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Soft serve & frozen yoghurt

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Executive Summary

The NSW Food Authority, in conjunction with twenty one NSW local governments (councils), conducted a survey of soft serve and frozen yoghurt. The survey was to gather up to date information and aimed to:

- assess the microbiological quality of soft serve and frozen yoghurt sold in NSW,
- gather information on the common handling practices in retail businesses that sell these products (eg cleaning and sanitation practices of the dispensing machines), and
- assist local council officers in providing food safety education and advice to retailers that sells these products.

Between November 2012 and February 2014, 153 soft serve and frozen yoghurt samples were collected during unannounced visits to 99 businesses that sell these products across NSW. When compared with the NSW Food Authority's *Microbiological quality guide for ready-to-eat foods*, 88.2% of samples were classified good or acceptable. The remainder were categorised as unsatisfactory due to an elevated standard plate count (SPC). No food samples tested positive for *E. coli*, *Salmonella* or *Listeria monocytogenes*.

Data analysis did not find any particular handling practices that contribute to the high standard plate count. Unsatisfactory samples were from different types of businesses that used different types of premix, machines, cleaning and sanitation practices. The age of the machines also ranged from one to two years up to ten years.

However, the survey did highlight the need for improvement in relation to the cleaning and sanitation of dispensing machines. Up to 50% of businesses that used sanitiser did not use it appropriately. The NSW Food Authority has published a *Cleaning and sanitising in food businesses factsheet* that can help businesses address this issue.

Some other practices that might assist businesses to prepare safe products include:

- Prepare premix according to the manufacturer's instruction and keep it under 5°C at all times. If water is needed, potable water must be used. Equipment should be cleaned and sanitised prior to use.
- Maintain the machine temperature at less than 5°C
- Maintain a documented cleaning schedule. This should include all information regarding cleaning of the machine (eg cleaning procedure and frequency) and should be adhered to at all times by appropriately trained and supervised staff
- All staff should have awareness of hygiene and safe food handling practices
- Manufacturers instructions regarding cleaning and sanitation of soft serve machines should be understood and adhered to by all responsible staff
- Cleaning agents and sanitisers suitable for use in food processing should be used and prepared according to the manufacturer's instructions

Introduction

Soft serve

Soft serve is a congealed dairy product produced by freezing a heat-treated mixture of milk, cream, milk solids, sugars, stabilisers, emulsifiers and flavourings. Soft serve differs from hard ice cream in that the pre-mix is distributed in powdered or liquid form and the final product is formed at retail. Pre-mixed product is introduced to the storage chamber of the machine where it is kept at 3°C. When product is drawn from the draw valve, fresh mix combined with the targeted quantity of air is introduced to the freezing chamber either by gravity or pump. It is then churned and frozen quickly and stored until required (Arbuckle, 1986).

In NSW, under the NSW Food Regulation 2010, producers of dairy products, including manufacturers of ice cream and soft serve pre-mix are required to be licensed with the NSW Food Authority (the Food Authority). Retail businesses selling soft serve are inspected by local councils.

Frozen yoghurt

Frozen yoghurt is a type of frozen dessert, which consists of milk solids, sweetener, milk fat, yoghurt culture, stabilisers, flavourings, and colouring. Frozen yoghurt gets its unique flavour from strains of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, which makes up about 1% of the ingredients (Arbuckle, 1986; Marshall & Arbuckle, cited in Davidson et al., 2000). Frozen yoghurt can also be made in a soft serve machine in much the same way as soft serve (as mentioned above). Frozen yoghurt is also commonly used as an ingredient in smoothies and protein shakes.

Frozen yoghurt was first introduced in the 1970s. However, it was not until the 1980s that it gained popularity. Its popularity then suffered a decline in the late 1990s, but it has been making a comeback in the last decade, with a new generation of flavours, toppings and store settings. Consumer interest in frozen yoghurt stems from the perceived desirable nutritional properties attributed to the product such as a lower fat content compared to ice cream and the presence of probiotic bacteria which some consumers perceive to provide additional health benefits (Davidson et al., 2000). Table 1 highlights the difference in nutritional composition value between ice cream and frozen yoghurt.

Table 1. Nutritional composition of frozen dairy products per 100g

Products	Energy (kJ)	Total fat (g)	Carbohydrate (g)	Sugar (g)
Ice cream – vanilla ¹	806	10.5	20	14.2
Frozen yoghurt – plain ²	400 – 600	0 – 2.5	20 – 26	20

¹ From Dairy Australia (n.d. a)

² From a number of frozen yoghurt companies' nutrition information available on the web

Consumption data

The Australian Health Survey³ (ABS, 2014) reported that frozen milk products were consumed by 15% of the people surveyed – 1.2% specifically mentioned frozen yoghurt or frozen dairy desserts other than ice cream. Taking into account a NSW population of 7.3 million in 2012 (ABS, 2012), it is estimated that about 88,000 people consumed these products per day. In this survey, the highest consumption of frozen milk products was reported for children aged 9 to 13 years old (26.7%), followed by children aged 4 to 8 years old (18.5%). In addition, 17% of persons 71 years old and over was reported to consume the products.

There is no available data on the volume of frozen yoghurt or soft serve consumed, however Dairy Australia (Dairy Australia, n.d. b) reported that Australia's consumption of ice cream is relatively high by world standards - generally reported at 18 litres per head and third only to New Zealand and the United States.

Euromonitor (2014) also reported an 11.3% increase in volume of ice cream consumption in Australia from 2008 to 2013, and predicted a further 13% growth by 2018. Ice cream consumption is highly seasonal, with the majority sold in the warmer months of the year. Unfortunately, there does not appear to be published data regarding what proportion of this is soft serve.

