risk to consumers ⁽⁶⁾ (i.e. it can cause listeriosis[‡] in susceptible members of the population). Salmonellae are bacterial pathogens which reside in the intestinal tract of infected animals and humans and are shed in the faeces. They are one of the most common causes of foodborne illness (salmonellosis is the disease caused by *Salmonella* spp.). Foods including those of animal origin (e.g. dairy products, meat and eggs) and those subject to faecal contamination (e.g. fruit, vegetables, meat) have been implicated as vehicles in the transmission of this pathogen to humans ⁽⁷⁾. In Ireland, 419 clinical isolates of *Salmonella enterica* were

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

referred to the National Salmonella Reference Laboratory in 2004 (crude incidence rate of 10.6 cases per 100,000) ⁽⁸⁾.

At the time of this survey microbiological criteria were not specified in legislation for pre-packaged mixed salads; however, *Commission Regulation (EC) No. 2073/2005 on Microbiological Criteria for Foodstuffs* ⁽⁹⁾ which has been in force since the 1st January 2006 lays down process hygiene criterion for *E. coli* and food safety criterion for *Salmonella* spp. in pre-cut fruit and vegetables. In addition, the Regulation lays down a food safety criterion for *L. monocytogenes* in all RTE foods (levels must not exceed 100cfu/g throughout the shelf life of the product).

This study was undertaken as part of the EU coordinated programme for 2005 (Commission Recommendation 2005/175/EC) ⁽¹⁰⁾.

2. Specific Objectives

The aim of this study as specified in Commission Recommendation 2005/175/EC ⁽¹⁰⁾ was to investigate the prevalence of *Listeria monocytogenes* in pre-packaged mixed raw vegetable salads containing meat, seafood or other ingredients. This Irish study also investigated the prevalence of *Salmonella* spp. in these products.

3. Method

3.1 Sample Source

Samples were obtained from retail premises including supermarkets, grocery shops and corner shops. All other premises including restaurants, caterers, hotels, canteens, manufacturing premises etc. were excluded.

3.2 Sample Description

The following samples were obtained:

Pre-packaged mixed raw vegetable salads containing meat, seafood or other ingredients (e.g. pasta, rice, noodles, egg, cheese) which:

- Required cold storage
- Were intended to be eaten without heat treatment.

Pre-packaged mixed salads which are labelled as organic were also sampled.

The following were specifically excluded:

- Salads which were packaged upon customer request (e.g. salads from deli counters)
- Leafy salads containing salad dressing only as the added ingredient (e.g. mediterranean salad)
- Vegetables containing mayonnaise only as the added ingredient (e.g. coleslaw, potato salad)
- Tinned products e.g. tuna salad
- Fruit salads

3.3 Sample Collection

Sampling was undertaken by Environmental Health Officers (EHOs) from the Health Service Executive (HSE) during September, October & November 2005. In each premises, EHOs obtained no more than one sample of each product from each manufacturer (sample weight = 150g). However, if difficulties were encountered obtaining samples, more than one sample was permitted provided they were from different production batches.

At the time of sampling EHOs measured the temperature of the storage unit and recorded the temperature on the questionnaire provided (see Appendix 1). Sections 1-4 of the questionnaire were completed at the time of sampling.

3.4 Sample Analysis

Analysis was undertaken in the HSE Official Food Microbiology Laboratories (OFMLs). Samples were analysed for *Listeria monocytogenes* (both qualitative and quantitative) and *Salmonella* spp.

3.5 Reporting of results and Follow-up/enforcement action

Reporting of laboratory results:

The OFMLs reported the microbiological results to the FSAI and the relevant EHO.

Follow-up/enforcement action:

EHOs were advised to undertake follow-up action on samples with the following results:

- presence of *L. monocytogenes* at levels exceeding 100cfu/g
- presence of *Salmonella* spp.

3.6 Questionnaire data

Upon receipt of the laboratory results, EHOs completed section 5 and 6 of the questionnaire (Appendix 1). These questionnaires were completed and returned to the FSAI within 2 months of the survey completion date. Questionnaires were returned for 76.9% (550/715) of samples.

