Dairy Food Safety Victoria

Product Testing Program

2014–2015

November 2015

Contents

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1. Executive summary

One hundred and sixty seven licensed dairy product manufacturers participated in the Dairy Food Safety Victoria (DFSV) Product Testing Program (PTP) during the 2014–2015 year. A total of 1410 samples were received and analysed according to a testing program based on product category and risk. The results provide the dairy industry with microbiological data across a range of dairy product categories.

The low rate of detection and the low numbers of microorganisms detected throughout the program indicate that the overall quality of Victorian dairy products is of a high standard.

Coliforms were present in 11% and *E. coli* were detected in 1.3% of dairy product samples analysed. This is a slight increase in the rate of detection observed during 2013–2014 where coliforms were present in 9% and *E. coli* present in 0.8% of total samples. The presence of these organisms may indicate a breakdown in process control or hygiene issues and where present in high numbers may suggest these manufacturers could benefit from guidance on strategies to control contamination by these organisms.

Ice cream had a much higher incidence of coliform detections compared to all other products, an observation consistent with previous testing years. Despite the relatively high rate of detection, the number of organisms present in ice cream was low.

Cheese and fermented milk products were most likely to be contaminated with *E. coli* at levels of concern. This is consistent with 2013–2014 results in which these products were also the only product categories in which *E. coli* was detected.

During the 2014–2015 year, high risk products such as dips, soft cheese and cut, grated and shredded cheeses were tested for Listeria as part of the targeted testing component of the program. A total of 439 samples were tested and *Listeria monocytogenes* was detected in one shredded cheese sample. The targeted component also involved analysis of milk for *B. cereus*, however this organism was not detected at levels of concern.

Of the 1410 samples submitted during the 2014–2015 survey, three samples (two cheese samples with *E. coli* and one shredded cheese sample in which *Listeria monocytogenes* was detected) were in breach of the microbiological criteria specified in the Australia New Zealand Food Standards Code[1]. All breaches were subjected to further investigation by DFSV and appropriate action was taken to protect public health.

Manufacturers producing low volumes of cheese (<500 tonnes) had a higher incidence of coliform and *E. coli* detections compared to manufacturers of larger volumes (>5000 tonnes). Similarly, sites processing lower volumes of milk and fermented milk products tended towards a higher incidence of coliform and *E. coli* detections. These are patterns that have also been observed during previous years of the PTP. This may suggest a need for technical support and advice directed at identification of additional control measures to allow small volume manufacturers to improve the quality and safety of their products.

Individual results and a summary report are provided to each manufacturer enabling them to review their results against similar sized manufacturers making comparable products. Due to the relatively low number of samples submitted by each manufacturer during each testing year, these results are considered as a supplement to, not a replacement of, each licensees own in-house product testing as documented under their food safety program.

Program results indicate that the quality of Victorian dairy products is of a high standard

2. Background

The PTP is a microbiological survey of licensed Victorian dairy product manufacturers. The program utilises a risk-based method for selection of dairy products for assessment.

The results are used to analyse trends and provide benchmarking data for industry. Data collected from the large number of samples submitted over the life of the program (2007–2015) provides a reliable baseline indication of the expected incidence and quantity of indicator organisms for each product category. This information is used by industry to gauge the microbiological status of their products against industry norms for the relevant product category, as well as against other licensees of comparable size manufacturing similar products.

The ten product categories surveyed during the 2014–2015 testing year were cream, dairy desserts, dairy dips, dried milk powders, fermented milk products, high moisture cheese, ice cream, low moisture cheese, dairy spreads and milk. Each manufacturer was required to submit a sample from three consecutive batches of each relevant product category at least twice per year.

Products were allocated to either a baseline or targeted sampling program based on risk. Samples in the baseline component of the program are tested for a number of indicator organisms including coliforms, *E. coli*, total plate count and yeast/moulds. The presence of these organisms may signify the potential presence of pathogens due to a failure in manufacturing process control, breaches of good manufacturing practice or an increased risk of spoilage due to ineffective cleaning.

In 2014–2015 year, the targeted component of the program focused on Listeria in high risk products such as cut, grated and shredded cheese, soft cheeses and dips. Samples were tested for Listeria species in addition to the baseline tests. Cut, grated and shredded cheeses were submitted four times per year, while soft cheese and dips were submitted twice per year. *B. cereus* was also monitored as part of this component due to elevated levels observed in milk during the 2012–2013 PTP.

The number of samples tested in each product category is given in Figure 1. The number of samples tested in many categories is trending up, indicating an increased number of manufacturers producing these products. High moisture cheese is the category with the highest number of samples. In total, 167 different licensees submitted samples in at least one product category.

All laboratory analysis during the 2014–2015 year testing years was undertaken by DTS Food Laboratories (Melbourne)

Microbiological results generated by the Product Testing Program are used to analyse trends and provide benchmarking data for industry.

