European Commission Co-ordinated Programme for the Official Control of Foodstuffs for 2005: Bacteriological Safety of Pre-Packaged Mixed Salads from Retail Premises for *Listeria monocytogenes*

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Introduction

The European Commission Recommendation 2005/175/EC[1] published in the Official Journal of the European Communities on 1 March 2005 required Member States to carry out a co-ordinated programme of sampling and testing of pre-packaged mixed salads containing raw vegetables and other ingredients such as meat or seafood from retail premises. The aim of this element of the co-ordinated programme was to investigate the prevalence of *Listeria monocytogenes* in such salad products in order to promote a high level of consumer protection.

Details of the UK Programme

The microbiological component of the programme was guided by the Food Standards Agency, London, and co-ordinated, on behalf of the Food Standards Agency, by the Health Protection Agency (HPA) and the Local Authorities Co-ordinators of Regulatory Services (LACORS), in collaboration with Environmental Health Departments and Official Food Control Laboratories in England, Wales, Scotland, and Northern Ireland.

Local Authorities were advised by LACORS, on behalf of the Food Standards Agency, to integrate the 2005 EC Co-ordinated Programme into their normal enforcement activities. Samples were examined from 1 May to 30 June 2005.

Detailed guidance was sent by LACORS and the HPA to local authorities and UK Official Food Control Laboratories examining collected samples included in the programme, to ensure that sampling and examination was undertaken in a way that would allow comparison between the results. Results were returned to the Environmental and Enteric Diseases Department, HPA Centre for Infections for collation and analysis.

Methods

Pre-packaged mixed raw vegetable salads containing meat or seafood or other ingredients were collected from retail premises, and in particular from supermarkets. Mixed salads included in the co-ordinated programme were those that were not heat treated in the final package, required refrigeration (i.e. cold storage), and were intended to be consumed without heat treatment or could be consumed without heat treatment before consumption. The temperature of storage and the shelf-life of the products were recorded at the time of sampling on a standard proforma.

Laboratories comply with the provisions of Article 12 of Regulation (EC) No 882/2004, and are accredited and assessed by the UK Accreditation Service (UKAS) according to the EN ISO 17025: 2000 standard and Euronorm (EN 45002 and 45003), respectively. *Listeria monocytogenes* were detected or enumerated by all laboratories in accordance the most recent versions of EN/ISO Standards (EN/ISO 11290-1 and 2).

Results

In total, 2686 samples of pre-packaged mixed raw vegetable salads containing meat (47%; 1268) or seafood (53%; 1418) were submitted by 298 local authorities and examined by 24 laboratories in the UK. Table 1 provides the complete set of collated results for the UK.

All the mixed raw vegetable salad samples with meat or seafood ingredients also contained a variety of other food ingredients, such as pasta (51%; 1371), mayonnaise (34%; 913), eggs (9%; 255), cheese (5%; 136), rice (2%; 43) and other ingredients (couscous, coleslaw, and croutons (1%; 26).

The majority of samples (78%; 2091/2686) were collected from supermarkets, the remainder were collected from sandwich shops and department stores (22%; 595).

Microbiological safety of retail mixed salads as regards *Listeria monocytogenes*

Overall, *Listeria monocytogenes* were detected in 4.8% (130/2686) of mixed raw vegetable salad samples.

Mixed raw vegetable salads containing meat

L. monocytogenes was detected in 5.9% (76/1268) of mixed raw vegetable salads containing meat samples examined, and was present at over 100 cfu/g in two (0.1%) samples (mixed raw vegetable salads containing chicken) (Table 1).

- Two-thirds (66%; 835/1268) of the mixed salad containing meat samples collected had chicken, followed by chicken and bacon (19%), beef (5%), ham (5%), bacon (2%), and other meat types (3.6%; turkey, pork) (Table 1).
- *L. monocytogenes* was detected in more samples of mixed raw vegetable salads containing chicken and bacon (8.1%) and chicken (6.2%)

compared with mixed salads containing bacon (3.5%), ham (3%), beef (1.7%), and other meat types (2.2%)

However, it should be noted that the sample size of salads containing beef, bacon, ham and other meat types is very small and that no statistical conclusions should be drawn from these results.

Mixed raw vegetable salads containing seafood

L. monocytogenes was detected in 3.8% (54/1418) of mixed raw vegetable salads containing seafood samples examined. No samples had *L. monocytogenes* present at over 100 cfu/g (Table 1).

- Half (50%; 705/1418) of the mixed salad containing seafood samples collected had tuna, followed by prawns (47%), salmon (2%), and other seafood types (1.5%; crayfish, mackerel) (Table 1).
- *L. monocytogenes* was detected in more samples of mixed raw vegetable salads containing salmon (10.0%) and other seafood types (10.0%) compared with mixed salads containing tuna (4.1%) or prawns (3.0%).