3.7 Statistical analysis

Results were analysed at a 95% confidence interval using the Z-test for two proportions.

4. Results and Discussion

4.1 Microbiological results

A total of 715 samples submitted from the 10 HSE areas were analysed in the 7 OFMLs (Appendices 2 & 3).

4.1.1 *Listeria monocytogenes*

Samples were analysed both qualitatively (i.e. presence/absence test) and quantitatively for *L. monocytogenes* (Tables 1, 2 & Appendix 4).

Qualitative analysis (Table 1) was carried out on 714 pre-packaged mixed salad samples and *L. monocytogenes* was detected in 2.7% (19/714) of samples.

Table 1: Qualitative results for *L. monocytogenes* (i.e. presence/absence) in pre-packaged mixed salad

Number of samples (%)		
<i>L. monocytogenes</i> absent in 25g	<i>L. monocytogenes</i> present in 25g	Total
695 (97.3)	19 (2.7)*	714

* *L. monocytogenes* was detected in mixed salad samples containing meat (n=9), pasta (n=4), fish (n=2), cheese (n=2), other ingredients (n=4). Please note that some salads contained more than one of these ingredients, e.g. 1 salad contained meat and cheese.

Quantitative analysis (Table 2) was carried out on 715 samples (this included the 19 samples in which *L. monocytogenes* was detected qualitatively). *L. monocytogenes* was present in 2 samples (0.3%, 2/715) at levels >100cfu/g (i.e. 400 and 1200 cfu/g). *L. monocytogenes* levels exceeding 100cfu/g in ready-to-eat food represent a risk to consumer health ⁽⁶⁾.

Table 2: Quantitative results for *L. monocytogenes* in pre-packaged mixed salads

Number of samples (%)			
<20 cfu/g [®]	20-100cfu/g	>100cfu/g	Total
713 (99.7)	0 (0)	2 (0.3) *	715

[®] OFMLs used a limit of detection of either 10 or 20cfu/g for the quantification of *L. monocytogenes*. More detailed information is provided in Appendix 4.

* Counts of 400 and 1200 cfu/g were recorded for these 2 samples

Details of the 2 samples containing *L. monocytogenes* at levels >100cfu/g are provided in Table 3 (these details were provided on the questionnaires).

Table 3: Details of pre-packaged mixed salad samples with *L. monocytogenes* counts >100cfu/g (n=2) [⊕]

Sample No.	Description	Storage temperature	Period of time to use-by date	Location of packaging	<i>L. monocytogenes</i> count
1	Ham & cheese salad bowl	4°C	2 days	N/S	400
2	Roast beef salad	4°C	136 days *	Retail premises	1200

[⊕] Both salads were sampled from supermarkets

* Further investigation revealed that this product was labelled with the wrong use-by date.

N/S: Not Stated

It is worth noting that both salads contained meat; however, this was not statistically significant ($p=0.05$).

The presence of *L. monocytogenes* at levels >100cfu/g resulted in follow-up action being taken by the relevant EHO.

Follow-up action taken on sample 1: The product was recalled from the market. A repeat sample was taken and *L. monocytogenes* was detected but at a lower level (<10cfu/g) than the original sample. An inspection of the manufacturing premises was also undertaken.

Follow-up action taken on sample 2: The product was no longer available at retail level therefore it was not possible to initiate a product recall or test a repeat sample. However, the ingredients typically used to manufacture this product were tested and *L. monocytogenes* was not detected in any ingredient. An inspection of the retail premises was also undertaken and this highlighted problems with handling practices, hygiene practices, temperature control and labelling of the product with incorrect use-by dates. Improvements were undertaken at retail level and these improvements were confirmed in subsequent inspections.