In 2015–2016, the program will undergo a significant expansion to allow an increase in the amount and type of information being collected. Baseline and benchmarking data will still be generated, but there will be more in-depth analysis of the physicochemical and microbiological characteristics of higher risk Victorian dairy products. The information will be used to monitor compliance with the Australia New Zealand Food Standards Code and inform enhanced technical support activities.

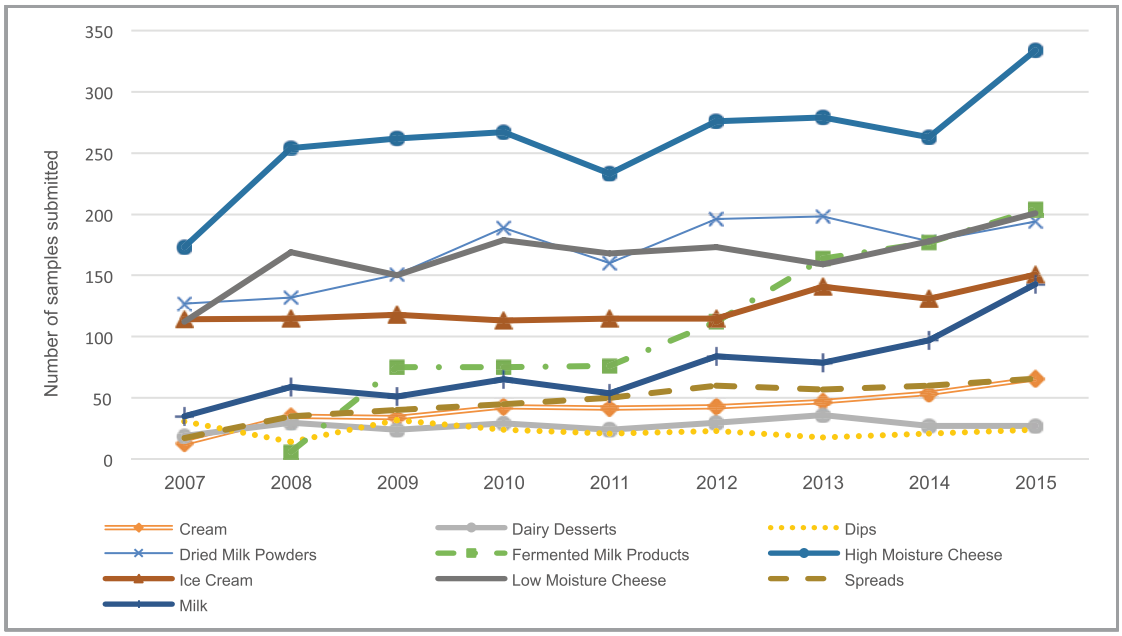

Figure 1: Number of samples tested in each product category during each testing year (PTP, 2007–2015).

3. Results and discussion

During the 2014–2015 PTP, 1410 samples across 10 product categories were tested for the presence of a number of pathogenic and indicator organisms. The number of samples tested represents a 19% increase from 2013–2014, when 1186 samples were submitted.

A summary of the tests undertaken within each product category is outlined in Table 1, where detections as a percentage of total samples tested are also presented.

Product category	Participating factories	Coliforms	*E. coli*	*B. cereus*	Yeasts	Moulds	Listeria	TPC (see Figure 8 for results)
Cream	13	6/66 (9%)	0/66 (0%)					66
Dairy desserts	6	0/27 (0%)	0/27 (0%)					27
Dips	4	2/24 (8%)	0/24 (0%)		1/6 (17%)	0/6 (0%)	0/24 (0%)	
Dried milk powder	33							194
Fermented milk products	36	12/204 (6%)	2/204 (1%)		23/201 (11%)	6/201 (3%)		
High moisture cheese	63	41/334 (12%)	5/334 (2%)				2/303 (1%)	
Ice cream	30	33/151 (22%)	2/151 (1%)					148
Low moisture cheese	38	26/201 (13%)	6/201 (3%)				0/ 112 (0%)	
Spreads	13							66
Whole milk	22	1/143 (1%)	0/143 (0%)	5/122 (4.1%)				
TOTAL		**124/1159 (11%)**	**15/1159 (1%)**	**5/122 (4%)**	**24/207(12%)**	**6/207 (3%)**	**2/439 (0.5%)**	**635**

Table 1: Results of testing for 2014–2015 testing year

3.1 Coliforms

During 2014–2015, 1159 samples from eight product categories were tested for coliforms. Coliforms were detected in 124 (11%) samples. The products in which coliforms were detected, and the proportion of samples in which they were present, is given in Table 1 and illustrated in Figure 2.
A comparison with the average coliform detection rate over the period that the program has been in operation (2007–2015) is also provided in Figure 2.

When samples with very low numbers of coliforms (<10 cfu/g) were excluded (represented by the black line), the incidence of coliforms at levels of concern was very low (Figure 2). In at least 90% of samples across all product categories, coliforms were either not detected or were present at less than 10 cfu/g or ml. Products more likely to have higher numbers of coliforms included high and low moisture cheese and cream.

