

2018-19 Product Surveillance Program report

Executive summary

The Dairy Food Safety Victoria (DFSV) Product Surveillance Program (the program) evaluates the microbiological and physicochemical status of dairy food products manufactured in Victoria. The data enables assessment of compliance with the Australia New Zealand Food Standards Code (the Code), provides verification of the effectiveness of the industry's food safety programs and gathers valuable information for determining the ability of various dairy products to support the growth of pathogens.

Depending on the assigned sampling plan, products were tested for hygiene indicators (coliforms, *E. coli* and *Listeria* species), pathogens (coagulase-positive staphylococci, *Bacillus cereus*, *Salmonella* and *Listeria monocytogenes*) and pH. A total of 3531 samples were tested across 734 batches of dairy foods collected from 156 manufacturers.

The results demonstrated good compliance with the Code. Eight of the 734 batches (1.09%) did not comply with the relevant criteria in Schedule 27 of Standard 1.6.1. Seven were due to the presence of unacceptable levels of *E. coli* in cheese and *Listeria monocytogenes* was detected in one batch of cheese. One of these incidents resulted in a recall, while the detections in other products were identified before release to market and products were subsequently destroyed. *Listeria* species were also detected in five samples of cheese. *Salmonella* was not detected in any sample.

Guidelines such as the DFSV Microbiological testing criteria – Minimum testing requirements for manufacturers of dairy food products (DFSV, 2015) (MTC guide) and the Compendium of Microbiological Criteria Food (FSANZ, 2018) (the Compendium) identify acceptable levels of specified pathogens and indicator organisms in dairy and other food products. Acceptable results verify that the food safety systems are working effectively. Where product does not meet these criteria, a failure in one or more process controls is indicated.

Seventy-one of the 734 batches (9.7%) did not meet the process hygiene criteria for coliforms as defined in the Compendium, which generally indicates ineffective post-pasteurisation hygiene. This is a slight increase from the previous testing year, where 6.5% of batches did not meet these criteria.

Eleven of the 734 batches of dairy products (1.5%) did not meet the relevant criteria in the MTC guideline for *E. coli*. This included three batches of surface mould ripened cheese, and two batches each of ice cream, fermented milk products, hard cheese and semi soft cheese. In all cases where high levels of *E. coli* were observed, follow-up action was undertaken by the relevant DFSV food safety manager to address any potential risks to consumers and ensure that appropriate corrective action was undertaken.

The program also determined the proportion of sites within each product category experiencing process control failures. This enabled assessment of whether the process control failures were related to the specific production process (where a large number of sites have failures) or to specific issues at individual sites.

Background

The program is an annual survey of the microbiological and physicochemical status of dairy foods produced by licensed dairy manufacturers in Victoria. Product testing is coordinated by DFSV and is additional to manufacturers' normal routine testing required under their food safety programs.

This was the fourth and final year of an expanded program designed to align with the guideline *Microbiological testing criteria – minimum testing requirements for manufacturers of dairy food products* (2015) and to reflect the sampling requirements of Standard 1.6.1 (Schedule 27) of the Code.

Process controls are described in a dairy manufacturer's food safety program and are implemented in the manufacturing facility to eliminate or reduce potential food safety hazards. Microbiological testing is routinely undertaken by dairy manufacturers to verify these controls. The presence of certain types of microorganisms above certain levels can indicate a failure in the process controls designed to control microbial pathogens.

Guidance is available to manufacturers which outlines microbiological criteria which, if not met, may suggest a failure in one or more of the process controls. These include the MTC guide and the Compendium.

Results from the survey are compared to the criteria in these guidelines to verify that process controls are operating effectively or identify where they are not and provides evidence to DFSV to demonstrate the effectiveness of food safety controls across the Victorian dairy industry. This information can also be used as intelligence to target specific activities or product categories that may require additional support or scrutiny from the regulator.

The program supports other compliance monitoring activities conducted by DFSV and provides manufacturers with benchmarking data to assess their performance relative to other manufacturers of similar products. It also provides DFSV with an enhanced understanding of the food safety risk across the industry at product and manufacturer level and informs technical support activities.