The findings of other surveys are summarised in Table 4. A statistical comparison ($p=0.05$) of the results of this study with the UK study ⁽¹¹⁾ (which was also undertaken as part of the EU coordinated programme for 2005) showed that there is no significant difference in the prevalence of positive samples; however, there is a significant difference in the number of samples with *L. monocytogenes* counts >100cfu/g. In the UK study, *L. monocytogenes* was detected in 4.8% (130/2686) of samples. It was detected in 6.0% (76/1268) of mixed raw vegetable salads containing meat and in 3.8% (54/1418) mixed raw vegetable salads containing seafood. Two salads (0.07%, 2/2686) contained the

pathogen at a level >100cfu/g (both of these salads contained meat). In other studies ^(12, 13, 14) the prevalence of *L. monocytogenes* at levels >100cfu/g ranged from 0 to 4.7%.

Table 4: *L. monocytogenes* in mixed salads: A comparison with other studies

Location of study	Year of study	Type of product	Qualitative test		Quantitative test
			No. of samples	No. positive for <i>L. monocytogenes</i>	No. of samples with <i>L. monocytogenes</i> count >100cfu/g
UK ⁽¹¹⁾	2005	Mixed salad with meat	1268	76 (6.0%)	2 (2/1268 = 0.16%) [†]
		Mixed salad with seafood	1418	54 (3.8%)	0 (0%)
		Overall	2686	130 (4.8%)	2 (2/2686 = 0.07%) [†]
Wales ^{‡ (12)}	1995-2003	Prepared mixed salads	224	0	N/A
United States ^{‡ (13)}	2003 [⊗]	Deli salads	8549	202 (2.4%)	1 (1/8549=0.01%) [∅]
		Seafood salads	2446	115 (4.7%)	2 (2/2446 = 0.08%) *
England & Wales ^{‡ (14)}	1993	Mixed salads	923	18 (2.0%)	N/S
Ireland (this study)	2005	Mixed salads	715	19 (2.7%)	2 (2/715=0.28%) *

[‡] These studies do not state if the salads were pre-packaged

[⊗] this is the year the article was published, the date of the study was not provided

[†] $10^2 - <10^3$ (n=2)

[∅] $>10^3 - 10^4$ (n=1)

* $>10^2 - 10^3$ (n=2)

* $>10^2 - 10^3$ (n=1); $>10^3 - 10^4$ (n=1)

4.1.2 *Salmonella* spp.

A total of 714 samples were tested for *Salmonella* spp. This pathogen was not detected in any sample (Table 5 & Appendix 5).

Table 5: Results for *Salmonella* spp. (presence/absence) in pre-packaged mixed salads

No. (%) of samples		
<i>Salmonella</i> spp. absent	<i>Salmonella</i> spp. present	Total
714 (100)	0 (0)	714

Similarly in a UK study undertaken in 1993 ⁽¹⁴⁾, salmonellae were not detected in any prepared mixed salads (n=923).

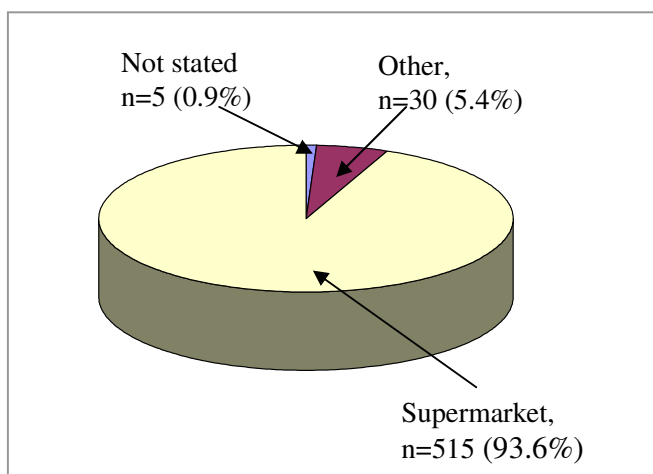
4.2 Questionnaire data

Information on a variety of parameters such as sample source, sample description & storage temperature was captured by means of a questionnaire (Appendix 1). Questionnaires were returned for 550 samples, i.e. 76.9% (550/715) response rate. This section of the report summarises the data received.

