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Safe and Healthy Foods

Practical implications for stakeholders:
Safe & Healthy Foods programme set out to improve the safety of food consumed or produced on the island of Ireland through the development of new analytical methods and food databases.

A suite of new residue test methods were developed that cover nearly 150 different analytes. The range of compounds covered included veterinary drugs, feed additives, hormonal agents and pyrrolizidine alkaloids in different foods. The application of these tests showed that food consumed on the island is generally of high purity. Residues were detected in a very small proportion of samples rendering them non-compliant. However, >99.6% of samples were residue free. A range of food safety databases were developed or updated on the project including the National Food Residue Database, Veterinary Drug and Feed Additives Databases (VetFAD) and the Central Microbial Database. A new comprehensive food ingredient database (INFID), which has been used to estimate the intake of four sweeteners (aspartame, saccharin, acesulfame K, sucralose) were within the Acceptable Daily Intake levels for preschool children. The Irish Food Compositional Database was updated with current data on nutrients and bioactive components for a range of different foods.

Main points
- The newly developed databases and technologies will allow stakeholders to significantly improve the safety and quality of food products produced on the island.
- The newly developed tools will allow the stakeholders to more effectively target resources and give better value for money.

Main results:
- New multi-residue test methods developed for nearly 150 contaminant residues in food.
- New databases were developed covering the area of food safety and food consumption.
- Food surveys and exposure assessments were completed showing that the food we eat is very safe.

Opportunity / Benefit:
During the project, new knowledge and technologies have been developed that can be used to improve the quality and safety of food products consumed or produced on the island.

Collaborating Institutions:
See the next section

Contact   Martin Danaher   Email: martin.danaher@teagasc.ie.

Teagasc project team: Dr. Martin Danaher (Project Coordinator/PI)
                                Dr. Mary Moloney
                                Dr. Kieran Jordan
                                Dr. Kaye Burgess
                                Dr. Geraldine Duffy
                                Dr. Declan Bolton
External collaborators: Prof. Chris Elliott, Queens University Belfast
                                Dr. Lisa Connolly, Queens University Belfast
                                Prof. Glenn Kennedy, Agri-Food and Biosciences Institute, Belfast
                                Dr. Steven Crooks, Agri-Food and Biosciences Institute, Belfast
                                Dr. Ambrose Furey, Cork Institute of Technology
                                Prof. Mike Gibney, University College Dublin
                                Prof. Albert Flynn, University College Cork
                                Prof. Francis Butler, University College Dublin
                                Prof. David McDowell, University of Ulster, Jordanstown
                                Dr. John Egan, Department of Agriculture Food & the Marine
                                Dr. Montserrat Gutierrez, Department of Agriculture Food & the Marine

1. Project background:

Safe and Healthy Foods was a large multidisciplinary project that focused on the integration of food safety and public health research on the island of Ireland. The project encompassed three main work areas, namely, chemical contaminants, nutrition & health and biological contaminants. The chemical contaminant research focused on the development of new improved multi-residue tests and their application to generate new exposure data for risk assessments. The development of new food databases was a major focus on the project, which acknowledged both the need to update current databases and develop new databases. Database development, including work on The National Food Residue Database (NFRD), the National Food Ingredients Database (INFID), the Irish Supplemental Food Composition Database, the Central Microbial Database and the Veterinary Medicinal Products & Feed Additives Database, was necessary.

2. Questions addressed by the project:

Can new multi-residue tests be developed to improve the safety of food consumed and produced on the island of Ireland?
Can the research team develop new databases that can be used for food safety and public health applications?
How safe is the food that we consume or produce on the island of Ireland?

3. The experimental studies:

Researchers at Teagasc and AFBI developed new multi-residue LC-MS/MS tests to detect veterinary drug and feed additive residues in food. This work included the development of new extensive multi-residue tests for the detection of antibiotic, anticoccidial and dye residues. The project team also set out to develop test methods for aminoglycoside antibiotics, which are very polar drugs that are extremely difficult to reliably analyze in food. CIT researchers, in collaboration with Teagasc, developed the first Irish tests for detecting pyrrolizidine alkaloid residues in food and herbal products. Advanced screening tests based on receptor assays were developed by QUB for the detection of sex hormonal contaminants in dietary supplements. All methodologies were validated to 2002/657/EC guidelines. Comprehensive surveys were carried out by the project team to determine the incidence of residues in different food products using existing and newly developed methods. Exposure assessments were carried out by UCD researchers, using data generated during the project, and these datasets were populated into the NFRD. VetFAD and the Central Microbial Database were developed in collaboration between researchers and regulatory agencies as new tools to support food safety activities on the island of Ireland. Extensive food consumption surveys were carried out by UCC and UCD to update the National Food Ingredients Database (INFID) and the Irish Supplemental Food Composition Database.

4. Main results:

Chemical residues

- A range of new analytical methods were developed and validated by the project team:
- A new multiplex screening method, which was applied to detect of four nitrofuran residues in honey.
- A multi-residue test was developed to measure 23 anticoccidial residues in eggs, milk and animal tissue using LC-MS/MS.
- AFBI developed a test for 13 triarylmethane and phenothiazine dyes in fish and poultry tissues.
- LC-MS/MS and multiplex immunoassays were developed to detect 18 aminoglycoside residues in honey. These are now the most comprehensive methods for the determination of aminoglycosides and significant improvements over existing methodologies.
- CIT developed a method to detect 14 pyrrolizidine alkaloids in honey, milk and herbal products.
- Multi-class methods were developed on the project to detect >60 antibiotic residues in aquaculture tissues.
- QUB developed sex hormonal receptor assays to detect known and unknown hormonal agents in dietary supplements.