Soft serve can be consumed either as is, or as an ingredient for thick shakes or milkshakes. It is commonly sold in retail places such as fast food outlets, independent retailers and mobile outlets/temporary events. There is no information on the number of places selling soft serve in NSW however, in September 2014 there were approximately 700 fast food retail outlets known to sell this product. IBIS World (2014) predicted that soft serve products will account for 17% of the industry revenue in 2014 – 15, valued to about \$91 million (this value does not take into account revenue from major fast food chains).

Over the past few years, there has also been an increase in the number of specialty frozen yoghurt shops opened in NSW (IBIS World, 2014). Euromonitor (2014) reported a 13.4% increase in volume of frozen yoghurt consumption in Australia from 2008 to 2013, and predicted a further 11% growth by 2018. Similar trends are observed in the UK and USA (Euromonitor, 2013a and 2013b).

Previous studies

A total of nine surveys on the microbiological quality of soft serve or the dispensing machines have been reported in Australia and overseas from 1992 to 2008. *L. monocytogenes* was detected in two of the studies with prevalence of 0.8% and 0.9%. Furthermore, six of the studies found a high percentage of samples were microbiologically unsatisfactory due to high level of coliforms and/or standard plate count (Appendix 1).

In NSW, a total of 56 soft serve, ice cream/gelato, shakes and frozen yoghurt samples were tested by the NSW Health Food Branch from 1995 to 1999. Six samples (10.7%) were unsatisfactory due to high standard plate count, ranged from 160,000 to 2,500,000 cfu/ml. Eight samples were tested for *L. monocytogenes* and all tested negative (NSW Food Authority, internal database).

³ The survey was conducted in 2011 – 2013. It involved the collection of detailed physical activity information using self-reported and pedometer collection methods, along with detailed information of dietary intake and foods consumed from over 12,000 participants across Australia. Frozen milk products included ice cream, thick shakes, frozen yoghurt, and other frozen dairy dessert.

FSANZ's *Risk Profile of Dairy Products in Australia* categorised ice cream as intermediate risk if stored frozen, but soft serve may allow growth of *L. monocytogenes*. This means that maintenance of temperature control through the supply chain is critical to ensure that they remain safe and suitable (FSANZ, 2006). When data from FDA/USDA (2003) was adapted to the Australian population, the estimated cases of listeriosis for vulnerable populations due to consumption of ice cream/frozen dairy products is less than 0.01 case per annum (NSW Food Authority, 2009b).

There is anecdotal evidence that recent improvements in the design of dispensing machines and the inclusion of self-pasteurising machines means that microbiological quality of these products may have improved. However, poorly cleaned and sanitised dispensing machines may compromise the microbiological quality of soft serve and pose a risk to consumers.

In 2010, an outbreak affecting six people (three adults and three children) was linked to *Staphylococcus aureus* and its enterotoxin in milkshakes and thick shakes made using soft serve from the same food outlet on a single day. An investigation carried out by Environmental Health Officers (EHOs) found that the soft serve dispensing machine had failed to undergo its automatic heat sterilisation process and there had been inadequate cleaning and disinfection of the internal parts of the machine after it was repaired. *Staphylococcus aureus* (10^2 to 10^3 cfu/g) and *Staphylococcus* enterotoxin were detected in soft serve samples taken from the machine. The organism was also detected in a mixing bucket that was used for preparing the premix before being added into the machine and this was considered to have been the likely source of the contamination (OzFoodNet Working Group, 2011).

To gather up to date information the Food Authority, in conjunction with NSW local councils has conducted a survey of soft serve and frozen yoghurt. The aims of the survey were to:

- assess the microbiological quality of soft serve and frozen yoghurt sold in NSW,
- gather information on the common handling practices in retail businesses that sell these products (eg cleaning and sanitation practices of the dispensing machines), and
- assist the local council officers in providing food safety education and advice to retailers that sell these products.

Materials and Methods

Council participation

In October 2012, invitations were sent to all local councils in NSW to take part in the survey. Participation from local councils involved collecting food samples as well as gathering information on the food handling practices at businesses selling soft serve and/or frozen yoghurt. In addition, the interested councils were asked to provide the number of businesses selling those products in their local government area (LGA).

Pilot survey

In November 2012, a pilot survey was carried out by officers from the Food Authority. Samples were collected from businesses located in LGAs that did not participate in the survey. The aim of the pilot survey was to gauge the types of premises that sell these products. A total of 28 samples were collected from fourteen businesses in five LGAs.

First round of sampling

A total of twenty local councils agreed to take part in the survey. All of the councils provided information on the number of businesses selling soft serve and/or frozen yoghurt in their LGA. A total of 314 shops were recorded and 76 shops were randomly sampled, representing approximately 25% of the total shops in those areas. Businesses surveyed included fast food chains, independent stores, mobile vendors and temporary event stalls. Sampling was done from January to June 2013.

Second round of sampling

Due to the limited number of mobile vendors or temporary event stalls surveyed in the first round, local councils were invited to participate in a second round of the sampling in December 2013, focusing on these types of businesses. Three local councils agreed to participate (two of them also took part in the first round of sampling). Sampling was conducted in January and February 2014 by the Food Authority and local council officers. A total of nine mobile vendors were surveyed.

As information was not available on volume of throughput for each business surveyed or the total number of businesses of this type in NSW, the survey provides only a snapshot of practices at the participating businesses rather than a statistical representation of the sector.

Method for laboratory analysis

From November 2012 to February 2014, 153⁴ soft serve and frozen yoghurt samples were collected during unannounced visits to 99 businesses that sell these products across NSW.