4.2.1 Sample source:

The majority of mixed salads (93.6%, 515/550) were sourced in supermarkets (Figure 1). 'Other' sample sources (n=30) included service stations (6/30), coffee shops (3/30) and delicatessens (2/30).

Figure 1: Sample source (n=550 salads)



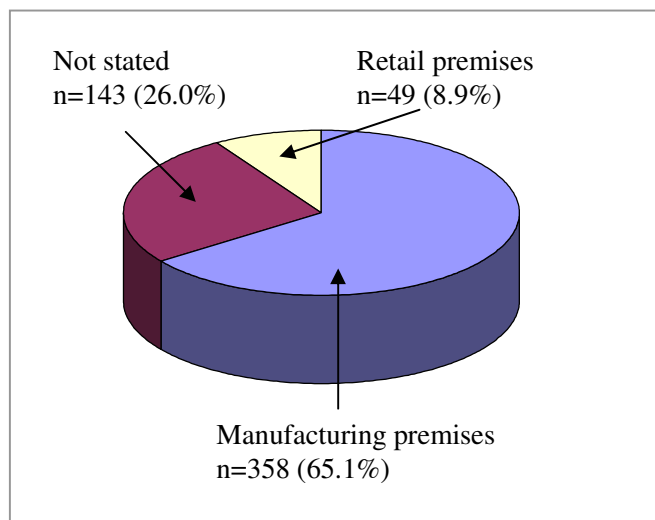
In this study *L. monocytogenes* was detected in 19 samples. Questionnaires were returned for 9 of these samples. All 9 samples were sourced in supermarkets (this included the two samples with *L. monocytogenes* counts >100cfu/g).

4.2.2 Location of pre-packaging:

The majority (65.1%, 358/550) of the mixed salads were pre-packaged at manufacturing level and 8.9% (49/550) were pre-packaged in the retail premises where they were sampled (Figure 2).

Information on the location of pre-packaging was provided for 8 of the 19 samples containing *L. monocytogenes*. Five of these samples were pre-packaged in manufacturing premises and 3 were packaged in the retail premises where they were sampled. One of the samples packaged in the retail premises contained *L. monocytogenes* at levels >100cfu/g. Information on the location of packaging was not provided for the other sample containing *L. monocytogenes* at levels > 100cfu/g.

Figure 2: Location of packaging (n=550 salads)



4.2.3 Ingredients:

There was much diversity in the type of ingredients used in the pre-packaged mixed salad (Table 6). In addition to the raw salad vegetables, almost half of the salads (48.7%) contained meat and almost a quarter (23.4%) contained pasta. Other ingredients included eggs, cheese and fish.

Table 6: Type of ingredient mixed with the raw salad vegetables (n=550 salads)

Ingredient	Number of salads containing this ingredient	% of salads containing this ingredient
meat	268	48.7
pasta	129	23.4
eggs	103	18.7
cheese	88	16.0
fish	81	14.7
rice	31	5.6
noodles	9	1.6
Other *	4	0.7
N/S	10	1.8

* **Other:** Cous cous (n=2), Cooked bulgar wheat (n=1), Quiche (n=1)

Note: Some salads contained more than 1 ingredient, e.g. 67 of the 550 salads contained both meat & pasta.

Details of meat and fish types are detailed in Tables 7 & 8 respectively. Chicken was the most common meat and tuna was the most common fish.

Table 7: Types of meat

Type of meat	Number of salads containing meat	% of salads containing meat
Chicken	128	47.8
Ham	75	28.0
Bacon	27	10.1
Chicken & Bacon	18	6.7
Beef	5	1.9
Ham & Turkey	4	1.5
Turkey	1	0.4
N/S	10	3.7
Total	268	100

N/S: Not Stated

Table 8: Types of fish

Type of fish	Number of salads containing fish	% of salads containing fish
Tuna	50	61.7
Prawns	26	32.1
Salmon	3	3.7
Crab	1	1.2
N/S	1	1.2
Total	81	100

