

Product Surveillance Program report

2017–2018



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Executive summary

The Dairy Food Safety Victoria (DFSVM) 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, *Salmonella* and *Listeria monocytogenes*) and physicochemical properties (pH, water activity, moisture, salt concentration and lactic acid concentration). A total of 3541 samples were tested across 743 batches of dairy foods collected from 156 manufacturers.

The results demonstrated good compliance with the Code. Six of the 743 batches (0.81%) did not comply with the relevant criteria in Schedule 27 of Standard 1.6.1. These were all due to the presence of unacceptable levels of *E. coli* in cheese. No *Salmonella* or *Listeria monocytogenes* were detected in any sample. *Listeria innocua* was detected in one sample of cheddar cheese.

Guidelines such as the DFSVM *Microbiological testing criteria – minimum testing requirements for manufacturers of dairy food products* (DFSVM, 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.

Forty-eight of the 743 batches (6.5%) did not meet the process hygiene criteria for coliforms as defined in the Compendium, which generally indicates ineffective post-pasteurisation hygiene.

Sixteen of the 743 batches (2.1%) of dairy products did not meet the relevant criteria in the MTC guideline. Fifteen samples (four batches each of semi-soft cheese, ice cream and fermented milk products, two batches of fresh cheese and one batch of cream cheese dips) did not meet the criteria for *E. coli*. One additional batch of semi-soft cheese did not meet the criteria for coagulase positive staphylococci. Where high levels of *E. coli* were observed, follow-up action was undertaken by the relevant DFSVM 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 is the third 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 to an acceptable level. 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 the microbiological criteria which, if not met, would 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. This allows DFSV to assess the effectiveness of food safety controls across the Victorian dairy industry and identify the product categories and sites which are prone to process control failures. This information can be used to determine the incidence of process control failures across the industry and identify sites and product categories which may require refinement of the controls in place or further scrutiny by 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 categories were collected at each audit.

Five samples per batch were tested for coliforms, *E. coli*, and if the testing protocol required, coagulase-positive staphylococci. 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 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 relevant physicochemical parameters (see Appendix 1).

Results and discussion

In 2017–2018, 3541 samples from 743 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 provided in the Compendium. The Compendium currently only provides coliform criteria for liquid milk and cream and cheese, so the criteria for cheese were used to assess the effectiveness of process control for other product categories. These are summarised in Table 1 and the results are given in Table 2.

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

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	30% (7/23)	26% (6/23)
Semi-soft cheese	12% (15/121)	9% (11/121)
Fermented milk products	10% (9/88)	6% (5/88)
Ice cream	8% (5/65)	5% (3/65)
Liquid cream	5% (1/20)	0% (0/20)
Liquid milk	5% (2/44)	0% (0/44)
Hard cheese	4% (3/68)	4% (3/68)
Surface-ripened cheese	3% (2/58)	2% (1/58)
Fresh cheese	3% (3/99)	2% (2/99)
Shredded, grated, cut cheese	1% (1/88)	0% (0/88)
Spreads, yoghurt-based dips, cream cheese dips, dairy desserts	0%	0%

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).

Results and discussion

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 causing 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.

A small percentage of batches of semi soft, fermented milk products, ice cream, hard cheese, surface-ripened cheese and fresh cheese appeared to have been affected by more severe process control failures based on one or more samples with coliform numbers greater than 'M' (not to be exceeded) in the Compendium.

No process control failures were observed in spreads, yoghurt-based dips, cream cheese dips and dairy desserts. This 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 of the testing are in Table 4.