Samples were collected aseptically from the soft serve or frozen yoghurt machine nozzle and dispensed into sterile containers. One sample was collected per nozzle, which gave a minimum sample of one per business. The maximum number of samples collected from each business was four.

⁴ Total number of samples included those collected in the pilot survey.

Samples were sent by courier or delivered in person to the Food Microbiology Laboratory of the NSW Forensic & Analytical Science Services (NSW FASS) at Lidcombe. The temperature of samples upon arrival was recorded. When samples arrived outside the temperature control (greater than 5°C), samples were not tested for standard plate count (SPC) because of the potential for numbers to be influenced by elevated temperatures. Frozen yoghurt samples were not tested for SPC since the test could not differentiate between the starter culture organisms added to these products and other bacteria.

All samples were analysed within 24 hours of receipt at the laboratory using the appropriate Australian Standard method as detailed in Table 2. Samples collected on the weekend or from regional areas were kept frozen until dispatch to ensure the microbiological integrity of the samples.

Table 2. Tests conducted and their corresponding Australian Standard

Tests	AS method
Coagulase positive staphylococcus (CPS) enumeration	AS 1766.2.4
Listeria monocytogenes enumeration	AS 5013.24.2
Listeria monocytogenes detection	AS 1766.16.1
Salmonella detection	AS 1766.2.5
Standard plate count (SPC)	AS 1766.2.1
Thermotolerant coliforms and <i>E. coli</i> enumeration	AS 1766.2.3

Method for data analysis

The microbiological results of soft serve and frozen yoghurt samples obtained from this survey were assessed against the NSW Food Authority's *Microbiological quality guide for ready-to-eat foods* (NSW Food Authority, 2009) as specified in Table 3.

Table 3. Guideline levels for determining the microbiological quality of ready-to-eat foods (NSW Food Authority, 2009a)

Test	Microbiological result (cfu/g)			
	Good	Acceptable	Unsatisfactory	Potentially hazardous
Standard Plate Count (SPC) (Category A ⁵)	<10 ⁴	<10 ⁵	≥10 ⁵	N/A
Enterobacteriaceae ⁶	<10 ²	10 ² to <10 ⁴	≥10 ⁴	N/A

⁵ Category A applies to ready-to-eat foods in which all components are fully cooked for immediate sale or consumption.

E. coli	<3	3 to 10 ²	>10 ²	N/A
Coagulase positive staphylococci	<10 ²	10 ² to <10 ³	10 ³ to <10 ⁴	≥10 ⁴
Salmonella	Not detected in 25g			Detected in 25g
Listeria monocytogenes (Food Group 2 ⁷)	Not detected in 25g	Detected but <100		≥10 ²

All results were entered into a Microsoft™ Excel 2010 spread sheet. Where enumeration was conducted, microbiological counts were transformed into log cfu/g. Viable count methods are often considered to have an accuracy of approximately ± 0.5 log cycles therefore generally differences of less than 0.5 log were not considered biologically significant (Jarvis, 1989).

Food handling questionnaire

At the time of sampling, a questionnaire was also undertaken to assess food handling practices at businesses that sell these products (see Appendix 2 – Food handling questionnaire for businesses selling soft serve or frozen yoghurt).

A completed questionnaire was received from 98 businesses⁸. The questionnaire collected information on type of premix, type of machine, and cleaning and sanitation practices of the machine.

The survey responses were collated and a summary of results was generated by SurveyMonkey™. Statistical analysis on the responses was conducted using Microsoft™ Office Excel 2010.

⁶ In the absence of a guideline for thermotolerant coliform results, these were compared with the guideline for Enterobacteriaceae as both groups of bacteria are similar (the bacteria detected by the coliform test are members of several genera within the family Enterobacteriaceae).

⁷ Food Group 2 applies to ready-to-eat food that will not support the growth of *L. monocytogenes* and has been stored prepared for greater than one day (eg the premix).

⁸ Food handling data was not collected from two of the businesses where sampling occurred. On the other hand, one business provided their food handling information, but no sample was collected since the machine was not operational at the time of the survey.

Results

Microbiological results

A summary of the microbiological results for all samples is shown in Table 4. When compared with the NSW Food Authority's *Microbiological quality guide for ready-to-eat foods*, 88.2% of samples were classified good or acceptable. No sample tested positive for *E. coli*, *Salmonella* or *L. monocytogenes*.

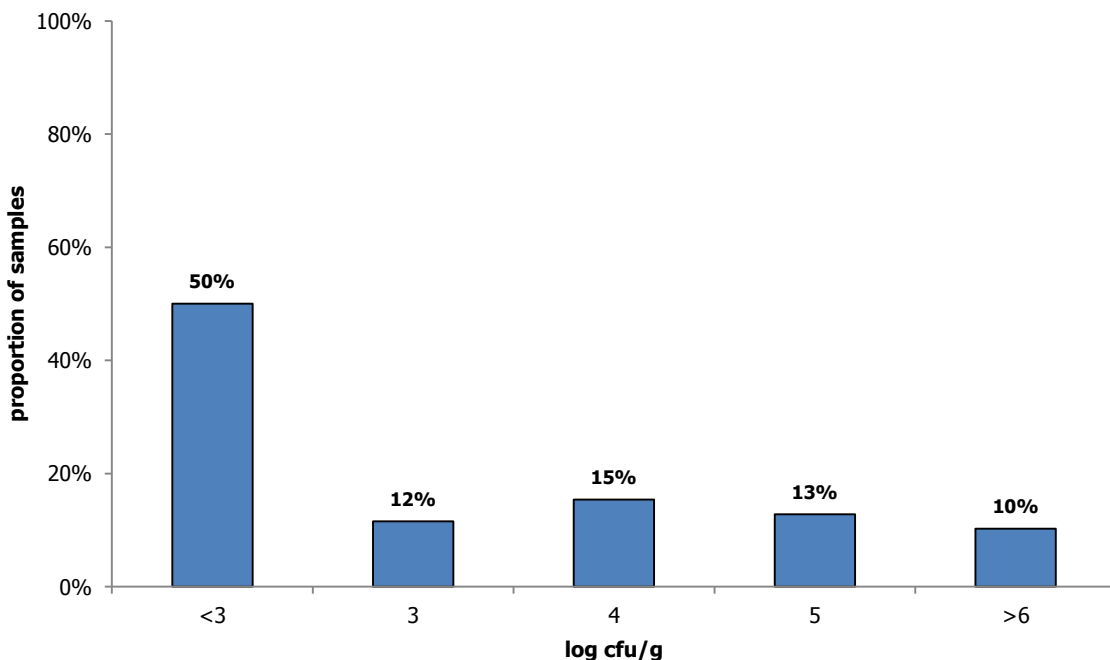
A total of eighteen samples were categorised as unsatisfactory due to an elevated SPC. The unsatisfactory samples came from fifteen businesses around NSW - two fast food chains, six independent stores, and seven mobile vendors/temporary event stalls.