Methods

Microbiological testing

Dairy products were assigned to one of 14 categories based on product characteristics and further allocated to a targeted or baseline testing plan. This determined the sampling frequency and testing requirements. A summary of the product categories and tests applied to each are listed in Appendix 1. Samples were collected twice per year during the scheduled DFSV audit. Two batches of product from each targeted category, and one batch from the baseline category were collected at each audit.

Five samples per batch were tested for coliforms, *E. coli*, and if the testing protocol required, coagulase-positive staphylococci or *Bacillus cereus*. Where relevant, the five samples were composited for analysis for Salmonella and Listeria species (25g per sample). This sampling plan enabled products to be assessed for compliance with Schedule 27 of the Code.

All testing was undertaken at a commercial testing laboratory according to Australian Standard methods (AS 5013 series) or validated alternatives. Coliforms and *E. coli* were tested using the most probable number (MPN) method while coagulase-positive staphylococci, *Bacillus cereus* and standard plate count were tested by the colony-count technique.

Physicochemical testing

One sample per batch of products within the targeted program was also tested for pH (see Appendix 1).

Results and discussion

In 2018–2019, 3531 samples from 734 batches collected from 156 different licensees were analysed. A summary of the number of samples and batches tested in each product category and the number of dairy manufacturer licensees submitting products in each category are provided in Appendix 2.

Microbiological testing – hygiene indicators

a) Coliforms

Coliforms are a group of closely related, predominantly harmless, lactose fermenting bacteria that inhabit soil and water. Coliform results are a useful measure of process hygiene and therefore a good gauge of the effectiveness of hygiene and sanitation controls in dairy food manufacturing premises. They do not necessarily indicate the presence of pathogens. High levels may suggest a failure of process control and highlight where improvements to good manufacturing practice (GMP) or good hygienic practice (GHP) may be required.

Results were compared to the process hygiene criteria for coliforms outlined in the Compendium. The Compendium currently only provides coliform criteria for liquid milk and cream and cheese. The criteria for cheese were used to assess the effectiveness of process control for other product categories. Coliform criteria are summarised in Table 1 and the results are given in Table 2.

Product	Coliforms /ml or g			
Milk and cream	n = 5	c = 0	m = 10/ml	
Cheese and other products	n = 5	c = 1	m = 100	M = 1000

n = number of samples units
c = number of sample units allowed to exceed m
m = the acceptable microbiological limit
M = the limit which must not be exceeded

Table 1: Process hygiene criteria for coliforms in dairy products tested in the program (Compendium of Microbiological Criteria for Food).

	% batches which failed process hygiene criteria (Table1)	% batches with coliforms above 'M' (not to be exceeded)
Smear- ripened cheese	48% (10/21)	43% (9/21)
Surface-ripened cheese	23% (16/70)	21% (15/70)
Ice cream	17% (11/65)	9% (6/65)
Semi soft cheese	12% (13/105)	9% (10/105)
Cream cheese dips	12% (1/8)	0% (0/8)
Cream	10% (2/20)	-
Liquid milk	8% (4/47)	-
Hard cheese	7% (5/75)	7% (5/75)
Shredded, grated and cut cheese	4% (2/48)	4% (2/48)
Fresh cheese	4% (6/143)	4% (6/143)
Fermented milk products	1% (1/83)	0% (0/83)
Spreads, yoghurt-based dips, dairy desserts	0% (0/49)	0% (0/49)

Table 2: Percentage of batches within each product category that failed process hygiene criteria, and the percentage of batches with coliforms exceeding 'M' (not to be exceeded), as outlined in Table 1 (number of samples exceeding limits / number of samples tested).

Smear-ripened cheese was most frequently contaminated with coliforms and had the highest incidence of failures of process control criteria. This category also had a high proportion of samples which failed the criteria due to levels of coliforms greater than 'M' (not to be exceeded), which would indicate more severe failures of process control. The production of many cheese types involves extensive post-pasteurisation handling and environmental exposure, providing numerous opportunities for contamination. This is particularly relevant for smear-ripened cheeses and may explain the very high incidence of coliforms in these products. Additionally, cultures used in the production of some smear-ripened cheeses may contain organisms which ferment lactose and produce gas and therefore have positive results in coliform tests. Products in which such cultures are used may be expected to exhibit high coliform counts, but this would not necessarily indicate a breakdown in hygiene control. It is important to differentiate between these two situations, and the use of *E. coli* as a hygiene indicator in these types of products may be more appropriate.