Product	<i>E. coli</i> / ml				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
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	

Table 3: Process hygiene criteria for *E. coli* in dairy products (*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)
Cream cheese-based dips	8% (1/13)	-
Ice cream	6% (4/65)	-
Fermented milk products	4.5% (4/88)	-
Semi-soft cheese	3% (4/121)	2.5% (3/121)
Fresh cheese	2% (2/99)	2% (2/99)
All other products	0%	0%

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 cream cheese dips, ice cream, fermented milk products, semi-soft cheese and fresh cheese, based on the presence of *E. coli* exceeding the criteria in the MTC. More severe loss of control was seen in the semi-soft cheese and fresh cheese categories where *E. coli* exceeded the limits described by 'M' in 2.5% and 2% 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. Manufacturers of these products need to be particularly diligent with GHP and GMP. While cream cheese-based dips showed the highest incidence of *E. coli* detections, this was due to a single batch of dip (corn relish), representing only one occurrence.

E. coli were detected in four batches of ice cream, compared to no detections in previous years. *E. coli* were not detected in dairy desserts (26 batches tested), liquid cream (20 batches), liquid milk (44 batches), shredded, grated and cut cheese (83 batches), spreads (15 batches), or yoghurt-based dips (14 batches). This 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 high 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.

Results and discussion

	% sites which failed process hygiene criteria (Table1)	% sites with coliforms above 'M' (not to be exceeded)
Smear-ripened cheese	67% (6/9)	67% (6/9)
Fermented milk products	15% (7/46)	13% (6/46)
Semi soft cheese	15% (5/33)	9% (3/33)
Ice cream	15% (5/33)	9% (3/33)
Surface-ripened cheese	10% (2/20)	5% (1/20)
Liquid cream	9% (1/11)	N/A
Hard cheese	8% (2/25)	8% (2/25)
Liquid milk	7% (2/27)	N/A
Fresh cheese	6% (3/51)	4% (2/51)
Other product categories	0%	0%

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).

Six of the nine sites (67%) 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 a large proportion of manufacturers of smear-ripened cheese are experiencing high coliform counts suggests that the production methods for this type 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 this type of cheese is subjected to extensive handling and environmental exposure during manufacture and ripening, where there are many opportunities for contamination.

As already mentioned, the use of secondary starter cultures may return a positive coliform result for cheese made from certain cultures and may contribute to the high number of manufacturers experiencing high coliform counts for these products. This aspect was investigated further, and it was observed that where a product was sampled multiple times during the survey, coliforms were detected in high levels in some batches and not detected in other batches of the same product from the same manufacturer. This suggests that the cultures were not the cause of the detections in these cases.

Other product categories in which a higher proportion (between 10-15%) of sites failed to meet the process hygiene criteria included fermented milk products, semi-soft cheese, ice cream, and surface-ripened cheese.

The liquid cream, hard cheese, liquid milk and fresh cheese categories showed a lower percentage of sites (less than 10%) 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, shredded, crated cut cheese, dairy desserts and cream cheese dips 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)
Cream cheese-based dips	25%	25%
Semi-soft cheese	9%	6%
Ice cream	9%	-
Fermented milk products	9%	-
Fresh cheese	4%	2%
All other products	0%	0%

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).

Cream cheese-based dips had the largest proportion of sites with one or more samples from a batch having *E. coli* present at levels greater than both 'm' and 'M'. Again, this represented a single batch from one site. A low proportion of sites producing semi-soft cheese, ice cream, fermented milk products and fresh cheese also failed these criteria, suggesting that failures are not widespread across a large number of sites.

Product from all sites manufacturing spreads, smear-ripened cheese, hard cheese, dairy desserts, liquid cream, liquid milk, shredded, grated and cut cheese or 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. Five product categories were tested for total plate counts (liquid milk, ice cream, liquid cream, dairy desserts and spreads).