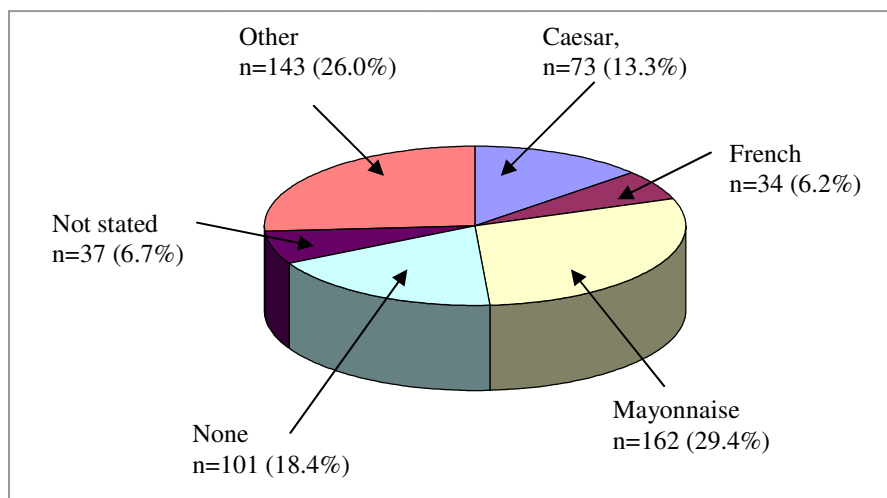
N/S: Not Stated

In this study, *L. monocytogenes* was detected in mixed salad samples containing meat (n=9), pasta (n=4), fish (n=2), cheese (n=2), other ingredients (n=4) (some salads contained more than one of these ingredients, e.g. 1 salad contained meat and cheese). Both salads with *L. monocytogenes* at levels >100cfu/g contained meat.

4.2.4 Salad dressing:

The mixed salads contained a wide variety of dressings including mayonnaise (29.4%, 162/550), caesar (13.3%, 73/550) and french (6.2%, 34/550) dressing (Figure 3). 50.7% (279/550) of dressings were pre-mixed with the salad; while, 19.1% (105/550) were provided in a separate package (this type of information was not provided for 30.2% (166/550) of samples).

Figure 3: Type of salad dressing (n=550 salads)



In this study *L. monocytogenes* was detected in 19 samples. Questionnaires were returned for 9 of these samples and these data revealed that 2 samples contained caesar dressing, 2 contained french dressing, 3 contained mayonnaise and 2 contained no dressing. The dressings were pre-mixed with 5 of these salads.

Salad dressings are generally acidic in nature and studies have been carried out to investigate their effect on the survival and growth of *L. monocytogenes*. The FDA reported in their 'risk assessment on the risk to public health from foodborne *L. monocytogenes* among selected categories of RTE food' that populations of *L. monocytogenes* decrease in salads made by food processors where sufficient acidity and the addition of preservatives create a hostile environment. They also report that salads made fresh in retail establishments typically do not contain preservatives and could support the growth of *L. monocytogenes* ⁽¹⁵⁾.

4.2.5 Organic salads:

In this study only one sample (0.2%, 1/550) was labelled as organic (Table 9). *L. monocytogenes* was not detected in this sample. Food is labelled as organic if it has been produced on a farm certified as organic and inspected by official certification bodies. In Ireland, organic food constitutes a relatively small but growing part of the food supply ⁽¹⁶⁾.

Table 9: Details regarding the organic nature of the sample

Was the sample labelled as organic?	No. of samples	% of samples
No	549	99.8
Yes	1	0.2
total	550	100

4.2.6 Storage temperatures:

Samples were stored at temperatures ranging from -1°C to 15.9°C (Table 10). Of particular concern was the finding that 23.8% (131/550) samples were stored at temperatures > 5°C (salads should be stored under refrigerated conditions, i.e. at ≤ 5°C). This finding raises concern as maintenance of the chill chain is essential to prevent/minimise microbial growth (this is particularly important for pathogens such as *L. monocytogenes* which are capable of growing at low temperatures and have a low infective dose, i.e. >100cfu/g). In addition, maintenance of the cold chain is now a legal requirement under Article 4 of Regulation 852/2004 on the Hygiene of Foodstuffs ⁽¹⁷⁾.