Table 4. Assessment of results using the microbiological criteria for ready-to-eat foods (NSW Food Authority, 2009a)

Food category	No. of samples	Microbiological quality (%)			
		Good	Acceptable	Unsatisfactory	Potentially hazardous
Frozen yoghurt	42	42 (100%)	-	-	-
Soft serve ⁹	111	80 (72%)	13 (12%)	18 (16%)	-

Frequency distribution for SPC for soft serve samples⁹ is presented in Figure 1. The graph shows that the majority of samples had a low SPC or a SPC under the limit of detection (<3 log cfu/g)¹⁰.

Figure 1. Frequency distribution for standard plate count in soft serve samples



⁹ Only 78 samples were tested for SPC.

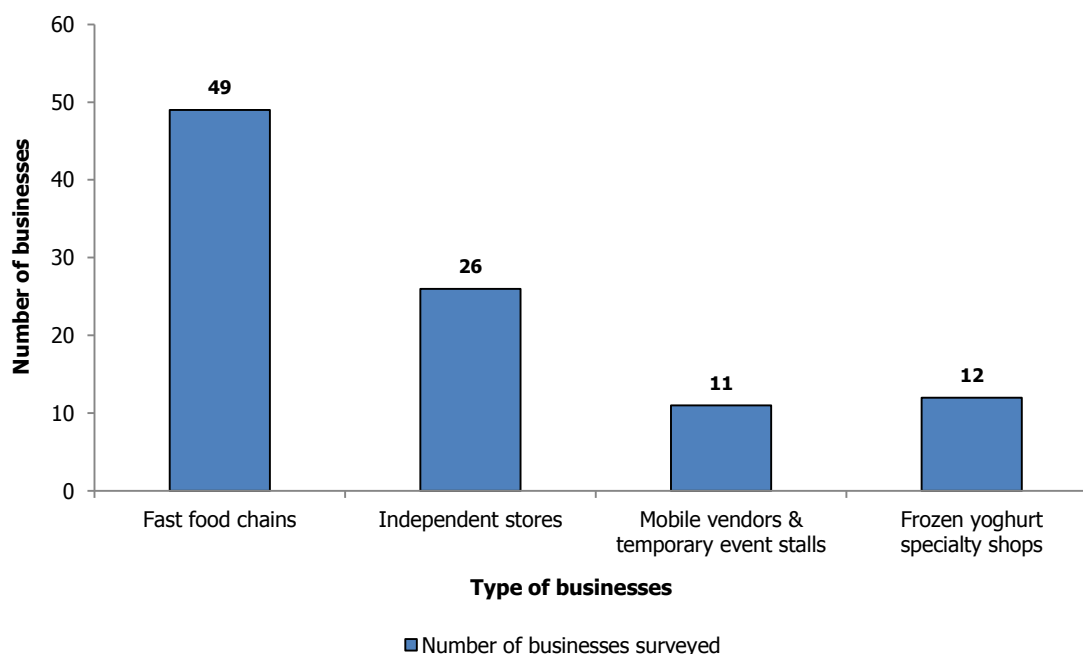
¹⁰ Samples with SPC $\geq 10^5$ were categorised as unsatisfactory.

Responses to food handling questionnaire

Type of businesses

A total of 98 food handling questionnaires were collected from businesses across NSW. Businesses surveyed include fast food chains, independent stores, mobile vendors & stalls at temporary events, and frozen yoghurt specialty shops (Figure 2).

Figure 2. Type of businesses surveyed



Type of premix

Responses to the questionnaire indicated that:

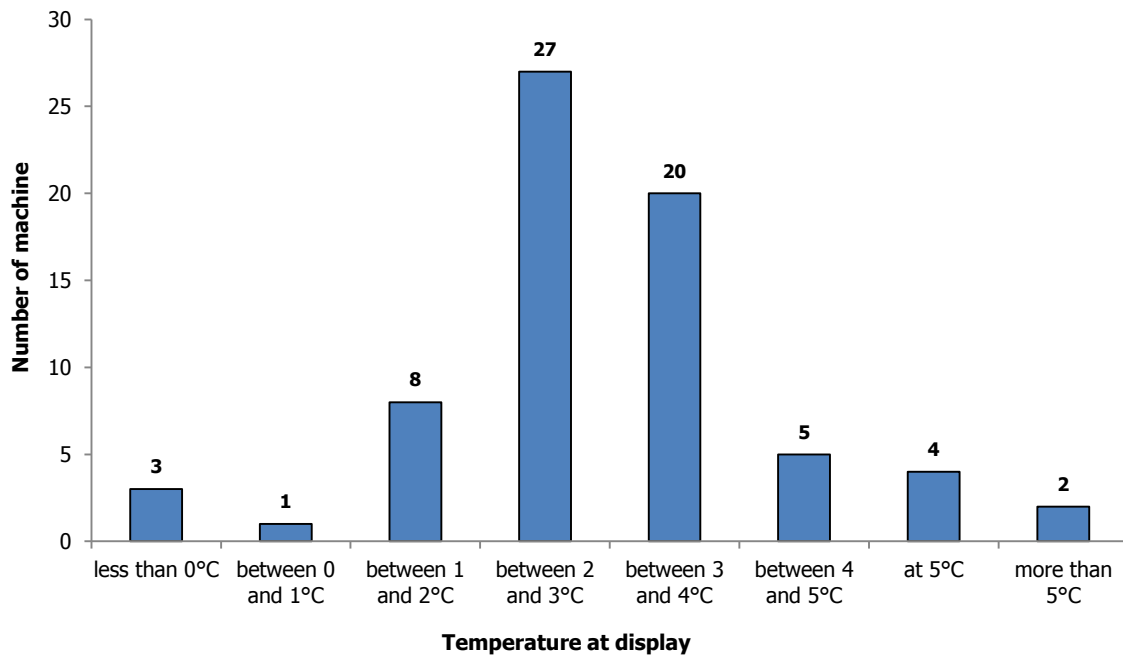
- Almost half (46/98, 47%) of these businesses used dried powder premix.
- Thirty six businesses (37%) used fresh liquid premix.
- Thirteen businesses (13%) used UHT premix.
- Three businesses (3%) used a combination of liquid and UHT premix; frozen premix; or made their own premix on site.

For businesses that used fresh liquid premix, 29/36 (81%) of them checked the temperature of premix upon arrival. Four businesses (13%) did not check the temperature upon arrival and three businesses (8%) were unsure.

Soft serve machine

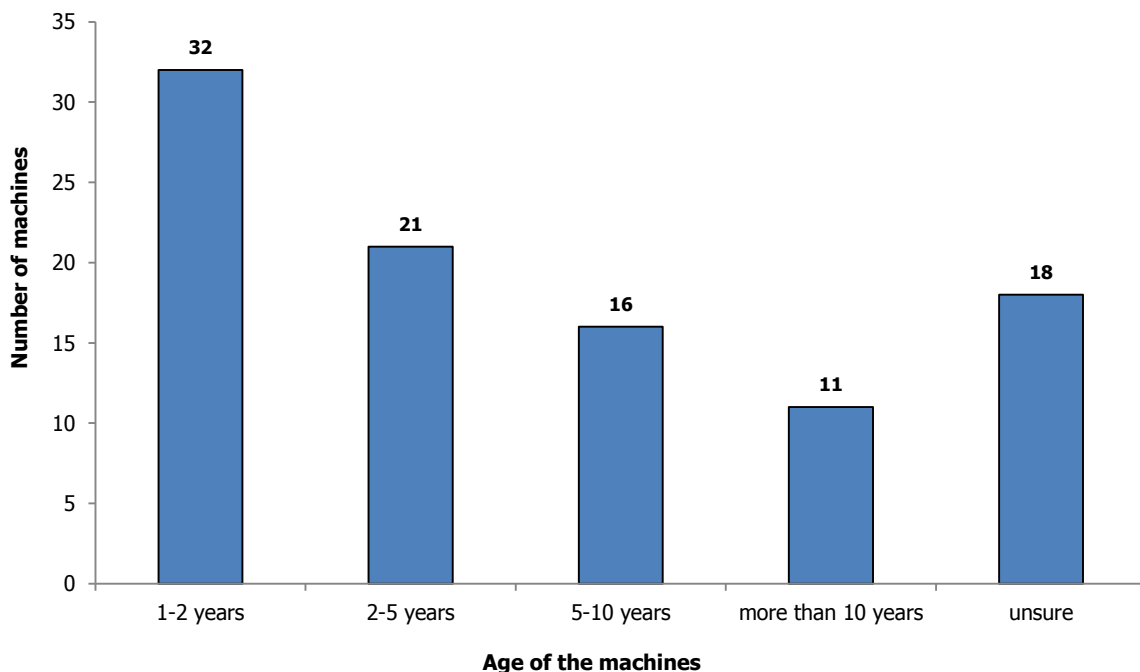
During the survey, the temperature of 70 machines at 54 businesses was recorded. Most of them (68/70, 97%) were at 5°C or lower (Figure 3). The other two machines were at 5.8°C and 12°C. Those businesses were asked to get the machines checked, and they were under temperature control (below 5°C) at the re-inspection.

Figure 3. Temperature displayed on the machine



In addition, businesses were also asked about the age of their machines. One-third of the businesses (32/98, 33%) had machines that were only one to two years old (Figure 4).

Figure 4. Age of machines surveyed



Handling practices with soft serve premix

The businesses were asked about how often they top up the premix¹¹:

- The majority of respondents (45/88, 52%) topped up two to five times a day.
- Twenty-four businesses (27%) topped up once a day.
- Ten businesses (11%) topped up more than five times a day.
- Nine businesses (10%) topped up every few days.

The questionnaire also revealed that the majority of businesses (77/97, 80%) left unused premix in the machine overnight. Fifteen businesses (15%) discarded unused premix at the end of the trading day. Only five businesses (5%) dispensed unused premix into a container, stored in refrigerator and reused the next day.