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 three batches of liquid milk, three batches of ice cream and two batches of dairy desserts were reported as >300,000 cfu/g. 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 10⁶ cfu/g (log 6 cfu/g) for Category 4¹, or 10⁵ cfu/g (log 5 cfu/g) for Category 3² ready-to-eat foods as satisfactory. With the exception of three batches of ice cream, three batches of dairy desserts and four batches of liquid milk, 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 both Category 3 and 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

Results and discussion

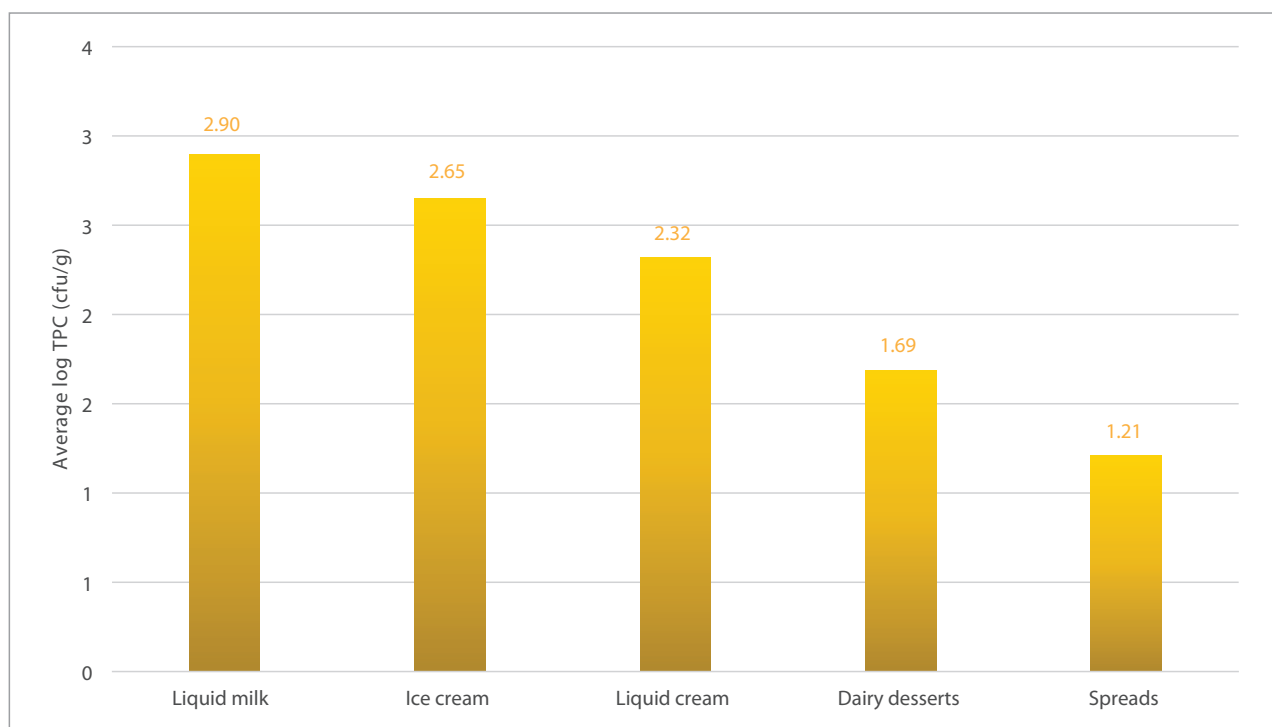


Figure 1: Total plate count results (average log cfu/g) for relevant product categories during the 2017-2018 testing year.

Microbiological testing – pathogens

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.

Coagulase-positive staphylococci were detected in five batches of product during 2017–2018. It was detected at a level of 100 cfu/g in one of the five samples from a batch each of bocconcini, fetta and brie. It was also present in two and three of the five samples taken from two batches of semi-soft cheese from the same manufacturer at levels of 100 cfu/g. One of these batches did not meet the criteria in the MTC, which only allow two of the five samples to have counts between 100 and 1000 cfu/g. Apart from this one batch, the low levels do not suggest major process control issues or a food safety risk in these products but may serve as a warning of hygiene problems or failure in GMP.

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 408 samples tested. *L. monocytogenes* was not present in any of the 472 samples tested, however *Listeria innocua* was detected in one sample of organic cheddar cheese from one manufacturer.

Salmonella and *L. monocytogenes* have not been detected in any product tested during the two previous years that the survey has been running in its current format.

