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Research providing a knowledge base to support the sustainable development of the farmhouse cheese industry.



#### Key external stakeholders:

Irish Farmhouse Cheesemakers Association, Food Safety Authority of Ireland

#### Practical implications for stakeholders:

This research has had an impact as follows:

- The results of the analysis have been given to each producer giving them valuable information on their product and process they would not otherwise have.
- Assistance and advice was given to the Farmhouse cheesemakers on issues not directly related to the project, facilitating the building of a good working relationship.
- A HACCP workbook is being implemented in the farmhouse cheese sector, which will have implications in the production of safer, higher quality cheese.
- Teagasc are working with the stakeholders to support the setting of limits for flukicides.
- The sector has an understanding of the food safety attributes valued by consumers and the importance in adopting a supply-chain approach when managing food safety policy. This can be used in the development of marketing strategies that will address market requirements.
- The results provide strong positive feedback on the contribution of the regulatory authorities to the artisan food sector.

#### Main results:

- Cheeses and cheesemaking facilities tested were generally within quality/safety parameters. Support was given to cheesemakers, and pre-emptive action taken where any issues were identified
- Anti-parasitic drug residues are not an issue in cheeses
- Consumers have confidence in the safety of Irish farmhouse cheese and its producers, and that the sector is well-regulated. They also perceive it to be a quality product.

#### Opportunity / Benefit:

- Farmhouse cheese manufactured in Ireland is safe and produced in hygienic processing facilities.
- This evidence-base provides an opportunity to build a strong competitive advantage for Irish farmhouse cheese in the domestic and export market.
- A HACCP booklet is available to assist producers in their efforts to continue producing safe high-quality product

#### Collaborating Institutions:

N/A

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### 1. Project background:

The Farmhouse Cheese industry is an important part of Ireland's image as a food island, with more than 20 of the 55 Farmhouse Cheese Producers (FCPs) involved in the export market with product going to the UK, continental Europe, the US and Australia. The objectives of this project were to develop a knowledge base for the sector in order to support it, to maintain and improve the quality and safety of the cheeses, to predict possible future regulatory and market-related controls relating to safety and quality and, therefore, make it more competitive in EU and International markets. This will result in a positive impact on the speciality dairy sector, generally.

### 2. Questions addressed by the project:

- What are baseline data on the microbial quality of Farmhouse cheese, and the environments where cheeses are produced?
- What are the sources and putative transfer routes of *Listeria monocytogenes*?
- What is the anti-parasitic drug residue status of Irish farmhouse cheese?
- What is the persistence of anthelmintic drug residues in milk, and the stability of residues in soft and hard cheeses?
- What are consumers' attitudes and perceptions on the safety and quality of Irish Farmhouse Cheeses?
- Will there be possible future regulatory and market related controls?

### 3. The experimental studies:

- Cheeses, and facilities where the cheeses were manufactured, were analysed for quality/safety parameters
- Methods were developed for measurement of anti-parasitic drug residues in cheese and 120 cheese samples were collected and analysed by LC-MS/MS.
- Market research was undertaken at consumer and trade level using desk based research, focus groups and in-depth interviews.

### 4. Main results:

#### Cheese and factory environment sampling

During 2007, 15 farmhouse cheese varieties were analysed for food pathogens (*Listeria monocytogenes*, *Staphylococcus aureus*), quality indicators (pH, salt, moisture) and 19 anti-parasitic drug residues. The following year the cheesemaking facilities (including raw materials and food contact surfaces) were sampled and analysed for *L. monocytogenes* and hygiene indicators such as coliforms. In total, 351 cheeses were analysed and 2,618 environmental, food contact surfaces and raw material samples were analysed.

#### Cheese data

All 351 cheeses were analysed for *L. monocytogenes*, *E. coli*, and *S. aureus*, the pathogens most likely to be found. A relatively low level of contamination was found in the cheeses (Table 1).

Table 1: Percentage of cheese samples below the maximum allowable limits for food pathogens.

| <i>L. monocytogenes</i> | <i>E. coli</i> | <i>S. aureus</i> |
|-------------------------|----------------|------------------|
| %                       | %              | %                |
| 94                      | 100            | 94               |

As the results were obtained the manufacturers were informed. Where cheeses were outside the specified limit, further samples were analysed and efforts made to address the problem. In the case of *S. aureus*, all the cheeses outside the limit were from one cheese producer and all were in the first half of the year. Working with the producer, the problem was resolved and all samples analysed during the second half of the year were below the maximum permitted limits. With regard to *L. monocytogenes*, no seasonal variation was observed.

There are no regulations with regard to the levels of anti-parasitic drug residues allowed in cheese. The work in this part of the project was undertaken to establish if a problem exists and to provide a baseline. Of the 351 cheeses tested, 97% were free of all residues tested. Low levels (4 times less than the permitted level in milk) of albendazole and moxidectin residues were found in two cheeses and again, working with the producer, the problem was identified and corrective action recommended.

Cheese quality indicators including pH, salt and moisture are not regulated, but their values are very helpful for the cheese manufacturer and can be used to produce consistently good quality cheese over the entire season. During the testing period, the researchers also provided the individual producers with data on the quality indicators of their cheeses.