Surveys were carried out by the project team during the project using food products purchased in retail surveys and collected in collaboration with the Irish food industry. Samples covered both domestic and imported foods. In general, results of the surveys showed that >99.6% of the samples were residues free of pharmaceutical agents. In agreement with previous research, pyrrolizidine alkaloids (PAs) were detected in a number of honey and herbal tea samples collected on the project. High levels of PAs were detected in honey samples from Australia and New Zealand compared to Europe. Exposure and risk assessments are currently being run on these samples to determine the risk to the consumer.

Microbial databases

A fully functional national microbial database was successfully developed, which incorporates data on the major pathogens in Irish food generated by the major regulatory and research institutions in Ireland. This is the first time such a database has been created and it is now fully operational with three years of data in the system. All partners have been issued with login details and can access the database online. The database is a repository of valuable information that can be used to underpin quantitative risk assessments for a large number of product / pathogen combinations. The data can be used to generate risk assessments of direct relevance to the industry as required. The microbial database represents a major resource to the regulatory and research institutions in Ireland working in food safety. This database includes capacity to sub-typed isolates (by PFGE to PulseNet standard and serotyping) of three relevant food poisoning organisms (Listeria monocytogenes, Salmonella and VTEC). This database represents an important resource for food safety management in Ireland. The database gives the ability to epidemiologically track sources of isolates, and isolate similarities and the ability to link food-poisoning cases and identify outbreaks. This capability allows food safety regulatory agencies manage food borne illness outbreaks and allows the potential identification of the food responsible for the outbreak.

Food ingredient databases

A comprehensive food ingredient database has been developed where detailed information on the ingredients of foods consumed by adults and children is recorded and has been quality controlled. Furthermore, a report on patterns of food additives in Irish foods has been supplied to the Food Safety Authority of Ireland and exposure assessments to artificial sweeteners (beyond the scope of this task) have been completed. Intakes of the four sweeteners (aspartame, saccharin, acesulfame K, sucralose) were shown to be within the Acceptable Daily Intake levels for preschool children.

The updated Irish Supplemental Food Composition Database is a supplement to the UK Tables of Food Composition that has been compiled by UCD from food consumption records collected in the Irish national food consumption surveys (the National Children's Food Survey, the National Teens' Food Survey, the National Adult Nutrition Survey and the National Pre-school Nutrition Survey; www.iuna.net), which together cover food consumption from age 1 - 90 years. Data are included for a total of 1533 new or updated food codes. The database facilitates ongoing monitoring (with FSAI) of intakes of nutrients, bioactive constituents and botanical and herbal products in Ireland and underpins Ireland's contribution to the EU level data collection required by EFSA.

5. Opportunity/Benefit:

A range of new technologies were developed on the project and will be available from the individual partners following the completion of the project. Some tests have been accredited to ISO17025 standard and are provided as a service for the food industry. Several databases were developed on the project, which can be used by industry for food safety purposes and the development of healthier food products.

6. Dissemination:

Dissemination outputs from the project team included 19 peer reviewed papers/book chapters, four PhD theses, one MSc thesis, 54 scientific presentations, two national reports, seven popular non-scientific publications, four YouTube videos and nine workshops.

Main publications:

Kinsella, B., O'Mahony, J., Malone, E., Moloney, M., Cantwell, H., Furey, A., Danaher, M. (2009). Current trends in sample preparation for growth promoter and veterinary drug residue analysis. Journal of Chromatography A, 1216:46, 7977-8015.

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Radovnikovic, A., Moloney, M., Byrne, P., Danaher, M. UPLC-MS/MS method for detection of nitrofuran residues in plasma. (2011). Journal of Chromatography B 879 159–166.

Cronly, M., Behan, P., Foley, B., Danaher, M., Malone, E., Regan, L. (2011). Survey of 11 nitroimidazole residues in hen and duck eggs from the Irish market. Food Additives & Contaminants: Part B 4:2 79–87.

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Radovnikovic, A., Conroy, E-R, Gibney., M., O'Mahony, J., Danaher, M. (2013) Residues analyses and exposure assessment of the Irish population to nitrofurans metabolites from different food commodities in 2009-2010. Food Additives & Contaminants: Part A 30:11 1858-1869.

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Clarke, L., Fodey, T.L., Crooks, S.R.H., Moloney, M., Delahaut, P., O'Kennedy, R., Danaher, M. (2014). A review of coccidiostats and the analysis of their residues in meat and other food. Meat Science. 97 358-374.

Griffin, C.T., O'Mahony, J., Danaher, M., Furey, A. (2014). Liquid Chromatography Tandem Mass Spectrometry Detection of Targeted Pyrrolizidine Alkaloids in Honeys Purchased within Ireland. Food Analytical Methods (in press).

Gadaj, A., di Lullo, V., Cantwell, H., McCormack, M., Furey, A., Danaher, M. (2014) Determination of nitroimidazole residues in aquaculture tissue using ultra high performance liquid chromatography coupled to tandem mass spectrometry. Journal of Chromatography B 960 105-115.

7. Compiled by: Martin Danaher and Kieran Jordan

Contact   Martin Danaher   Email: martin.danaher@teagasc.ie.

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