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 743 batches of dairy products analysed, six batches (0.81%) did not comply with the Code due to the presence of *E. coli* at levels which did not meet the microbiological criteria in Schedule 27. These included three batches of

bocconcini (from two different manufacturers), two batches of fresh cheese (ricotta and farm cheese) and one batch of mozzarella. These non-conformances were addressed directly with the licensees by the relevant DFSV food safety manager.

This is the third year of the expanded program. In 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	<i>Salmonella</i>	5	0	not detected in 25g	
Ready-to-eat food in which growth of <i>Listeria monocytogenes</i> can occur	<i>Listeria monocytogenes</i>	5	0	not detected in 25g	
Ready-to-eat food in which growth of <i>Listeria monocytogenes</i> 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.



Results and discussion

Physicochemical testing

Product categories in the targeted program were tested for pH, water activity, moisture, lactic acid concentration and salt concentration. 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, especially for pH, salt and lactate concentrations. 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 observed within cheese categories.

a) pH

The pH results are shown in Table 8. The pH of the cream cheese dips and the yoghurt-based dips fell within a narrow range, while other products exhibited a wide range of pH values. Many products were within the pH range in which pathogens can grow.

	Number of samples tested	Minimum pH	Average pH	Maximum pH
Cream cheese-based dips	13	4.1	4.3	4.5
Dairy desserts	21	4.4	6.1	6.9
Fresh cheese	7	4.2	5.4	6.7
Fermented milk products	75	3.5	4.3	5.9
Hard cheese	64	4.8	5.3	6.4
Shredded grated cut cheese	87	4.3	5.3	7.3
Smear-ripened cheese	23	5.0	5.7	6.7
Surface-ripened cheese	54	4.8	5.6	7.0
Semi-soft cheese	101	4.7	5.6	7.5
Yoghurt-based dips	13	4.0	4.1	4.4

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

b) Water activity

Water activity is a measure of unbound water which is available for microbial growth. Most bacteria are unable to grow at water activities below 0.92. A wide range of water activities was observed, due to the diversity of product characteristics and formulations, but most were within the range in which pathogens can grow (Table 9).

	Number of samples tested	Minimum Aw	Average Aw	Maximum Aw
Cream cheese-based dips	7	0.97	0.97	0.98
Dairy desserts	11	0.94	0.98	0.99
Fresh cheese	4	0.96	0.97	0.99
Hard cheese	37	0.86	0.94	0.99
Shredded grated cut cheese	52	0.69	0.92	0.99
Smear-ripened cheese	11	0.96	0.97	0.98
Surface-ripened cheese	30	0.94	0.97	0.98
Semi-soft cheese	62	0.85	0.97	0.99
Yoghurt-based dips	9	0.97	0.98	0.99

Table 9: Average, minimum and maximum water activity values of samples within each product category.

c) Moisture

Moisture measurements indicate the total amount of water in a product. It does not consider the water which is bound to other food components such as salt and sugar, so is a poor indicator of a product's ability to support the growth of pathogens. Moisture testing results are in Table 10.

	Number of samples tested	Minimum moisture (%)	Average moisture (%)	Maximum moisture (%)
Fresh cheese	7	40.7	61.3	79.3
Hard cheese	64	24.5	36.0	48
Shredded grated cut cheese	87	12.6	34.1	55.7
Smear- ripened cheese	23	35.7	48.3	55.5
Surface-ripened cheese	54	32.4	49.7	61.8
Semi soft cheese	101	30.6	47.8	76.5

Table 10: Average, minimum and maximum moisture values of samples within each product category.

Results and discussion

d) Salt concentration

Salt is added to many dairy products to enhance flavour and control bacterial growth. The levels of salt varied widely both within and between categories due to individual product formulations and characteristics. The salt concentration of samples within each product category tested in the targeted program are in Table 11.