Surface-ripened cheese had the second highest incidence of failures of process control criteria. Approximately one fifth of samples failed criteria due to levels of coliforms greater than 'M', which would indicate more severe failures of process control. As for smear-ripened cheese, surface-ripened cheese production involves extensive post-pasteurisation handling and environmental exposure during ripening which may provide numerous opportunities for contamination.

A small percentage of batches of semi soft cheese, ice cream, hard cheese, shredded grated and cut cheese and fresh cheese had one or more samples with coliform numbers greater than 'M' criteria (not to be exceeded) in the Compendium.

No process control failures were observed in spreads, yoghurt-based dips, and dairy desserts. This trend has been observed over the four years of the testing program and suggests good management of hygiene by manufacturers of these products.

b) *E. coli*

While coliforms are a well-established and useful indicator of hygiene, *E. coli* are a more specific indicator of potential enteric contamination. Testing for *E. coli* assesses the potential for pathogens to be present in dairy products and is evidence of failures in the process control measures intended to control these organisms. Its detection, especially in high numbers, should trigger urgent corrective action.

The DFSV MTC guideline provides specific microbiological criteria for *E. coli* in various dairy product categories. Where results exceed these criteria, it would suggest that the microbial controls have not been effective for that batch of product. These criteria are given in Table 3, and results are in Table 4.

Product	<i>E. coli</i> / ml			
Ice cream	n = 5	c = 0	m = 0	
Fermented milk products	n = 5	c = 0	m = 0	
Milk and cream	n = 5	c = 1	m = 1	M = 10
Butter and dairy blends	n = 5	c = 2	m = 1	M = 10
Cheese	n = 5	c = 1	m = 10	M = 100
Dairy-based dips and desserts	n = 5	c = 1	m = 10	M = 100

n = number of samples units
c = number of sample units allowed to exceed m
m = the acceptable microbiological limit
M = the limit which must not be exceeded

Table 3: Process hygiene criteria for *E. coli* in dairy products tested in the program *Microbiological testing criteria – Minimum testing requirements for manufacturers of dairy food products.*

	% batches with <i>E. coli</i> exceeding MTC criteria (Table 3)	% batches with <i>E. coli</i> above 'M' (not to be exceeded)
Surface- ripened cheese	4.3% (3/70)	4.3% (3/70)
Ice cream	3.1% (2/65)	-
Hard cheese	2.7% (2/75)	2.7% (2/75)
Fermented milk products	2.4% (2/83)	-
Semi-soft cheese	1.9% (2/105)	1.9% (2/105)
All other products	0% (0/336)	0% (0/336)

Table 4: Percentage of batches within each product category failing process hygiene criteria or failing 'M' (not to be exceeded) as provided in the MTC guide (number of samples exceeding limits / number of samples tested).

Evidence of process control failures in a small percentage of batches was observed in surface-ripened cheese, ice cream, hard cheese, fermented milk products and semi-soft cheese based on the presence of *E. coli* exceeding the criteria in the MTC. More severe loss of control was seen in the surface mould ripened cheese, hard cheese and semi-soft cheese categories where *E. coli* exceeded the limits described by 'M' in 4.3%, 2.7% and 1.9% of batches respectively.

This suggests these products have a higher potential for contamination with enteric pathogens and the manufacturing process may be especially prone to failures in process control. The manufacturers of these products may need to be particularly diligent with GHP and GMP.

The number of batches with *E. coli* detections was lower than the previous testing year. *E. coli* were not detected in dairy desserts (25 batches tested), liquid cream (20 batches), liquid milk (47 batches), shredded, grated and cut cheese (48 batches), spreads (16 batches), or yoghurt-based dips (8 batches). This trend has been evident over the last two years of testing and suggests that controls have been effective for these categories.

Site analysis

a) Coliforms

The proportion of manufacturing sites with coliform detections in product from each category was analysed to determine whether contamination was limited to a small number of sites or common across numerous sites. A large percentage of sites with high coliform counts could suggest that the observed detections in a product category are related to the process for making these types of products, causing them to be more susceptible to contamination. A lower percentage of sites with high levels of coliform contamination may indicate that contamination is caused by poorly managed hygiene or process control failures at specific sites.