Cleaning and sanitation practices of the machine

In terms of cleaning practices:

- The majority (70/98, 71%) cleaned their machines manually.
- Thirteen businesses (13%) used self-pasteurising machines.
- Fifteen businesses (16%) used self-pasteurising machines that clean automatically at the end of trading days, but still do manual cleaning fortnightly.

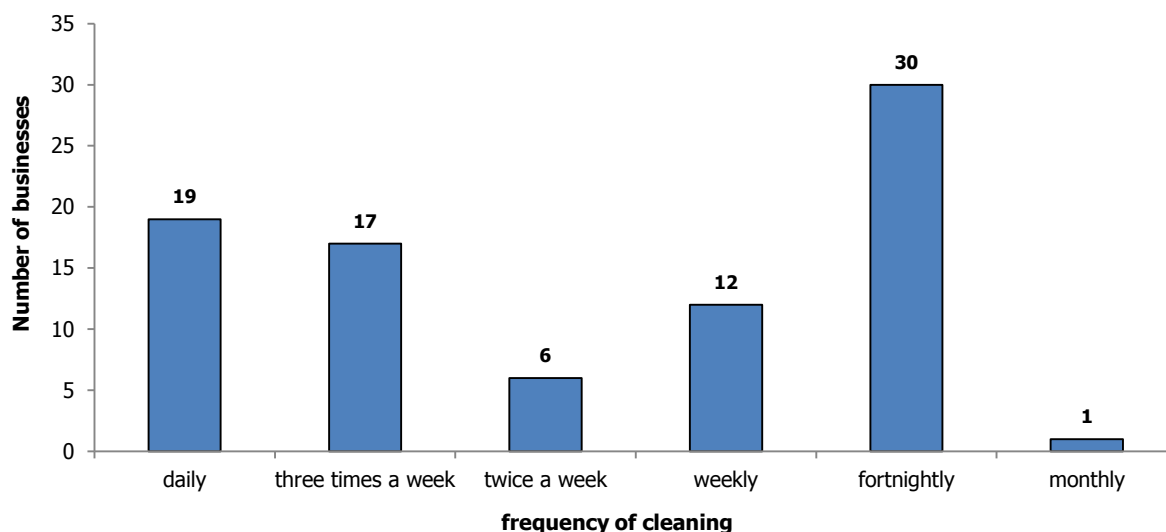
Half of the businesses surveyed (47/97, 48%) had documented cleaning procedures which specified how the machine should be cleaned and the frequency of the cleaning. Of these 47 businesses, 38 (81%) of them maintained cleaning records relating to their machines and were verified by the manager or supervisor. A further five businesses (5%) did not have documented cleaning procedures, but they maintained cleaning records.

The frequency of machine cleaning varied between businesses, from daily to monthly. The majority of respondents (30/98, 31%) stated that their machines were cleaned fortnightly (

¹¹ Only 88 businesses responded to this question

Figure 5). In addition, eleven businesses cleaned their machines using a combination of daily cleaning followed by machines being disassembled for thorough cleaning fortnightly, which was normally done by contractors. Two mobile businesses stated that their machines were cleaned at the end of each day they were operating.

Figure 5. Frequency of cleaning of soft serve machines



In terms of sanitation practices:

- A total of 73 businesses (75%) used hot water and sanitiser. They also used a combination of sponges, cleaning cloths, single use paper towels and brushes.
- Seven businesses (7%) used only hot water.
- Sixteen businesses (16%) used only sanitiser.
- Two businesses (2%) were unsure of their sanitation practices.

Of the 89 businesses that used sanitiser, half of them did not know the strength of sanitiser used or time taken to sanitise the machine. Of those that knew that information, the time taken to sanitise the machines varied from one minute to eight hours.

Training on cleaning/sanitation practices

Businesses were asked about the training of staff on cleaning and sanitation of the machine:

- Half of them (49/98, 50%) received training onsite.
- Nine respondents (9%) received training from an external agent.
- Thirteen respondents (13%) received training both on-site and from an external agent.
- Twenty respondents (20%) stated that they did not receive any training on cleaning and sanitation of the machine.
- Seven businesses (8%) used contractors to clean their machines, so no staff training was conducted.

Follow-up actions

When samples were found to be unsatisfactory, in accordance with the risk management strategy agreed prior to the commencement of the survey, additional samples were collected from the business. Follow-up samples taken from each business included: three samples of soft serve taken directly from the dispensing nozzle, and three samples of pre-mix from the holding tank of the machine. Follow-up samples were collected from nine of the fifteen businesses with unsatisfactory samples obtained during the survey. Follow-up actions on the majority of mobile vendors were not possible due to the seasonal and nomadic nature of the businesses.

If samples collected during the follow-up visit were found to be good or acceptable, no further action was taken. If the follow-up samples returned an unsatisfactory result, the business was inspected by an EHO and/or a Food Authority officer to determine whether food handling controls and hygiene practices were adequate. A total of four businesses needed to be inspected during the course of the survey. The common issues found across these businesses were the absence of cleaning procedures and inappropriate use of sanitiser. Businesses were provided with advice on proper food handling practices and cleaning procedures and were given a month to rectify the issue, after which more samples were collected. Samples collected after inspections were satisfactory for three businesses. The other business still had unsatisfactory results due to high level of SPC. The EHO continued to work with this business until the issue was resolved.

Discussion

The results from the microbiological testing illustrated that soft serve and frozen yoghurt sold in NSW was of a good or acceptable microbiological standard, with 88.2% of tested samples being categorised as such. In addition, *E. coli*, *Salmonella* and *L. monocytogenes* were not detected in any of the samples.