	Number of samples tested	Minimum salt concentration (%)	Average salt concentration (%)	Maximum salt concentration (%)
Cream cheese-based dips	13	0.8	1.5	2.9
Fresh cheese	7	0.6	1.8	4.1
Hard cheese	63	0.1	2.0	7.6
Shredded grated cut cheese	86	0.1	2.1	7.6
Smear-ripened cheese	23	0.2	1.6	3
Surface-ripened cheese	54	0.1	1.4	2.9
Semi-soft cheese	95	0.1	1.6	7.2
Yoghurt-based dips	13	0.3	0.8	1.5

Table 11: Average, minimum and maximum salt concentration of samples within each product category.

e) Lactic acid concentration

Lactic acid is generated during fermentation of dairy products. High levels of lactic acid are inhibitory to pathogens and other bacteria. The lactic acid concentration can provide information about the ability of a product to support the growth of pathogens and enable more accurate predictive modelling. The level of lactic acid can vary widely depending on the product and the results shown in Table 12 demonstrate this.

	Number of samples tested	Minimum lactic acid (mg/100g)	Average lactic acid (mg/100g)	Maximum lactic acid (mg/100g)
Cream cheese-based dips	13	240	420.8	600
Fresh cheese	6	6	695.7	1502
Hard cheese	64	30	1105.3	1800
Shredded grated cut cheese	86	21	1087.9	1800
Smear-ripened cheese	23	26	572.0	1500
Surface-ripened cheese	54	15	371.5	1400
Semi-soft cheese	99	3	610.5	1700

Table 12: Average, minimum and maximum lactic acid concentration 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.

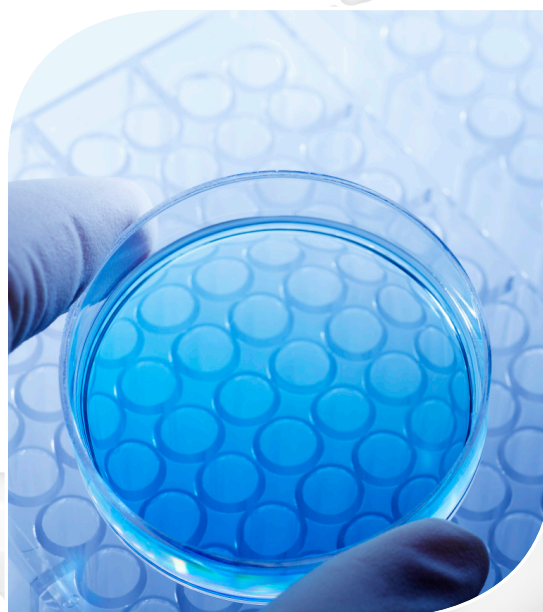
Six batches (0.81%) did not comply with the Code due to the presence of *E. coli* at levels which did not meet the criteria specified in Schedule 27 to Standard 1.6.1. This is marginally higher than last year when 0.76% of batches did not comply with the Code, also due to the presence of *E. coli* in cheese. The implicated batches included three batches of bocconcini (from two different manufacturers), two batches of fresh cheese (ricotta and farm cheese) and one batch of mozzarella. Of these six batches, three were from the same manufacturer.

Cheese categories were particularly prone to the presence of hygiene indicators such as coliforms and *E. coli*. Smear-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. Semi-soft cheese was the category most frequently contaminated with high levels of *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 a large proportion of manufacturers of smear-ripened cheese. Combined data from the past three 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.

The water activity, pH, moisture content, salt and lactic acid concentration of dairy products considered higher risk in terms of food safety were also measured. This data is used to assess the risk of pathogen growth in different types of dairy products and to better inform predictive modelling and technical support activities by DFSV.