Table 10: Storage temperatures

No. of samples	Temperature range of storage unit (°C)	No. (%) of samples stored at the following temperatures		
		≤ 5°C	> 5°C	N/S
550	-1°C to 15.9°C	400 (72.7%)	131* (23.8%)	19 (3.5%)

* >5 - ≤ 6 (n=50); >6-≤ 7 (n=26), >7-≤ 8 (n=13), >8 (n=38), >5 (n=4)

N/S: Not Stated

In this study storage temperatures were provided for 9 of the 19 samples containing *L. monocytogenes*. Six of these samples were stored at ≤ 5°C and 3 samples were stored at >5°C. The two samples with *L. monocytogenes* counts >100cfu/g were stored at 4°C.

5. Conclusions

In this study *L. monocytogenes* was detected in 2.7% (19/715) of samples and was present at levels >100cfu/g in 0.3% (2/715) of samples. *Salmonella* spp. was not detected in any sample (n=714). While these findings are encouraging it is imperative that the food industry does not become complacent as both pathogens can cause serious illnesses in susceptible members of the population.

Compliance with temperature control requirements and maintenance of the cold chain is a legal requirement for all food business operators. RTE foods such as salads should be stored under refrigerated conditions (i.e. $\leq 5^{\circ}\text{C}$); however, this study revealed that 23.8% (131/550) of samples were stored at temperatures $>5^{\circ}\text{C}$. This finding is unacceptable.

Refrigeration is necessary to prevent/minimise microbial growth; however, refrigeration alone cannot be relied upon to ensure product safety (this is particularly true for psychrotrophic pathogens such as *L. monocytogenes*). Strategies to avoid and control contamination must be implemented at all stages of the food chain, i.e. from farm to fork. These strategies have been briefly discussed in the introduction to this report.

6. Bibliography

1. European Commission Scientific Committee on Food. 2002. Risk profile on the microbiological contamination of fruits and vegetables eaten raw.
http://europa.eu.int/comm/food/fs/sc/scf/out125_en.pdf
2. Garg, N., Churey, J.J. and Splittstoesser, D.F. 1990. Effect of processing conditions on the microflora of fresh-cut vegetables. *Journal of Food Protection*, **53**, (8), 701-703.
3. Ministry of Health and Welfare of Japan, National Institute of Infectious diseases and infectious disease control division. 1997. Verocytotoxin producing *Escherichia coli* (enterohaemorrhagic *E. coli*) infection, Japan, 1996-June 1997. *Infectious Agents Surveillance Report*, **18**, 153-154
4. Long, S.M., Adak, G.K., O'Brien, S.J. and Gillespie, I.A. 2002. General outbreaks of infectious intestinal disease linked with salad vegetables and fruit, England and Wales, 1992-2000. *Communicable Disease and Public Health*, **5**, (2), 101-105
5. Sivapalasingam, S., Friedman, C.R., Cohen, L. and Tauxe, R.V. 2004. Fresh produce: A growing cause of outbreaks of foodborne illness in the United States, 1973 through 1997. *Journal of Food Protection*. **67**, 2342-2353
6. European Commission. 1999. Opinion of the Scientific Committee on Veterinary Measures Relating to Public Health on *Listeria monocytogenes*.
http://europa.eu.int/comm/food/fs/sc/scv/out25_en.html
7. International Commission on Microbiological Specifications for Foods. 1996. Salmonellae. P 217-264. In *Micro-Organisms in Foods. 5. Characteristics of Microbial Pathogens*. Roberts, T.A., Baird Parker, A.C. and Tompkin, R.B. eds. Blackie Academic & Professional, London.
8. Health protection Surveillance Centre. 2004. Annual report of the HPSC 2004.
<http://www.ndsc.ie/hpsc/AboutHPSC/AnnualReports/File,1438,en.pdf>
9. Commission Regulation (EC) No 2073/2005 of 15 November 2005 on microbiological criteria for foodstuffs (OJ L338, p1, 22/12/2005).
http://www.fsai.ie/legislation/legislation_update/2005/Dec05/Reg2073_2005.pdf
10. European Commission. Commission Recommendation of 1 March 2005 concerning a coordinated programme for the official control of foodstuffs for 2005 (2005/175/EC, OJ L 59, p.27, 5/3/2005).
http://eur-lex.europa.eu/LexUriServ/site/en/oj/2005/l_059/l_05920050305en00270039.pdf
11. Little, C.L., Taylor, F. and Sagoo, S.K. European Commission programme for the Official Control of Foodstuffs for 2005: Bacteriological safety of pre-packaged mixed salads from retail premises for *Listeria monocytogenes*.
<http://www.food.gov.uk/multimedia/pdfs/prepackagedmixedsaladreport.pdf>
12. Meldrum, R.J., Ribeiro, C.D., Smith, R.M.M., Walker, A.M., Simmons, M., Worthington, D. and Edwards, C. 2005. Microbiological quality of ready-to-eat foods: Results from a long-term surveillance program (1995-2003). *Journal of Food Protection*. **68**, 8, 1654-1658
13. Gombas, D.E., Chen, Y., Calvero, R.S. and Scott, V.N. 2003. Survey of *Listeria monocytogenes* in ready-to-eat foods. *Journal of Food Protection*. **66**, 4, 559-569