Over the course of the year, 21 samples (cream, high moisture cheese and low moisture cheese and ice cream) had coliforms greater than 1000 cfu/g.

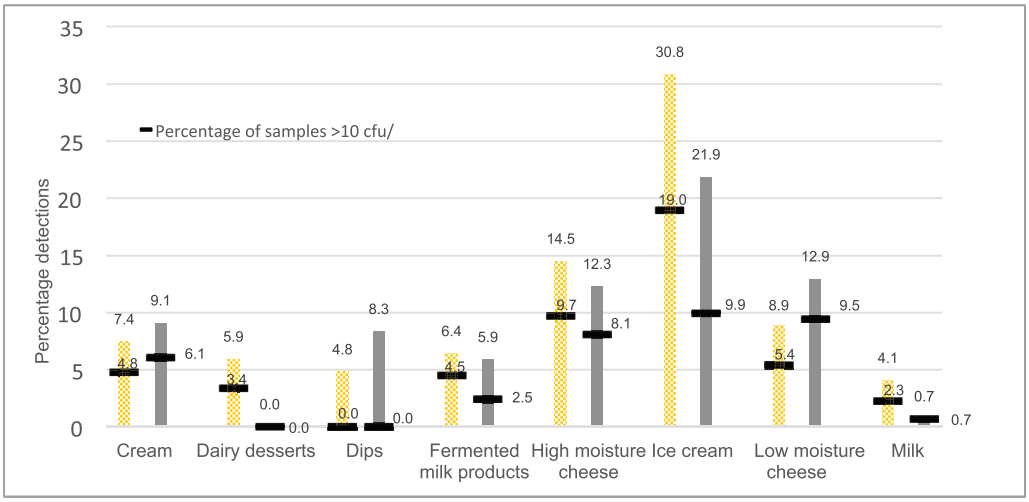

Figure 2: Incidence of coliform detections in 2014–2015 year (solid bars) compared to the average rate of detections over the life of the PTP (shaded bars). The black line indicates the percentage of samples in which coliforms were present at greater than 10 cfu/g or ml.

Dairy desserts, fermented milk products, high moisture cheese and milk samples all displayed a decrease in the incidence of coliform detections compared to program averages.

The incidence of coliform detections in cream, dips, and low moisture cheese were slightly higher than the program average (Figure 2). These increases are slight and do not suggest a cause for concern. During the 2013–2014 testing year, dips were found to show an unusually high incidence of coliforms compared to the program average. This appears to have resolved this year with the incidence of coliforms in dips reverting to near baseline levels.

There was an increase in the incidence of coliforms in low moisture cheese during the 2014–2015 testing year compared to the program average. Coliforms were present in 12.9% (26/201 samples) of low moisture cheese samples submitted. Of the 26 samples, 14 were from a single manufacturer and another five were from a second factory. These two sites were largely responsible for the spike in coliform detections in low moisture cheese. Further investigation with these two premises may be required to determine the reason for the increased incidence of coliforms.

Ice cream continues to return the highest incidence of coliform detections, although a decrease in incidence has been occurring over the past three years from a peak of 42% in 2011–2012 (Figure 3). This may suggest an improvement in process control by ice cream manufacturers over this period. While coliforms have been commonly detected in ice cream, they are present in low numbers and therefore may not represent a major contamination or failure in food safety processes. However, an incidence of 22% is still a very high proportion of detections and may represent a breakdown in good manufacturing practice (GMP) and good hygienic practice (GHP) that could lead to food safety issues.

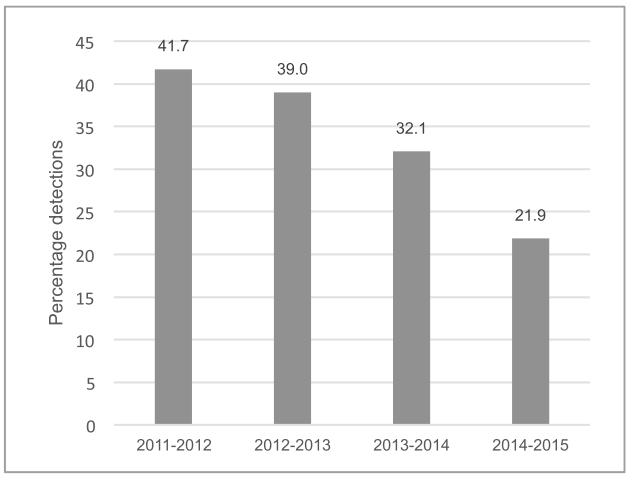

Figure 3: Incidence of coliform detections in ice cream over the past four years of the program.

The rate of detection of coliforms in milk samples was substantially lower than that observed over the past four years (Figure 4). There were five detections during the 2013–2014 testing year attributed to three small size factories, two with multiple detections. There was only one detection during the 2014–2015 testing year (and this was at a low level) which represented a considerable improvement.