The unsatisfactory soft serve samples had an elevated SPC ranging from log 5.1 cfu/g to log 7.6 cfu/g. The percentage of samples with elevated SPC in this survey was less than that observed in the various UK and Irish studies, which found between 35% and 51% of samples were unsatisfactory¹² due to high SPC (FSAI, 2001; FSAI, 2008; Little & de Louvois, 1997).

Data analysis did not find any particular handling practices that contributed to the high SPC. Different types of businesses had unsatisfactory samples. They used different types of premix, machines, cleaning and sanitation practices. The age of the machines that produced unsatisfactory results ranged from one to two years up to ten years.

Previous studies suggested that high SPC in soft serve may indicate that there has been a breakdown in hygienic practices at some point between manufacture and sale (FSAI, 2001; Little & de Louvois, 1997).

Little and de Louvois (1997) stated that inadequate temperature control of pasteurised and opened containers of prepared premix would allow any bacteria present to increase to high levels. The Irish study (FSAI, 2001) found that as the temperature reading on the machine temperature monitor increased, so did the SPC. The relationship between machine temperature and high SPC was not observed in this study. Six of the fifteen businesses with unsatisfactory samples had temperature display on their machines and they were all at 5°C or below.

Another Irish study found that the type of machine had a significant effect on the SPC levels in the soft serve (FSAI, 2008). Better results were obtained from self-pasteurising machines. However, in our study, the influence of type of machine and SPC results were not found to be significant. Two of eight (25%) samples collected from self-pasteurising machines were unsatisfactory, whereas fourteen of 50 (28%) samples collected from manually cleaned machines were unsatisfactory. The rest of the businesses used a combination of self-pasteurising machines and manual cleaning.

A few studies indicated that a lack of awareness of cleanliness and sanitation procedures by staff and food handlers and/or difficulty in cleaning and sanitising the dispensing machines may contribute to high SPC (FSAI, 2001; SA Health, 2009). This area may be the contributing factor to unsatisfactory samples in this study. Only two of the businesses with unsatisfactory samples had a documented cleaning schedule and cleaning records. Both of them used manual cleaning. One business cleaned the machine twice a week and the other was once a week. In addition, thirteen of the fourteen businesses stated that they used sanitiser, but most of them were not sure about the strength of sanitiser used. The time taken to sanitise their machines also ranged from one minute to three hours. An increased level of staff training and knowledge transfer, particularly in relation to food safety, food handling and soft serve machine maintenance and cleaning would improve the situation (FSAI, 2001; FSAI, 2008).

¹² In the UK and Irish studies, samples with SPC greater than 10⁵ cfu/g were considered unsatisfactory. The same limit was used in the NSWFA's guidelines.

Conclusion

The microbiological testing illustrated that soft serve and frozen yoghurt sold in NSW at the time of the survey was, in general, of a good or acceptable microbiological standard. 88% of samples tested were categorised as good or acceptable and *E. coli*, *Salmonella* and *L. monocytogenes* was not detected in any of the samples.

However, the survey did highlight the need for improvement in relation to cleaning and sanitation of soft serve dispensing machines. Up to 50% of businesses that used a sanitiser did not use it appropriately. The NSW Food Authority has published a *Cleaning and sanitising in food businesses* factsheet that can help businesses selling these products address the issue.

Other practices that might help businesses ensure that their products are safe for consumption include:

- Prepare premix according to the manufacturer's instruction and keep it under 5°C at all times. If water is needed, potable water must be used. Equipment should be cleaned and sanitised prior to use
- Maintain the machine temperature at less than 5°C
- Maintain a documented cleaning schedule. This should include all information regarding cleaning of the machine (eg cleaning procedure and cleaning frequency) and should be adhered to at all times by appropriately trained and supervised staff
- All staff should have awareness of hygiene and safe food handling practices
- Manufacturers instructions regarding cleaning and sanitation of soft serve machines should be understood and adhered to by all responsible staff
- Cleaning agents and sanitisers suitable for food processing environment should be used and prepared appropriately according to the manufacturer's instructions

Acknowledgement

The NSW Food Authority acknowledges the assistance of EHOs from the following councils who participated in this survey:

- Albury City Council
- Armidale Dumaresq Council
- Auburn City Council
- Ballina Shire Council
- Bathurst Regional Council
- Blacktown City Council
- Campbelltown City Council
- Coffs Harbour City Council
- Council of the City of Sydney
- Fairfield City Council
- Great Lakes Council
- Greater Taree City Council
- Kogarah City Council
- Holroyd City Council
- Newcastle City Council
- North Sydney Council
- Randwick City Council
- Singleton Council
- Snowy River Shire Council
- Strathfield Municipal Council
- Sutherland Shire Council
- Wagga Wagga City Council
- Warringah Council
- Wollongong City Council

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Appendix 1. Selected surveys on the microbiological quality of soft serve in Australia and overseas