Results were compared to the guideline criteria as described above and are provided in Table 5.

	% sites which failed process hygiene criteria (Table1)	% sites with coliforms above 'M' (not to be exceeded)
Smear-ripened cheese	100% (6/6)	83% (5/6)
Surface-ripened cheese	57% (12/21)	43% (9/21)
Semi soft cheese	32% (11/34)	18% (6/34)
Cream cheese dips	25% (1/4)	0% (0/4)
Ice cream	24% (9/37)	11% (4/37)
Hard cheese	18% (4/23)	13% (3/23)
Liquid milk	13% (3/24)	-
Fresh cheese	12% (6/50)	8% (4/50)
Liquid cream	9% (1/11)	-
Shredded, grated and cut cheese	8% (2/25)	4% (1/25)
Fermented milk products	2% (1/44)	0% (0/44)
Yoghurt-based dips, dairy desserts	0% (0/11)	0% (0/11)

Table 5: The percentage of sites producing one or more batches of product which did not meet the process hygiene criteria for coliforms provided in the FSANZ Compendium of Microbiological Criteria for Food (number of samples exceeding limits / number of samples tested).

All six sites which manufacture smear-ripened cheese had at least one batch of product in which coliforms did not meet the process hygiene criteria in the Compendium.

The observation that all of the manufacturers of smear-ripened cheese and approximately half of surface-ripened cheese manufacturers are experiencing high coliform counts suggests that the production methods for these types of cheese pose a higher risk of contamination and that the controls are not as effective for these organisms compared to other product categories. This is not surprising as these types of cheese are subjected to extensive handling and environmental exposure during manufacture and ripening, where there are many opportunities for contamination.

Other product categories in which a higher proportion (between 20-25%) of sites failed to meet the process hygiene criteria included cream cheese dips, semi-soft cheese and ice cream, suggesting that these types of products may be more susceptible to post pasteurisation contamination.

The liquid cream, fresh cheese, shredded, grated and cut cheese, liquid milk and fermented milk product categories showed a lower percentage of sites (less than 15%) failing to meet the criteria for coliforms. This may reflect breakdowns in hygiene control at individual sites rather than being due to the nature of the manufacturing process itself.

There was no evidence of process control failures in the batches of yoghurt-based dips, spreads and dairy desserts based on coliform results meeting the process hygiene criteria in the Compendium.

b) *E. coli*

The proportion of sites in which *E. coli* failed to meet the criteria in the MTC are shown in Table 6.

	% sites with <i>E. coli</i> exceeding MTC criteria (Table 3)	% sites with <i>E. coli</i> above 'M' (not to be exceeded)
Surface-ripened cheese	10% (2/21)	10% (2/21)
Semi-soft cheese	6% (2/34)	6% (2/34)
Ice cream	5% (2/37)	-
Hard cheese	4% (1/23)	4% (1/23)
All other products	0% (0/185)	0% (0/185)

Table 6: The percentage of sites producing one or more batches of product which did not meet the microbiological criteria for *E. coli* provided in the MTC (number of samples exceeding limits / number of samples tested).

Surface ripened cheese had the largest proportion of sites with one or more samples from a batch having *E. coli* present at levels greater than 'M'. Two sites with a single batch from each contributed to this figure. A low proportion of sites producing semi-soft cheese, ice cream and hard cheese also failed these criteria, suggesting that failures are not widespread across a large number of sites and that this organism is well controlled by most of these manufacturers.

Product from all sites manufacturing cream cheese dips, dairy desserts, liquid cream, liquid milk, shredded, grated and cut cheese, fermented milk products, fresh cheese, spreads and yoghurt-based dip categories met the criteria for *E. coli* outlined in the MTC.

Total plate count

Total plate count is a measure of the total viable organisms in a food sample and provides a gauge of the extent of post-pasteurisation contamination. Four product categories were tested for total plate counts (liquid milk, ice cream, liquid cream and dairy desserts).