However, it should be noted that the sample size of salads containing salmon and other seafood types is very small and that no statistical conclusions should be drawn from these results.

Table 1. Microbiological safety of retail mixed salads as regards *Listeria monocytogenes* in the UK

Bacterial pathogens	Product identification	Number of samples	Analysis Results					
			Detection in 25g		Enumeration cfu/g			
			Absence	Presence	<10	10-99	100-999	≥1000
Listeria monocytogenes	**Mixed salad with meat**	**1268**	**1192**	**76**	**73**	**1**	**2**	**0**
	- with chicken	835	783	52	50	0	2	0
	- with chicken & bacon	235	216	19	18	1	0	0
	- with beef	60	59	1	1	0	0	0
	- with bacon	28	27	1	1	0	0	0
	- with ham	66	64	2	2	0	0	0
	-with other (e.g. turkey, pork)	44	43	1	1	0	0	0
	Mixed salad with seafood	**1418**	**1364**	**54**	**53**	**1**	**0**	**0**
	- with tuna	705	676	29	29	0	0	0
	- with prawns	663	643	20	19	1	0	0
	- with salmon	30	27	3	3	0	0	0
	- with other (e.g. crayfish, mackerel)	20	18	2	2	0	0	0

Temperature of storage of the mixed salads

The majority (93%) of pre-packaged mixed salad samples were stored or displayed at or below 8°C (Table 2). *L. monocytogenes* were present more often in mixed salad samples stored or displayed above 8°C (5.7%), compared to those displayed at or below 8°C (4.7%) (Table 2), although this finding was not statistically significant (p=0.5564).

Table 2. Storage temperature of mixed salad samples in relation to presence of *L. monocytogenes*

Storage temperature	No. samples n = 2686 (%)	Samples with *L. monocytogenes* (%)
≤ 8°C	2503 (93%)	120 (4.7%)
> 8°C	158 (6%)	9 (5.7%)
Not Recorded	25 (1%)	1 (4.0%)

Shelf-life of the mixed salads

Most mixed salad samples (87%) had a Use By Date (UBD) recorded on the packaging, of which 20% also had a Display by Date on the packaging (Table 3). Based on the UBD, most (81%) samples collected had remaining shelf-lives ranging from zero to three days (Table 4).

There was no significant correlation between the presence of *L. monocytogenes* in the mixed salad samples and the type of product expiry date used (p=0.3176) (Table 3). *L. monocytogenes* were present in samples that had UBDs ranging between zero to 12 days (Table 4). One of the two samples that contained *L. monocytogenes* at over 100 cfu/g had a remaining shelf-life of zero days, while the other sample had no expiry date. One of the other two samples with *L. monocytogenes* present between 10-99 cfu/g also had a remaining shelf-life of zero days, while the other sample had no expiry date.

Table 3. Product expiry date of mixed salad samples in relation to presence of *L. monocytogenes*

Product expiry date	**No. samples n = 2686 (%)**	**Samples with *L. monocytogenes* (%)**
Use by date	1790 (67%)	120 (4.7%)
Display by date	107 (4%)	9 (5.7%)
Use by date & Display by date	544 (20%)	0
No date	207 (8%)	0
Not Recorded	38 (1%)	1 (4.0%)

Table 4. Remaining shelf-life of mixed salad samples in relation to presence of *L. monocytogenes*

Use by date and days to expiry of shelf-life	**No. samples n = 2332 (%)**	**Samples with *L. monocytogenes* (%)**
0	430 (18%)	19 (4.4%)
1	646 (28%)	27 (4.2%)
2	452 (20%)	29 (6.4%)
3	355 (15%)	21 (5.9%)
4	167 (7%)	9 (5.3%)
5	93 (4%)	3 (3.2%)
6-12	189 (8%)	2 (1.1%)

Conclusions

Although listeriosis is a relatively rare disease, the severity of the disease and the frequent involvement of manufactured foods, especially during outbreaks, mean that the social and economic impact of listeriosis is among the highest of the foodborne diseases[2]. An important factor in foodborne listeriosis is that the pathogen can grow to significant numbers at refrigeration temperatures when given sufficient time. The draft EC Regulation on microbiological criteria for foodstuffs proposes that *L. monocytogenes* should be below 10^2 cfu/g during the shelf life of ready-to-eat foods[3].

In the UK examination of pre-packaged mixed raw vegetable salads containing meat or seafood ingredients revealed that the vast majority (95.2%; 2556/2686) did not have *L. monocytogenes* present. However, two (0.07%) samples were found to have adverse *L. monocytogenes* results (≥100 cfu/g)[3,4] that were reported to the appropriate food authority and, as necessary, they collaborated with the Food Standards Agency, the HPA and the manufacturers to take the necessary enforcement and control actions. A further 4.8% of samples had *L. monocytogenes* present (<10 cfu/g; 4.7%) or at levels below 100 cfu/g (0.07%).

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