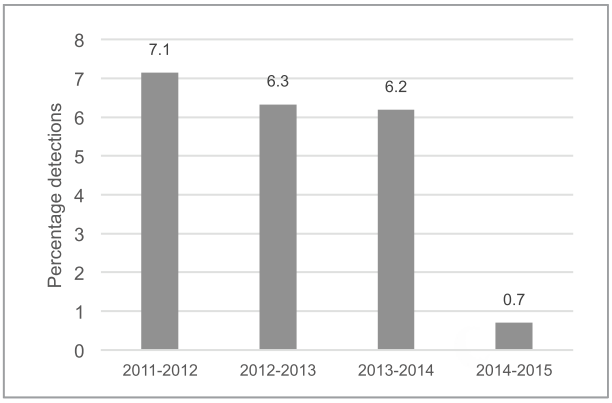

Figure 4: Incidence of coliform detections in milk over the duration of the PTP program (2007–2015).

Coliform detections in high moisture cheese have shown a downward trend since the start of the program in 2007 (Figure 5). Given the high number of samples submitted in this product category, this represents a meaningful trend.

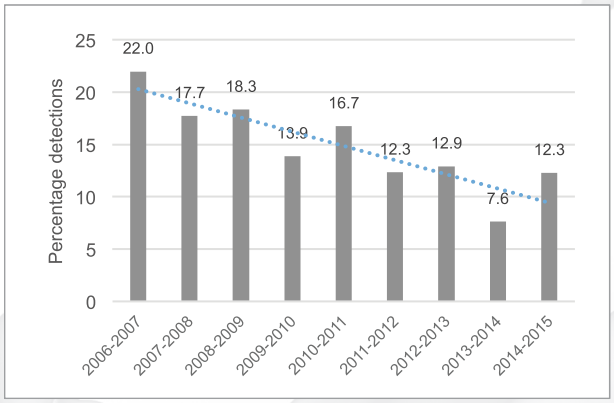

Figure 5: Incidence of coliform detections in high moisture cheese over the duration of the PTP program.

3.2 *E. coli*

All samples in which coliforms were detected were further tested for *E. coli*. Of the samples tested, *E. coli* was present in 1.3% (15/1159) of all the dairy products subjected to coliform tests. This is a slight increase compared to the previous year when 0.8% of samples were positive for *E. coli*.

E. coli were detected in 1% of fermented milk product samples, high and low moisture cheeses (1.5% and 3% respectively) and ice cream (1.3% of samples) (Figure 6). Details of the samples in which *E. coli* were detected are given in Appendix 6.1.

E. coli have not been detected in cream, dips, dairy desserts, milk powders, spreads or milk at any point over the life of the PTP survey (2007–2015).

Trend patterns were difficult to assess due to the low number of samples in which *E. coli* were detected. The incidence of *E. coli* in ice cream, fermented milk products and high moisture cheese were within the ranges observed over previous years. However, the incidence of *E. coli* in low moisture cheese was higher than has been observed in the past.

E. coli were present at less than 10 cfu/g in all ice cream samples (Figure 6). *E. coli* was present in two low moisture cheese products at levels in breach of the Food Standards Code (where M = 100 cfu/g)1. DFSV further investigated each of these results.

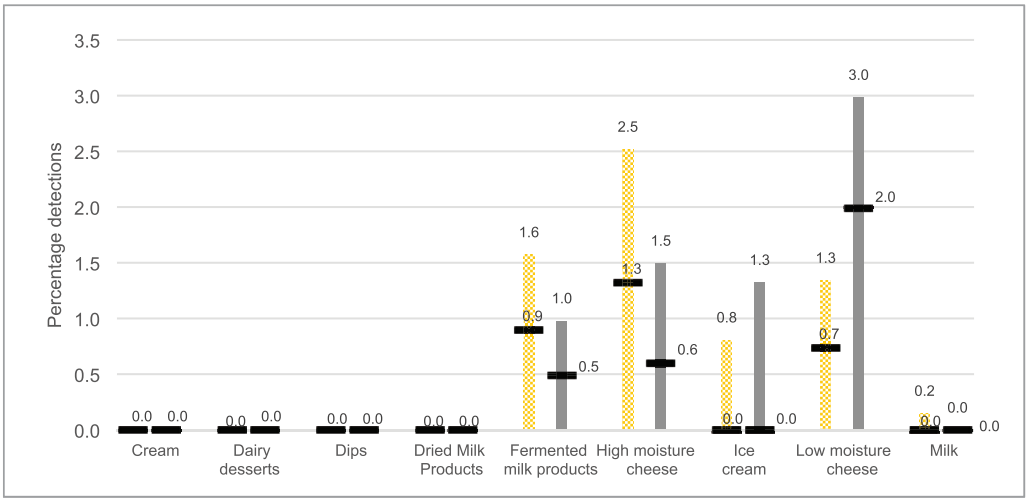

Figure 6: Incidence of *E. coli* detections in 2014–2015 (solid bars) compared to the average rate of detections over the life of the PTP (shaded bars). The black line indicates the percentage of samples over 10 cfu/g or ml.