Year	Country	Samples tested	No of samples	Findings	Reference
2008	Australia (SA)	Soft serve	20 premises (5 samples from each)	<ul style="list-style-type: none"> - 5/20 fail Standard plate count (SPC $\geq 10^4$ cfu/g) - 5/20 fail coliforms (≥ 10 cfu/g) - No samples found to contain <i>E. coli</i>, <i>Salmonella</i> or <i>Listeria</i> 	SA Health (2009)
2008	Ireland	Soft ice cream (Whipped and scoop) Scoop ice cream Uncategorised (information not provided)	643 86 125	<ul style="list-style-type: none"> - 223/643 (35%) of samples unsatisfactory for aerobic colony count ($\geq 10^5$ cfu/g) and/or <i>Enterobacteriaceae</i> ($\geq 10^4$ cfu/g) - 18/86 (21%) of samples unsatisfactory for aerobic colony count and/or <i>Enterobacteriaceae</i> - 49/125 (39%) of samples unsatisfactory for aerobic colony count and/or <i>Enterobacteriaceae</i> 	FSAI (2008)
2006	USA, Iowa	Soft serve dispensing machines	30	<ul style="list-style-type: none"> - 14/30 (47%) exceeded state standards for coliforms - 7/30 (23%) exceeded state standards for standard plate count 	Krogstad (2006)
2003	USA, Wisconsin	Soft serve dispensing machines	22	<ul style="list-style-type: none"> - 15/22 "dangerous levels of coliforms and other bacteria" 	Cited in (Powell, 2008)
2001	Ireland	Soft ice cream	552	<ul style="list-style-type: none"> - 51.1% of samples unsatisfactory for Aerobic colony count (ACC $\geq 10^5$ cfu/g) - 6.5% unsatisfactory for <i>Enterobacteriaceae</i> ($\geq 10^4$ cfu/g) 	FSAI (2001)

Year	Country	Samples tested	No of samples	Findings	Reference
1997	UK	Soft ice cream Soft serve premix	1246 597	<ul style="list-style-type: none"> - 1 sample unacceptable for <i>Staphylococcus aureus</i> ($>10^4$ cfu/g) - 26% of samples unsatisfactory due to high APC and <i>Enterobacteriaceae</i> counts - <i>Salmonella</i> not detected - <i>L. monocytogenes</i> detected in 10/1214 (0.8%) samples at levels below 100 cfu/g - Powder mix (19/19 acceptable) - Pasteurised liquid mix (33/203 unsatisfactory for APC, 16/206 unsatisfactory for <i>Enterobacteriaceae</i>) - UHT liquid mix (75/252 unsatisfactory for APC, 24/252 unsatisfactory for <i>Enterobacteriaceae</i>) - Liquid mix (unknown) 17/52 unsatisfactory for APC, 6/52 unsatisfactory for <i>Enterobacteriaceae</i>) 	Little and de Louvois (1997) Little and de Louvois (1999)
1996	Australia (NSW)	Soft serve	86	<ul style="list-style-type: none"> - 49/86 “dangerous bacteria levels” 	Cited in (Powell, 2008)
1992	Australia (WA)	Soft serve	114	<ul style="list-style-type: none"> - 1 (0.9%) sample positive for <i>Listeria monocytogenes</i> 	Health Department of WA, (1992)
1992	Ireland	Soft ice cream	106	<ul style="list-style-type: none"> - 3.8% of samples unsatisfactory for ACC (ACC $\geq 10^6$ cfu/g) 	Cited in FSAI (2001)

Appendix 2. Food handling questionnaire for business that sell soft serve and/or frozen yoghurt

Soft serve ice cream survey

Food handling questionnaire - to be filled in by EHO when visiting an outle...

Store: _____ Date: _____
 Address: _____ Start time: _____
 Rego number (for mobile van): _____ End time: _____
 Contact person: _____ Position: _____
 Council name: _____ EHO name: _____

1. What form of soft serve premix does the business use?

Liquid (fresh), refrigerated UHT Dried powder Unsure

2. Who is the manufacturer (supplier) of the premix?

Name: _____
 Address: _____
 Suburb: _____
 State: _____
 Postcode: _____
 Contact Number: _____

3. (For fresh liquid mix only) - Is the temperature checked at receipt?

Yes No Unsure

4. Details of ice cream machine:

Brand / make: _____
 Model Number: _____
 Number of nozzles: _____

5. Is there a temperature display on the machine?

Yes No

If yes, please record the temperature

6. How old is the machine?

1-2 years 2-5 years 5-10 years more than 10 years Unsure

7. How often do they top up the machine?

every few days once a day 2 - 5 times a day more than 5 times a day

Soft serve ice cream survey

8. At the end of the day, what happens to the unused soft serve mix in the machine?

- Unused mix is discarded
 Unused mix is left in the machine overnight
 Unused mix is dispensed from the machine into a container and reused the next day

Other (please specify)

9. If soft serve mix is reused, how long may it be reused for?

- Next day only 2-3 days 4-5 days 6-7 days

Other (please specify)

10. How is the machine cleaned?

- automatic (self-pasteurising) manual cleaning

Other (please specify)

11. Is there a cleaning schedule for the soft serve ice cream machine?

- Yes - documented cleaning schedule available
 Yes - an informal cleaning schedule that is not documented
 No

12. If the cleaning schedule is documented, does it contain the following information?

- | | Yes | No |
|---|-----------------------|-----------------------|
| How the machine should be cleaned | <input type="radio"/> | <input type="radio"/> |
| How often the machine should be cleaned | <input type="radio"/> | <input type="radio"/> |

Specify how often it should be cleaned

13. Are cleaning records relating to the machine maintained by the food business?

- Yes No

14. If yes, are they verified by a manager/supervisor?

- Yes No N/A

15. What is the frequency of cleaning the machine?

- Daily 3 times a week Weekly Fortnightly Monthly

Other (please specify)

Soft serve ice cream survey

16. What type of cleaning tools are used to clean the machine?

- Hot water Sanitiser Sponge Cleaning cloth Single use towel

Other (please specify)

17. If sanitiser agent is used:

What brand of sanitiser is used?

What strength is used?

How much time does it take to sanitise?

How often does the machine get sanitised?

18. When was the interior of the machine last cleaned?

19. When was the machine last disassembled for full cleaning?

20. How do staff receive training on cleaning/sanitising the machine?

- On-site External Combination of on-site and external No training

21. Additional Comments:

Thank you for your assistance!

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