*Environmental data*

Data were also collected from raw materials and selected points from the cheese manufacturing environment that potentially could contaminate the cheese. Table 2 summarises the sample points and results for the main pathogens, residues in milk and quality indicators tested. Where milk was positive for *L. monocytogenes*, further milk samples and the cheese manufactured from the milk were analysed. *L. monocytogenes* positive milks were always sporadic and none of the cheeses made from that milk were positive. *L. monocytogenes* was detected in 15% of environmental samples. As *L. monocytogenes* is frequently found in the environment, this level was expected. It does, however, show the need for vigilance with regard to this pathogen. Where *E. coli* was identified in water, follow-up samples were analysed and changes implemented until the problem was resolved.

Of the milk samples tested, 96% were free of all residues. Low levels (20 times less than the permitted level) of moxidectin were found in 5 milk samples: this was not considered to be a cause for concern.

Table 2. Percentage of samples within the limits for pathogens and residues

|              | <i>S. aureus</i> | <i>E. coli</i> /coliform | <i>L. monocytogenes</i> | TBC | Residues |
|--------------|------------------|--------------------------|-------------------------|-----|----------|
| Milk         | 97               | -                        | 92                      | 98  | 100      |
| Water        | -                | 96                       | -                       | -   | -        |
| Brine        | 91               | -                        | 99                      | -   | -        |
| Food contact | -                | 90                       | -                       | -   | -        |
| Environment  | -                | -                        | 85                      | -   | -        |

*Isolate characterisation*

Over 200 *L. monocytogenes* isolates were characterised for their genetic fingerprint by pulsed field gel electrophoresis (PFGE). Forty-six PFGE patterns were identified; no strain was identified at more than one facility; 4 persistent strains were isolated; raw milk was a source of environmental contamination at 7 facilities, although only 7% of raw milk samples were contaminated.

**Anti-parasitic drug data**

The study has shown that many flukicide residues are highly persistent in milk and identified potential residue issues with dairy products which will help reduce non-compliant samples further. Teagasc are working with the stakeholders to support the setting of Maximum Residue Limits (MRLs) at present.

A total of 120 cheese samples were collected and analysed by LC-MS/MS which resulted in the detection of new residues in cheese, namely, nitroxylin and closantel. The results were reported to the producers and subsequent milk and cheese samples were collected. These follow-up samples were reanalysed by LC-MS/MS and were negative.

**Marketing/consumer data**

Market research was undertaken at consumer and trade level using desk based research, focus groups and in-depth interviews. Consumers have confidence in the safety of Irish farmhouse cheese and its producers and that the sector is well-regulated. Ensuring the safety of farmhouse cheese was seen as a responsibility

that should be shared by the cheese-maker and the retailer. The food safety regulatory agencies are highly regarded by consumers. Endorsements from food commentators such as chefs and food writers trusted by consumers play a significant role in forming consumer opinion of farmhouse cheese as a safe high quality product. However, consumers are failing to distinguish between European speciality cheeses and Irish farmhouse cheeses; this is an issue that needs to be addressed by the sector. Overall the findings provide the foundations for building competitive advantage on the domestic and export market and provide strong positive feedback on the contribution of the regulatory agencies to the artisan food sector.

#### 5. Opportunity/Benefit:

- Farmhouse cheese manufactured in Ireland is safe, residue free and produced in hygienic processing facilities.
- A HACCP booklet is available to assist producers in their efforts to continue producing safe high-quality product.
- This evidence-base provides an opportunity for building competitive advantage for Irish farmhouse cheese in the domestic and export market.

#### 6. Dissemination:

Technology transfer to various audiences included:

- Scientific community: the project resulted in 4 papers in peer reviewed journals, 1 book chapter, 11 conference presentations, 2 articles in T-Research and 4 popular articles.
- Industry: as the results were generated (on a monthly basis) the cheese producers were informed. In addition, 2 specific workshops were held for the producers. A further series of 6 workshops was held at various centres around the country in order to inform the wider speciality dairy industry about the results.
- A HACCP –type booklet was produced in association with the Farmhouse Cheesemakers Association and FSAI. This is aimed at ease of implementation of hygiene practices.
- Conference: a Conference on Listeria was held at Moorepark in September 2009.

#### Main publications:

- O'Brien, M., Hunt, K., McSweeney, S. and Jordan, K. (2009). Occurrence of foodborne pathogens in Irish farmhouse cheese. *International Journal of Food Microbiology*, 26, 910-914.
- Whelan, M., Kinsella, B., Furey, A., Moloney, M., Cantwell, H., Lehotay, S.J. and Danaher, M. (2010). Determination of anthelmintic drug residues in milk using ultra high performance liquid chromatography-tandem mass spectrometry with rapid polarity switching. *Journal of Chromatography A*, 1217, 4612-4622.
- Fox, E., Hunt, K., O'Brien, M. and Jordan, K. (2011). *Listeria monocytogenes* in Irish Farmhouse cheese processing environments. *International Journal of Food Microbiology*, 145, S39-S45.

#### Popular publications:

- Jordan, K., O'Brien, M. and McSweeney, Sara. (2009). Research supporting the farmhouse cheese industry. T-Research Vol 4, Winter 2009.
- Jordan, K. and Fox, E. (2010). *Listeria monocytogenes* – here to stay? T-Research Vol 5, Autumn 2010.
- Jordan, K. and McSweeney, Sara. (2008). Research back-up. Today's Farm, September/October 2008.

#### 7. Compiled by: Kieran Jordan, Maeve Henchion and Martin Danaher