14. Nichols, G.L., Little, C.L., Monsey, H.A and de Louvois, J. The microbiological quality of ready-made foods. An analysis of the results from the 1993 European Community Coordinated Food Control Programme for England and Wales.
15. FDA/USDA. 2003. Quantitative Assessment of Relative Risk to Public Health from Foodborne *Listeria monocytogenes* Among Selected Categories of Ready-to-Eat Foods. <http://www.foodsafety.gov/~dms/lmr2-toc.html>
16. Food Safety Authority of Ireland. 2004. Organic Foods leaflet. http://www.fsai.ie/publications/leaflets/organic_leaflet.pdf.
17. European Commission. Regulation (EC) No 852/2004 of the European parliament and of the Council of 29 April 2004 on the Hygiene of Foodstuffs (OJ L226/3, 25/06/2004).
http://www.fsai.ie/legislation/food/eu_docs/Food_hygiene/Reg852_2004.pdf

APPENDIX 1

Questionnaire 04NS3: Bacteriological safety of pre-packaged mixed salads

Please note: 1) EHOs must complete this questionnaire for all samples, 2) all questions are mandatory & 3) all questionnaires must be returned to the FSAI by 31/01/06

1) General Information:

- * EHO Name: _____
- * EHO Sample Reference Number (i.e. EHO's own personal reference number for the sample): _____
- * Laboratory Reference Number (upon receipt of lab report): _____

2) **Sample source** (see section 3 of protocol): Supermarket ☐; Other (Please specify) _____

3) Sample description (see section 6 of protocol):

Please indicate the type of ingredient mixed with the raw salad vegetables (tick as many boxes as necessary):

- 1) Meat ☐ (Please indicate the type of meat: Ham ☐, Chicken ☐, Bacon ☐, Beef ☐, Other: _____)
- 2) Fish ☐ (Please indicate the type of fish: Salmon ☐, Prawns ☐, Tuna ☐, Other: _____)
- 3) Pasta ☐, 4) Rice ☐, 5) Noodles ☐, 6) Eggs ☐, 7) Cheese ☐, 8) Other _____

Please indicate the type of salad dressing:

- None ☐, Mayonnaise ☐, French dressing ☐, Caesar dressing ☐, Other _____
- Was the dressing: (i) Premixed with the salad - Yes ☐ or (ii) Provided in a separate package (e.g. in a sachet) - Yes ☐

4) Sample information:

- Product name (exactly as recorded on label): _____
- Brand name / manufacturer: _____
- Was the sample packaged in the retail premises (Yes ☐) or in the manufacturing premises (Yes ☐)?
- Is there a batch number? Yes ☐ or No ☐ If yes please specify _____
- Is there a plant number? Yes ☐ or No ☐ If yes please specify _____
- Is there a use-by date? Yes ☐ or No ☐ If yes please specify _____
- Is the sample labelled as organic? Yes ☐ or No ☐
- Temperature of storage unit (temperature measured by EHO, see section 7 of protocol): _____ °C

5) Bacteriological Results (See section 10 of protocol):

Qualitative results (please tick the appropriate boxes)

Microorganism	Detection in 25g	
	Absence	Presence
<i>Salmonella</i> spp.		
<i>L. monocytogenes</i>		

Quantitative results (please tick the appropriate box):

Organism	Enumeration cfu/g			
	<10	10-99	100-999	≥1000
<i>L. monocytogenes</i>				

6) Follow up/Enforcement Action (see section 11 of protocol, Please tick as many boxes as necessary):

- None ☐; Verbal warning ☐; Written warning ☐; Improved in house control required ☐; Product recall ☐; Repeat sample ☐ (lab ref. no. of repeat sample: _____),
- Other (Please specify) _____

APPENDIX 2

No. of samples submitted from each Health Service Executive Region

HSE Region	HSE Area	Number of samples submitted
HSEDMLR	East Coast Area	57
	Midlands Area	27
	South Western Area	95
HSEDNER	North Eastern Area	36
	Northern Area	84
HSESR	South Eastern Area	154
	Southern Area	90
HSEWR	Mid-Western Area	53
	North Western Area	60
	Western Area	59
Grand Total		715

APPENDIX 3

No. of samples analysed in each Official Food Microbiology Laboratory (OFML)

OFML	No. of samples analysed in each OFML
Cherry Orchard	183
Cork	90
Galway	59
Limerick	53
Sligo	60
SPD	116
Waterford	154
Total	715

APPENDIX 4

Qualitative results – *L. monocytogenes*

HSE Area	Number of samples		
	<i>L. monocytogenes</i> present	<i>L. monocytogenes</i> absent	Total
East Coast Area	2	55	57
Midlands Area	0	27	27
Mid-Western Area	3	50	53
North Eastern Area	0	36	36
North Western Area	3	57	60
Northern Area	3	81	84
South Eastern Area	3	151	154
South Western Area	2	93	95
Southern Area	1	88*	89
Western Area	2	57	59
Grand Total	19	695	714

* 1 sample from the Southern Area HSE area was not tested qualitatively for *L. monocytogenes*

Quantitative results – *L. monocytogenes*

HSE Area	Number of samples			
	<10 cfu/g	<20 cfu/g	>20 cfu/g	Total
East Coast Area	37	20	0	57
Midlands Area	27	0	0	27
Mid-Western Area	53	0	0	53
North Eastern Area	0	36	0	36
North Western Area	59	0	1	60
Northern Area	36	48	0	84
South Eastern Area	154	0	0	154
South Western Area	16	79	0	95
Southern Area	88	2	0	90
Western Area	58	0	1	59
Grand Total	528	185	2	715

* The sample from the Southern Area HSE area which was not tested qualitatively for *L. monocytogenes* was tested quantitatively and the result is included in the Table above (i.e. <20cfu/g).

APPENDIX 5

Salmonella results

HSE Area	Number of samples		
	<i>Salmonella</i> spp. absent	<i>Salmonella</i> spp. present	Grand Total
East Coast Area	56*	0	56
Midlands Area	27	0	27
Mid-Western Area	53	0	53
North Eastern Area	36	0	36
North Western Area	60	0	60
Northern Area	84	0	84
South Eastern Area	154	0	154
South Western Area	95	0	95
Southern Area	90	0	90
Western Area	59	0	59
Grand Total	714	0	714

* 57 samples were submitted from the East Coast Area but one sample was not tested for *Salmonella* spp.