3.3 *Bacillus cereus*

Milk samples submitted for testing were held in the laboratory for 10 days post manufacture before analysis for *B. cereus*. Of the 122 samples tested, *B. cereus* was detected in five samples (4.1%) from four different manufacturers (Figure 7). Four (3 cow and 1 goat) contained 100 cfu/g which was at the limit of detection, in a fifth sample *B. cereus* was detected at 200 cfu/g (Appendix 6.2). These levels are all considered low and not a cause for concern.

B. cereus testing was conducted during 2014–2015 after it was detected in an unexpectedly high number of samples (14.8%) during the 2012–2013 testing year. At that time, eight out of 54 samples tested positive.

It is unclear why the incidence of *B. cereus* was much lower than that observed during 2012–2013 but this organism is known to vary with seasonal conditions and feeding regimes.

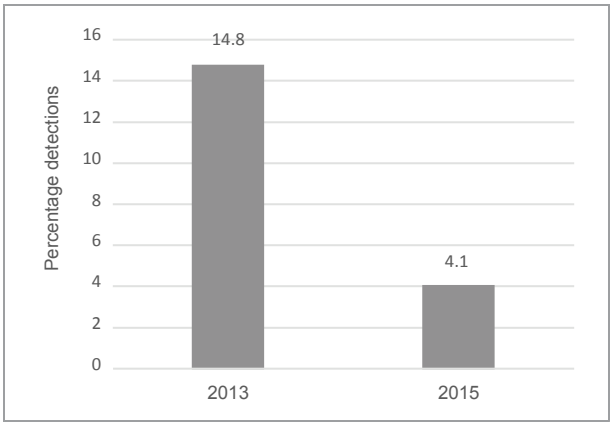

Figure 7: Incidence of *B. cereus* detections during the 2012–2013 and 2014–2015 testing years

3.4 Yeasts and moulds

Dips and fermented milk product samples were tested for yeasts and moulds. Due to the low number of licensed dip manufacturers, very few samples are tested in this product category. As a result it is difficult to gauge trends and obtain reliable baselines. However, the results indicate that the dips tested during 2014–2015 were of high quality in respect of yeast and mould contamination and were lower than the overall averages for dips.

Of the 201 fermented milk product samples analysed, there were 23 yeast detections, and mould was observed in six samples. A small proportion of samples (2.5%) had yeast at levels of >1000 cfu/g, but otherwise the levels of both yeast and moulds were generally low. Elevated levels of yeasts and moulds reflect poor hygienic conditions during processing and have the potential to compromise product quality and shelf life. Details of the samples in which yeasts and moulds were detected are given in Appendix 6.3 and 6.4. The rate of detection of yeasts and moulds in fermented milk samples tested in 2014–2015 were lower than the overall averages for the program.

3.5 Total plate count

Total plate count is a measure of total viable organisms and can be used to gauge overall process hygiene. While it is a more useful indicator of quality rather than food safety, high counts in non-fermented foods can be indicative of process control issues. Total plate count testing was conducted on 638 samples from six product categories. Results of this testing are summarised in Figure 8. Milk, ice cream and cream had the highest average log counts. The average log plate count obtained by all products during 2014–2015 was consistent with the program averages for each category.The average log count obtained from samples in each product category were consistent with previous years and no obvious trends were observed in any product category.

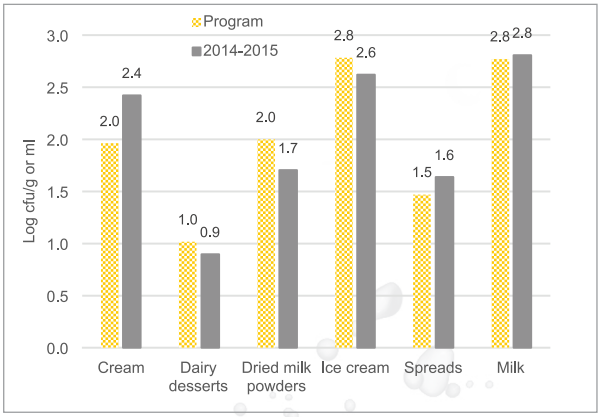

Figure 8: Average log total plate counts for each product category tested during 2014–2015.

3.6 Listeria

Four hundred and thirty nine (439) samples from three product categories (cut, grated and shredded cheese, soft cheese and dairy dips) were tested for Listeria species. Listeria species were detected in two cheese samples, with one isolate from a shredded mozzarella confirmed as *L. monocytogenes*. DFSV undertook further investigation of both positive results and the product in which *L. monocytogenes* was detected was withdrawn from sale.

