

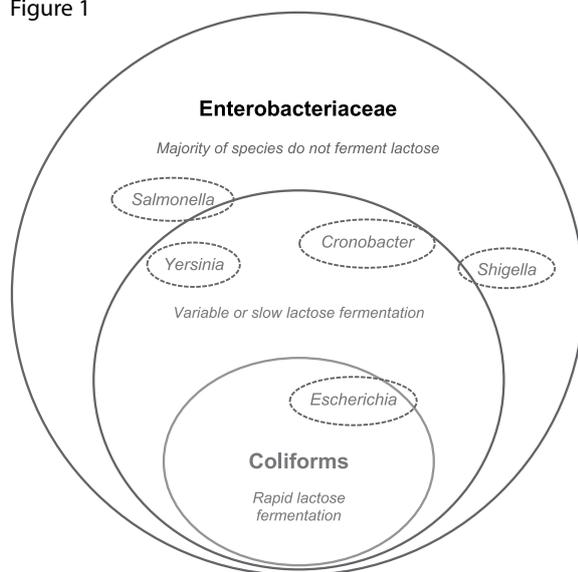
Indicator organisms in the dairy industry

Indicator organisms are bacteria that either signify the potential presence of pathogenic bacteria (also called index organisms) or indicate the effectiveness of process control. The most common indicators in the food industry include the coliform group, *Escherichia coli*, and the Enterobacteriaceae. Figure 1 illustrates the relationship between these three groups of organisms.

These groups were chosen as indicator organisms because they were understood to originate from the human or animal gut and expected to be associated with pathogens of the same origin. However, it is now recognised that many of these bacteria inhabit the environment or other sources.

Testing dairy products for the presence of indicator organisms is a useful verification activity for monitoring process controls, good manufacturing practices, and good hygienic practices. Positive detections indicate potential failures in these areas. Testing for indicators is usually quicker and more cost effective than testing for specific pathogens and allows more frequent monitoring of process control.

Figure 1



Types of indicator organisms

Coliforms are identified by their ability to ferment lactose rapidly with the production of gas and acid, and are defined by their method of detection rather than taxonomic traits. Coliforms can survive and grow in food processing environments, and include most *E. coli* as well as a wide range of other non-enteric organisms. Their presence in food does not necessarily indicate faecal contamination but provides a warning of unhygienic conditions or ineffective processing.

E. coli are considered a more reliable indicator of faecal contamination and the potential presence of pathogens compared to coliforms or Enterobacteriaceae. However, they can also become established and grow in food processing environments, so detection does not necessarily signify faecal contamination. Conversely, the absence of *E. coli* does not always guarantee the absence of enteric pathogens. Pathogenic strains of *E. coli* are not generally detected using standard *E. coli* methods.

Enterobacteriaceae are defined by their ability to ferment glucose with the production of gas and acid. They include the coliform group in addition to non-coliform pathogens such as *Salmonella*, *Shigella*, *Yersinia* and pathogenic *E. coli*.

Opinions vary on the most effective indicators for monitoring process control. Coliforms are commonly used in the Australian dairy industry and are generally well understood, however there is a growing international trend towards the use of Enterobacteriaceae.

Mesophilic aerobic bacteria may also be used as indicator organisms as they can identify instances of contamination. Use of mesophilic aerobic bacteria as indicators should be considered carefully as some foods naturally contain high numbers of bacteria (e.g. fermented foods). *The Compendium of Microbiological Criteria for Food*¹ provides guidance on the interpretation of results for mesophilic aerobic bacteria in different food types.

Use of indicators for monitoring hygiene control

For most pasteurised dairy products it is reasonable to expect coliforms, *E. coli*, and Enterobacteriaceae to be absent as these organisms are destroyed by pasteurisation. Therefore, the presence of these indicators in product will be evidence of process failure or post pasteurisation contamination.

The presence of low levels of indicators in some products may be inevitable due to the complexity of the manufacturing process. Trending of results for these products is a good way of identifying when controls are becoming less effective or starting to fail. Indicator organisms may also be present in products which have not been through a heat treatment or which contain post pasteurisation additions. It is important to understand the normal levels of these bacteria in a particular product and look for upward trends which can signal a gradual loss of control.

Testing for indicator organisms

A dairy food manufacturer's food safety program will outline the microbiological testing undertaken for verification purposes. The DFSV publication *Minimum testing requirements for manufacturers of dairy food products*² (2015) provides guidance on which organisms should be tested for, and the frequency of testing. It is a DFSV expectation that regular pathogen testing is included in the food safety program.

*The Compendium of Microbiological Criteria for Food*¹ (FSANZ, 2016) provides guidelines for interpreting results of testing for indicator organisms, acceptable limits and recommended actions in response to unsatisfactory results. Failure to consistently achieve satisfactory limits should be regarded as an indication of process control failure and result in prompt investigative action. For example, detection of *E. coli* in a processed product should trigger an immediate investigation and potential disposal of product.

Satisfactory results from regular indicator and pathogen testing will confirm that the process is under control and provides verification of the effectiveness of the food safety program. Testing for indicator organisms may also be part of an environmental monitoring program identifying potential sources of product contamination. The detection of indicator organisms on food contact surfaces should trigger corrective action to identify and rectify the failure.

Test methods

Testing for indicator organisms may be undertaken by external commercial laboratories or by a manufacturer's in-house laboratory. National Association of Testing Authorities (NATA) accreditation of commercial laboratories provides confidence in the expertise of analysts and the accuracy of testing. They may offer a number of methods for detection and are well positioned to give advice on the most appropriate methods.

Various test kits and media suitable for in-house testing for indicator organisms are commercially available. It is important that the personnel conducting the testing are competent and that the test is appropriately validated and verified for each product type to ensure results are accurate and reliable. Inaccurate results may mean that process control failures are not identified, exposing product to potential food safety risks. Conversely, false positive results can result in unwarranted, resource-intensive investigations and potentially unnecessary product wastage.

Key points to consider

- Routine monitoring for indicator organisms is an effective means of verifying food safety controls within a food manufacturing facility.
- Indicator organisms can provide an early warning of process control failures and should be investigated.

References

1. Food Standards Australia New Zealand, *The Compendium of Microbiological Criteria for Food*, FSANZ, Canberra, 2016.
2. Dairy Food Safety Victoria. *Microbiological testing criteria – Minimum testing requirements for manufacturers of dairy food products*, DFSV, Melbourne, 2015.

Further information

Further food safety technical information is available at www.dairysafe.vic.gov.au

Or contact Dairy Food Safety Victoria on (03) 9810 5900 or info@dairysafe.vic.gov.au

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