The average log total counts for these products are given in Figure 1. These results suggest that significant post-pasteurisation contamination has not occurred in the majority of these products. Results for two batches of liquid milk, one batch of ice cream and one batch of liquid cream were reported as >300,000 cfu/g (3×10^5). These were not included in the average counts provided in Figure 1 as no numerical result was available and the extent of the contamination unknown. It is likely that these results were due to a post-pasteurisation contamination event during manufacture of these products.

The Compendium considers total counts of less than 10^6 cfu/g (log 6 cfu/g) for Category 4¹, or 10^5 cfu/g (log 5 cfu/g) for Category 3² ready-to-eat foods as satisfactory. With the exception of nine batches of ice cream, two batches of liquid cream, six batches of liquid milk and one batch of dairy desserts, all product was considered satisfactory according to the Category 3 (log 5 cfu/g) threshold. With the potential exception of products reported as greater than 300,000 cfu/g, all product was within the satisfactory range for Category 4 ready-to-eat foods.

¹ Applies to foods which contain some components that have not been cooked

² Applies to foods in which all components of the foods have been cooked and there is some handling and/or refrigerated storage before sale or consumption

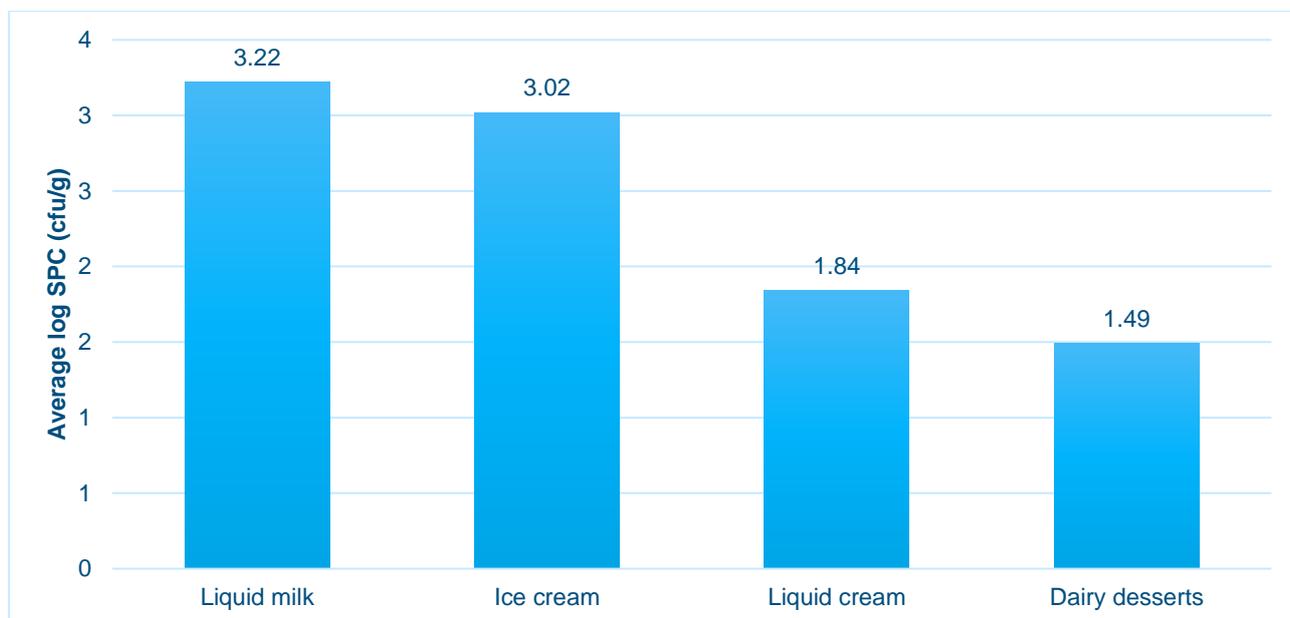


Figure 1: Total plate count results (average log cfu/g) for relevant product categories during the 2018-2019 testing year

Microbiological testing – pathogens

a) *Coagulase-positive staphylococcus*

Coagulase-positive staphylococcus is a foodborne pathogen that produces a toxin responsible for illness. The organism is normally associated with post-pasteurisation contamination and/or poor food handler hygiene. It is effectively killed by pasteurisation, however toxin produced before pasteurisation will not be inactivated. All cheese samples, except for those in the shredded, grated and cut category were tested for coagulase-positive staphylococci.