4. Factory size analysis

Manufacturers were categorised according to production volume to allow analysis of the relationship between production volume and the incidence of coliforms and *E. coli*. The criteria for allocating manufacturers to size categories are outlined in Appendix 6.6.

4.1 Coliforms

Cheese

The incidence of coliforms in high moisture cheese was highest in manufacturers classified as small (100–500 tonnes). Very small sites had a slightly lower incidence compared to medium sized sites. This observation is consistent with the average results collected over the whole program (shown in Figure 11 by shaded bars), in which both small and very small manufacturers (<500 tonnes) tend to have a higher incidence of coliform detections in high moisture cheese compared to medium and large sites. These results may indicate better process hygiene in large factories.

Low moisture cheese produced by very small sized manufacturers (<100 tonnes per annum) during 2015 had a considerably higher incidence of coliform detections compared to manufacturers in other size categories (Figure 9). The large volume of data collected over the seven years of the project supports this pattern of an increased rate of coliform detections as the production volume decreases.

Cream

During the 2014–2015 year, the incidence of coliforms in cream was substantially higher in small plants compared to large and medium size plants. This was due to four detections out of 18 samples submitted from small factories. Three of the four detections were from a single processor (Appendix 6.7) suggesting that these results may be due to issues within a single plant.

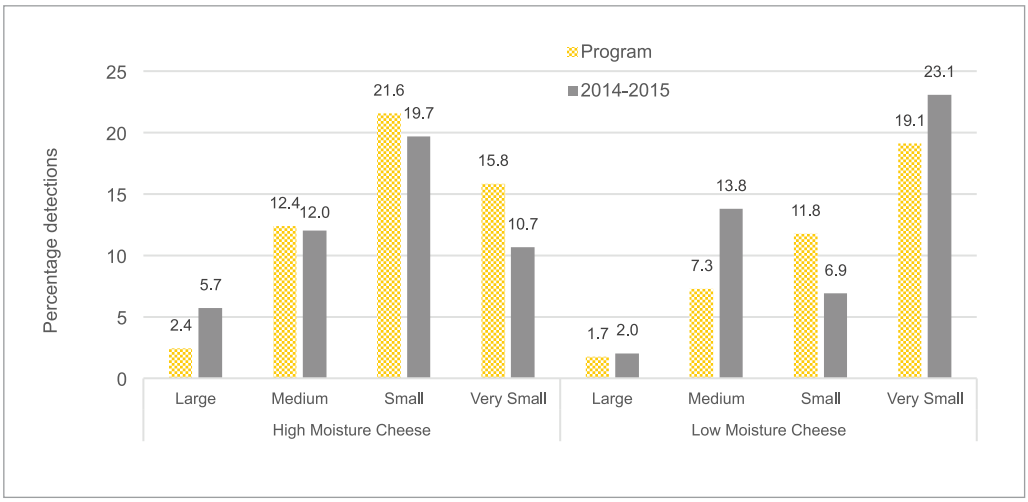

Figure 9: Incidence of coliform detections in high and low moisture cheese during 2014–2015 testing year.

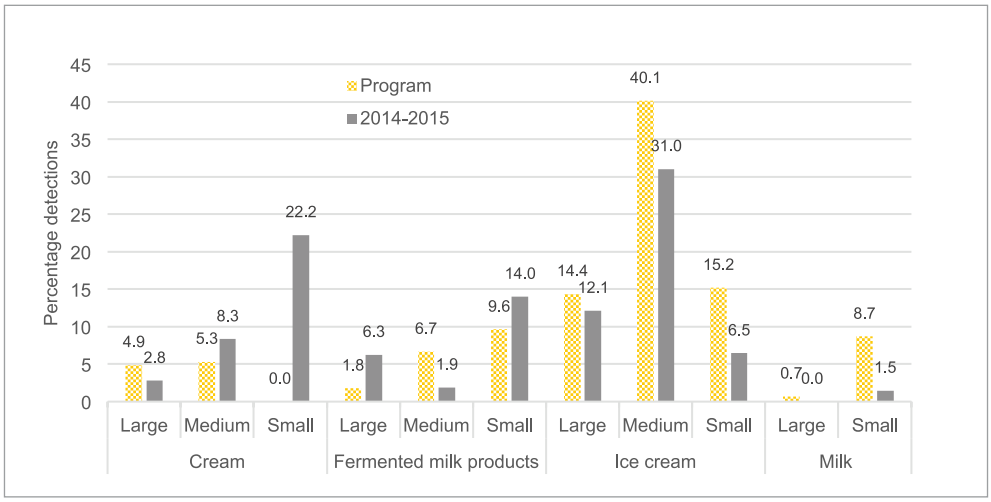

Figure 10: Incidence of coliform detections in cream, fermented milk, ice cream and milk samples submitted during the 2014–2015 testing year compared with average of results collected over the life of the PTP project.