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*

Food Standards Australia New Zealand, 2018,
Compendium of Microbiological Criteria for Food

Appendix 1

Baseline program:

Fermented milk products	Coliforms <i>E. coli</i> pH
Fresh cheese	Coliforms <i>E. coli</i> <i>Staphylococcus aureus</i>
Ice cream	Coliforms <i>E. coli</i> Total plate count Listeria
Spreads	Coliforms <i>E. coli</i> Total plate count
Pasteurised liquid milk	Coliforms <i>E. coli</i> Total plate count
Pasteurised liquid cream	Coliforms <i>E. coli</i> Total plate count

Appendix 1

Targeted program:

Cream cheese-based dips	Coliforms <i>E. coli</i> Listeria spp. Salmonella spp.	pH Water activity Salt concentration Lactic acid concentration
Hard cheese	Coliforms <i>E. coli</i> Listeria spp. Salmonella spp.	pH Water activity Moisture Salt concentration Lactic acid concentration
Yoghurt-based dips	Coliforms <i>E. coli</i> Listeria spp. Salmonella spp.	pH Water activity Salt concentration Lactic acid concentration
Semi-soft cheese	Coliforms <i>E. coli</i> <i>Staphylococcus aureus</i> Listeria spp. Salmonella spp.	pH Water activity Moisture Salt concentration Lactic acid concentration
Smear-ripened cheese	Coliforms <i>E. coli</i> <i>Staphylococcus aureus</i> Listeria spp. Salmonella spp.	pH Water activity Moisture Salt concentration Lactic acid concentration
Shredded, grated, cut cheese	Coliforms <i>E. coli</i> Listeria spp. Salmonella spp.	pH Water activity Moisture Salt concentration Lactic acid concentration
Surface-ripened cheese	Coliforms <i>E. coli</i> <i>Staphylococcus aureus</i> Listeria spp. Salmonella spp.	pH Water activity Moisture Salt concentration Lactic acid concentration
Dairy desserts	Coliforms <i>E. coli</i> Total plate count Listeria spp. Salmonella spp.	pH Water activity

Appendix 2

The number of participating licensees, batches and samples tested during the 2017–2018 Product Surveillance Program.

	Number of participating licensees	Number of batches	Number of samples
Cream cheese-based dips	4	15	65
Dairy desserts	9	26	130
Fresh cheese	51	99	466
Fermented milk products	46	88	437
Hard cheese	25	68	340
Ice cream	33	65	290
Liquid cream	11	20	100
Liquid milk	27	44	217
Shredded, grated, cut cheese	27	88	440
Smear-ripened cheese	9	23	115
Spreads	10	15	75
Surface-ripened cheese	20	58	274
Semi-soft cheese	33	121	527
Yoghurt-based dips	4	13	65
Total	156	743	3541

Appendix 3

Summary of *E. coli* detections in batches tested during the 2017–2018 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	7.7%	(1/13)	7.7%	(1/13)	7.7%	(1/13)
Dairy desserts	0.0%	(0/26)	0.0%	(0/26)	0.0%	(0/26)
Fresh cheese	4.0%	(4/99)	3.0%	(3/99)	1.0%	(1/99)
Fermented milk products	4.5%	(4/88)	3.4%	(3/88)	2.3%	(2/88)
Hard cheese	2.9%	(2/68)	0.0%	(0/68)	0.0%	(0/68)
Ice cream	6.2%	(4/65)	1.5%	(1/65)	0.0%	(0/65)
Liquid cream	0.0%	(0/20)	0.0%	(0/20)	0.0%	(0/20)
Liquid milk	0.0%	(0/44)	0.0%	(0/44)	0.0%	(0/44)
Shredded, grated, cut cheese	0.0%	(0/88)	0.0%	(0/88)	0.0%	(0/88)
Smear-ripened cheeses	4.3%	(1/23)	0.0%	(0/23)	0.0%	(0/23)
Spreads	0.0%	(0/15)	0.0	(0/15)	0.0%	(0/15)
Surface-ripened cheese	1.7%	(1/58)	1.7%	(1/58)	0.0%	(0/58)
Semi-soft cheeses	7.4%	(9/121)	5.8%	(7/121)	2.5%	(3/121)
Yoghurt-based dips	0.0%	(0/13)	0.0%	(0/13)	0.0%	(0/13)

Appendix 4

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	
Dried milk powders			<1,000 tonnes	1000–10,000 tonnes	>10,000 tonnes
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



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