One batch of blue cheese had with coagulase-positive staphylococci detected at 200 cfu/g. This level complied with the criteria in the MTC, which allows two of the five samples to have counts between 100 and 1000 cfu/g. Coagulase-positive staphylococci was not detected in any of the product categories tested.

b) *Salmonella and Listeria monocytogenes*

Salmonella and *L. monocytogenes* are foodborne pathogens capable of causing severe illness. These organisms may be found in unpasteurised milk, and *L. monocytogenes* is also a common environmental contaminant. Salmonella was not detected in any of the 437 samples tested in 2018-19. *L. monocytogenes* was detected in one (shredded, grated and cut cheese) of the 568 samples tested from this category.

c) *Bacillus cereus*

B. cereus is a foodborne pathogen that produces a toxin which can cause illness. While heat treatments kill the vegetative cells, spores can survive. If the characteristics of the food allow growth and the food is not kept under temperature control, *B. cereus* can multiply over the shelf life of a product. Two product categories were tested for *B. cereus* at end of shelf life. In total, 116 batches were tested (96 fresh cheese and 20 dairy desserts).

The Compendium considers counts of *B. cereus* of between 10^3 cfu/g – 10^5 cfu/g unsatisfactory for ready to eat foods. Of the fresh cheese samples, sixty-six batches had no detections, 13 batches fell within the marginal range of 10^2 cfu/g – 10^3 cfu/g and four batches had results that were unsatisfactory according to the Compendium. *B. cereus* was not detected in any samples of dairy desserts.

Compliance

A major function of the program is to monitor compliance with the Code. The criteria in Standard 1.6.1 (Schedule 27) of the Code which apply to the dairy products evaluated in the Program are in Table 7.

Of the 734 batches of dairy products analysed, eight batches (1.09%) did not comply with the Code. Seven of these batches (0.95%) were due to the presence of *E. coli* at levels which did not meet the microbiological criteria in Schedule 27. These included two batches of parmesan, two batches of fresh cheese (bocconcini and caciotta) and three batches of brie (from two different manufacturers). *Listeria monocytogenes* was detected in one batch of shredded, grated and cut cheese (mozzarella). These instances of non-compliance were addressed directly with the licensees by the relevant DFSV food safety manager. This resulted in one recall, while the other non-compliant products were either destroyed or reprocessed.

This is the fourth year of the expanded program. In 2017-18 six out of 743 batches (0.81%) 2016–2017, five out of 656 batches (0.76%) and in 2015–2016, eight of 618 (1.3%) batches tested did not comply with Schedule 27 of the Code.

		n	c	m	M
All cheese	<i>Escherichia coli</i>	5	1	10/g	10 ² /g
Soft and semi soft cheese (moisture content >39%) with pH >5.0	Salmonella	5	0	not detected in 25g	
Ready to eat food in which Listeria monocytogenes can occur	<i>Listeria monocytogenes</i>	5	0	not detected in 25g	
Ready-to-eat food in which growth of Listeria monocytogenes will not occur	<i>Listeria monocytogenes</i>	5	0	10 ² cfu/g	

Table 7: Microbiological criteria from Schedule 27 of Standards 1.6.1 of the *Australia New Zealand Food Standards Code* relevant to the dairy product categories monitored in this survey.

pH testing

Selected product categories were tested for pH. These measurements allow assessment of the ability of dairy products to support the growth of pathogens and are useful for providing input data for predictive modelling which can assist with process validation and troubleshooting activities.

Physicochemical results may vary widely due to the unique nature of individual products, even within a category of similar products. This can be seen in the wide range of values observed for pH. Results for cheese samples also need to be considered in context of the manufacturing process. The physicochemical properties of ripened cheeses change during ripening and will vary with the stage of maturation and age of a product. This, in addition to the variations in formulations for different products, results in the high variation within cheese categories.

The pH results are shown in Table 8. The pH of the cream cheese dips, and the yoghurt-based dips fell within a relatively narrow range, while other products exhibited a wide range of pH values. Many products were within the pH range in which pathogens can grow. Two fermented milk products measured a high pH of 6.2 and 6.0, these were drinking yoghurts from a single manufacturer.