Fermented milk

Coliforms were present at a higher incidence in small factories (detected in seven out of 50 samples (14%) of samples) compared to large and medium sized factories. Of the seven samples, three were at very low levels (<10 cfu/g) (Appendix 6.8). Three of the remaining four samples were from the same manufacturer, again indicating that these elevated results compared to program averages may be due to process control at a single site. Average results collected over the life of the program confirm that small-sized manufacturers tend towards a higher incidence of coliform detections.

Ice cream

Medium sized ice cream processors displayed the highest incidence of coliform detections, with results substantially higher than those observed in large and small-sized facilities.

Milk

Program data suggests that samples submitted by low volume manufacturers of fresh milk were more commonly contaminated with coliforms than those manufacturing large volumes. This could be attributable to the sophistication and automation of the equipment available to large processors.

4.2 *E. coli*

Four per cent of fermented milk samples from small processers tested in 2014–2015 had *E. coli* detections, which is higher than the program average (Figure 11).

E. coli was present in 6.1% of samples from sites producing large volumes of ice cream. However, this represented only two out of 33 samples. Both these samples were from the same manufacturer and present at very low levels (2 cfu/g) and do not suggest a cause for concern.

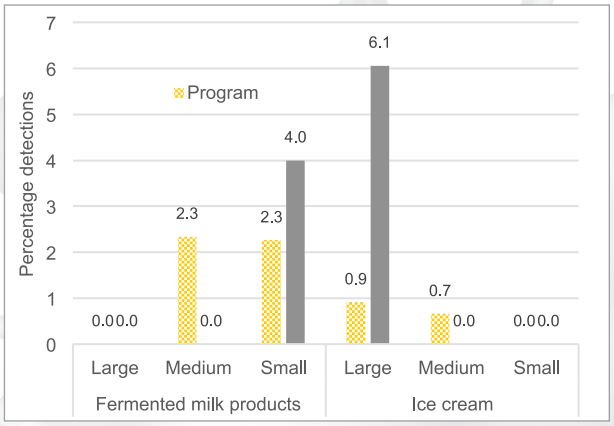

Figure 11: Incidence of *E. coli* detections in fermented milk products and ice cream.

High moisture cheese

E. coli were not detected in samples submitted by licensees classified as large (>5000 tonnes/annum) and were more commonly detected in samples from smaller sites (Figure 12). Program averages suggest that small manufacturers (100–500 tonnes/annum) have the highest incidence of *E. coli*.

Low moisture cheese

Processors classified as small (100–500 tonnes/year) displayed the highest incidence of *E. coli* followed by very small sites (<100 tonnes). *E. coli* were not detected in any samples submitted by large factories, and not commonly detected in samples from medium sized sites (Figure 12).

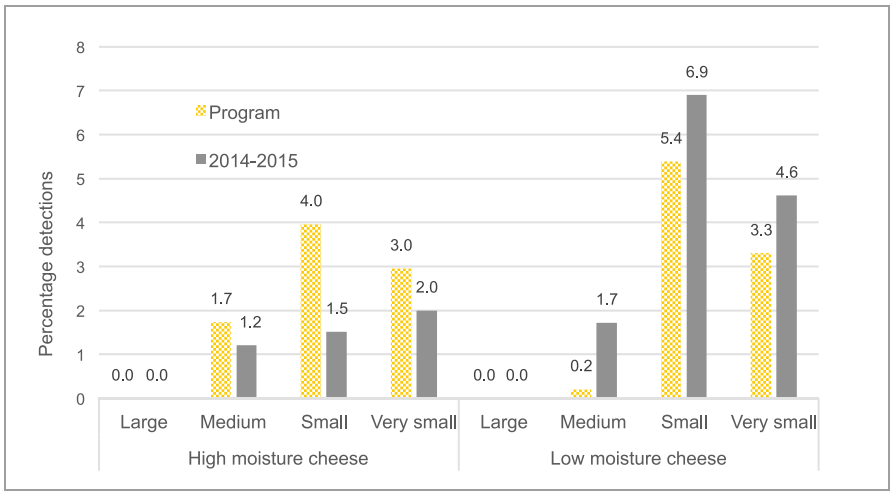

Figure 12: Incidence of *E. coli* detections in high moisture cheese and low moisture.

5. Conclusion

The results of the 2014-2015 PTP indicate that the microbiological status of Victorian dairy products is of a high standard.

While coliforms were commonly detected in most product categories, this organism was generally present at low levels. *E. coli* were detected in only a small number of samples in the fermented milk products, cheese and ice cream categories and generally at very low levels. As observed in previous years cheese, and to a lesser extent fermented milk are the product categories most likely to be contaminated with *E. coli* at levels of concern.

Bacillus cereus was detected in a very low number of milk samples and at levels not considered a cause for concern. In general, manufacturers producing lower volumes of product were more likely to have a higher incidence of coliforms and *E. coli*.

The 2014–2015 Product Testing Program demonstrates low rates of detection and low numbers of microorganisms in Victorian dairy products.

6. Appendix

6.1 *E. coli* detections

Manufacturer	Date sampled	Category	Result (cfu/g)	Factory size
A	June	Fermented milk product	170	Small
B	March	Low moisture cheese	170	Medium
A	December	Low moisture cheese	130	Small
C	November	High moisture cheese	79	Very small
D	April	Low moisture cheese	23	Very small
D	November	Low moisture cheese	23	Very small
C	November	High moisture cheese	13	Very small
E	December	High moisture cheese	9	Small
D	November	Low moisture cheese	9	Very small
F	March	High moisture cheese	8	Medium
A	June	Fermented milk product	5	Small
G	December	High moisture cheese	5	Very small
A	June	Low moisture cheese	5	Small
H	December	Ice cream	2	Large
H	December	Ice cream	2	Large

6.2 Positive *B. cereus* results

Manufacturer	Date sampled	Category	Result (cfu/g)	Factory size
A	September	Milk	100	Small
B	October	Milk	100	Small
C	December	Milk	100	Large
B	March	Milk	100	Small
D	February	Milk	200	Small

6.3 Mould detections

Manufacturer	Date sampled	Category	Result (cfu/g)
A	January	Fermented milk product	130
A	October	Fermented milk product	20
B	April	Fermented milk product	10
C	November	Fermented milk product	10
D	October	Fermented milk product	10
E	September	Fermented milk product	10

6.4 Yeast detections

Manufacturer	Date sampled	Category	Result (cfu/g)
H	September	Fermented milk product	25000
B	February	Fermented milk product	2800
D	March	Fermented milk product	2500
K	February	Fermented milk product	2500
F	November	Fermented milk product	1600
D	March	Fermented milk product	640
H	September	Fermented milk product	520
K	September	Fermented milk product	430
K	September	Fermented milk product	210
K	February	Fermented milk product	200
K	September	Fermented milk product	120
I	March	Fermented milk product	110
A	January	Fermented milk product	70
L	October	Fermented milk product	70
A	January	Fermented milk product	40
C	June	Fermented milk product	30
J	November	Fermented milk product	30
E	October	Fermented milk product	30
J	November	Fermented milk product	20
G	April	Fermented milk product	10
I	March	Fermented milk product	10
I	October	Fermented milk product	10
A	October	Fermented milk product	10

6.5 Positive Listeria samples

Manufacturer	Date sampled	Category	Result
A	March	High moisture cheese	Not *L. monocytogenes*
B	December	High moisture cheese	*L. monocytogenes*

6.6 Production volumes used for categorising manufacturers according to size

Product	Large	Medium	Small	Very small
Cheese	>5,000 tonnes	500-5,000 tonnes	100-500 tonnes	<100 tonnes
Cream	>1,000,000 litres	100,000-1,000,000 litres	<20,000 litres	
Dairy desserts		All		
Dips		All		
Dried milk powders	>10,000 tonnes	1000-10,000 tonnes	<1,000 tonnes	
Fermented milk products	>10,000 tonnes	100-10,000 tonnes	<100 tonnes	
Ice cream	>1,000,000 litres	5,000-1,000,000 litres	<5,000 litres	
Spreads	>5,000 tonnes		<5,000 tonnes	
Milk	>1,000,000 litres		<1,000,000 litres	

6.7 Coliforms detected in cream from small manufacturers

Manufacturer	Date sampled	Category	Result (cfu/g)	Size
A	February	Cream	240	Small
A	February	Cream	240	Small
B	March	Cream	>1600	Small
A	February	Cream	>1600	Small

6.8 Coliforms in fermented milk products from small manufacturers

Manufacturer	Date sampled	Category	Result (cfu/g)	Size
A	June	Fermented milk product	170	Small
A	June	Fermented milk product	5	Small
B	February	Fermented milk product	>1600	Small
C	October	Fermented milk product	2	Small
B	September	Fermented milk product	110	Small
B	September	Fermented milk product	140	Small
B	September	Fermented milk product	8	Small

6.9 Coliforms in low moisture cheese from medium manufacturers

Manufacturer	Date sampled	Category	Result (cfu/g)	Size
A	March	Low moisture cheese	33	Medium
B	March	Low moisture cheese	350	Medium
C	March	Low moisture cheese	5	Medium
B	December	Low moisture cheese	130	Medium
B	December	Low moisture cheese	110	Medium
B	December	Low moisture cheese	79	Medium
B	September	Low moisture cheese	33	Medium
D	September	Low moisture cheese	5	Medium

7. References

1. Food Standards Australia New Zealand – Food Standards Code *Standard 1.6.1 – Microbiological Limits for Food*.

Dairy Food Safety Victoria
Level 2, 969 Burke Road, Camberwell, Victoria 3124

Postal address
PO Box 8221, Camberwell North, Victoria 3124

Phone: + 61 3 9810 5900 **Fax:** + 61 3 9882 6860
Email: info@dairysafe.vic.gov.au
www.dairysafe.vic.gov.au