	Number of samples tested	Minimum pH	Average pH	Maximum pH
Cream cheese-based dips	8	4.1	4.2	4.4
Dairy desserts	25	4.3	6.1	7.0
Fresh cheese	136	3.5	5.0	6.8
Fermented milk products	72	3.6	4.3	6.2
Hard cheese	74	4.8	5.3	5.8
Smear-ripened cheese	21	5.1	5.8	6.9
Surface-ripened cheese	68	4.1	5.6	7.1
Semi-soft cheese	103	4.8	5.8	7.5
Yoghurt-based dips	8	3.9	4.1	4.4

Table 8: Average, minimum and maximum pH values of samples within each product category.

Conclusion

DFSV's Product Surveillance Program is one means of verifying the food safety programs of Victorian dairy manufacturers. Results which fail to meet certain microbiological criteria will signify a probable process control failure. While microbiological testing is an effective means of identifying a loss of process control, some failures may result in microbiological contamination that is intermittent and not homogeneously distributed throughout the batch. The limitations of sampling may mean that the contamination is not be detected. Therefore, microbiological testing alone does not provide reliable assurance of process control, and satisfactory observations from other verification activities are required to provide confidence that all controls are working effectively.

Of the eight batches that did not comply with the Code, seven were due to the presence of *E. coli* at levels which did not meet the microbiological criteria in Schedule 27 to Standard 1.6.1. The implicated batches included two batches of parmesan, two batches of fresh cheese and three batches of brie. *Listeria monocytogenes* was detected in one batch of shredded, grated and cut cheese (mozzarella). This was the only detection of *Listeria monocytogenes* during the four years of the expanded testing program.

Cheese categories were particularly prone to the presence of hygiene indicators such as coliforms and *E. coli*. Smear-ripened and surface-ripened cheese had the highest incidences of coliforms, potentially due to the manufacturing process which, in most cases, involves significant handling and environmental exposure. This illustrates the need for additional attention and/or improvement to hygiene control in plants that manufacture these products. Surface-ripened cheese was the category most frequently contaminated with *E. coli* suggesting that manufacturers of these products may need to improve GMP and hygiene controls.

High levels of coliforms (>100 MPN/g) were observed in product from all manufacturers of smear-ripened cheese. Combined data from the past four years of the program also identified that a high proportion of surface-ripened cheese manufacturers produced product with high levels of coliforms. This suggests that the production processes for these types of cheese make them particularly susceptible to coliform contamination and particular attention to hygiene controls and GMP at these sites is required.

Data generated by the Product Surveillance Program, each manufacturer's in-house testing data and other internal verification activities, as well as DFSV audits, combine to verify the effectiveness of the food safety programs within the Victorian dairy industry.

References

Australia New Zealand Food Standards Code: [Standard 1.6.1, Microbiological limits in food.](#)

Australia New Zealand Food Standards Code: [Schedule 27, Microbiological limits in food.](#)

Australian Standard AS 5013 Series 2014–2017, Food microbiology

Dairy Food Safety Victoria, 2015, [Microbiological testing criteria – Minimum testing requirements for manufacturers of dairy food products](#)

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Jensen, I. and Moir, C.J. (2003). *Bacillus cereus* and other *Bacillus* species. In: *Foodborne Microorganisms of Public Health Significance*, Sixth Edition. (Ed. A.D. Hocking). AIFST, NSW Branch, Food Microbiology Group, Waterloo, NSW, pp 445-478

Appendix 1

Baseline program:

Cream cheese-based dips	Coliforms <i>E. coli</i> Listeria spp.	pH
Fermented milk products	Coliforms <i>E. coli</i>	pH
Ice cream	Coliforms <i>E. coli</i> Total plate count Listeria	
Pasteurised liquid milk	Coliforms <i>E. coli</i> Total plate count	
Pasteurised liquid cream	Coliforms <i>E. coli</i> Total plate count	
Spreads	Coliforms <i>E. coli</i>	
Shredded, grated and cut cheese	Coliforms <i>E. coli</i> Listeria spp.	
Yoghurt based dips	Coliforms <i>E. coli</i> Listeria spp.	pH

Targeted program:

Dairy desserts	Coliforms <i>E. coli</i> Total plate count <i>Bacillus cereus</i> Listeria spp. Salmonella spp.	pH
Fresh cheese	Coliforms <i>E. coli</i> <i>Staphylococcus aureus</i> <i>Bacillus cereus</i> Listeria spp. Salmonella spp.	pH
Hard cheese	Coliforms <i>E. coli</i> Listeria spp. Salmonella spp.	pH
Semi-soft cheese	Coliforms <i>E. coli</i> Listeria spp. Salmonella spp.	pH
Smear-ripened cheese	Coliforms <i>E. coli</i> Listeria spp. Salmonella spp.	pH
Surface-ripened cheese	Coliforms <i>E. coli</i> Listeria spp. Salmonella spp.	pH

Appendix 2

The number of participating licensees, batches and samples tested during the 2018-19 Product Surveillance Program.

	Number of participating licensees	Number of batches	Number of samples
Cream cheese-based dips	4	8	40
Dairy desserts	7	25	125
Fresh cheese	50	143	675
Fermented milk products	44	83	388
Hard cheese	23	75	364
Ice cream	37	65	65
Liquid cream	11	20	100
Liquid milk	24	47	235
Shredded, grated, cut cheese	25	48	240
Smear-ripened cheese	6	21	97
Spreads	10	16	80
Surface-ripened cheese	21	70	323
Semi-soft cheese	34	105	510
Yoghurt-based dips	4	8	40
Total	156	734	3531

Appendix 3

Summary of *E. coli* detections in batches tested during the 2018–2019 Product Surveillance Program.

	Percentage of batches with <i>E. coli</i> detections (number batches positive / total number of batches tested)		Number of batches in which <i>E. coli</i> were detected at greater than 10 MPN/g (number of batches positive / total number of batches tested)		Number of batches in which <i>E. coli</i> were detected at greater than 100 MPN/g (number of batches positive/ total number of batches tested)	
Cream cheese-based dips	12.5%	(1/8)	0.0%	(0/8)	0.0%	(0/8)
Dairy desserts	0.0%	(0/25)	0.0%	(0/25)	0.0%	(0/25)
Fresh cheese	2.4%	(2/83)	0.0%	(0/83)	0.0%	(0/83)
Fermented milk products	0.7%	(1/143)	0.0%	(0/143)	0.0%	(0/143)
Hard cheese	2.7%	(2/75)	2.7%	(2/75)	2.7%	(2/75)
Ice cream	3.1%	(2/65)	1.5%	(1/65)	1.5%	(1/65)
Liquid cream	0.0%	(0/20)	0.0%	(0/20)	0.0%	(0/20)
Liquid milk	0.0%	(0/47)	0.0%	(0/47)	0.0%	(0/47)
Shredded, grated, cut cheese	0.0%	(0/48)	0.0%	(0/48)	0.0%	(0/48)
Smear-ripened cheese	4.8%	(1/21)	4.8%	(1/21)	0.0%	(0/21)
Spreads	0.0%	(0/16)	0.0%	(0/16)	0.0%	(0/16)
Surface-ripened cheese	7.1%	(5/70)	5.7%	(4/70)	4.3%	(3/70)
Semi-soft cheese	5.7%	(6/105)	2.9%	(3/105)	1.9%	(2/105)
Yoghurt-based dips	0.0%	(0/8)	0.0%	(0/8)	0.0%	(0/8)

Appendix 6

Criteria for categorising manufacturing sites based on production volume.

Product	Micro	Very small	Small	Medium	Large
Cheese	<20 tonnes	20-100 tonnes	100-500 tonnes	500-5,000 tonnes	>5,000 tonnes
Cream	-	-	<20,000 litres	100,000-1,000,000 litres	>1,000,000 litres
Dairy Desserts	-	-		All	
Dips	-	-		All	
Fermented milk products	-	-	<100 tonnes	100-10,000 tonnes	>10,000 tonnes
Ice cream	-	-	<5,000 litres	5,000-1,000,000 litres	>1,000,000 litres
Spreads	-	-	<5,000 tonnes		>5,000 tonnes
Milk	-	-	<1,000,000 litres	1,000,000-50,000,000 litres	>50,000,000 litres