



**Government of South Australia**

Department of Health

# Sweet Baked Goods

**A survey of the microbiological quality of sweet baked goods**

**FOOD POLICY AND PROGRAMS BRANCH, PUBLIC HEALTH**

*Report compiled by*

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## A survey of the microbiological quality of sweet baked goods

### Background to the survey

In the years 2001 to 2005, OzFoodNet recorded eleven outbreaks in Australia associated with the consumption of food from bakeries (Table 1). These eleven outbreaks affected at least 243 people with 23 (9%) people hospitalised and one death.

The median size of the outbreaks was 16 cases (range 5–70). *Salmonella* Typhimurium caused 82% (9/11) of outbreaks and 73% (8/11) of outbreaks involved cream or custard filled cakes or tarts. Five of the outbreaks were in South Australia.

In October 2005, Tasmania experienced the largest *Salmonella* outbreak in several years. The outbreak of over 70 cases of *Salmonella* Typhimurium 135a occurred in northern Tasmania in association with contaminated foods prepared by two bakeries. Inspection of the bakery premises identified poor hygiene and significant potential for contamination of food products. Cream and piping bags from the bakery were positive for *Salmonella* Typhimurium 135a, along with other environmental samples.

**Table 1:** Outbreaks of food borne illness associated with bakeries in OzFoodNet Sites 2001 - 2005.

State	Year	Setting food prepared	Ill	Medical	Hospitalised	Died	Food Vehicle	Aetiology	Notes
NSW	2002	Bakery	29	25	4	0	Cream filled cakes	<i>Salmonella</i> Typhimurium 135a	14/22 primary cases ate cream filled cakes. Some people who ate cakes did not get ill.
QLD	2004	Bakery	5	3	0	0	Custard Fruit Tart	<i>Salmonella</i> Typhimurium 135a	An almond sauce added to fruit tarts which does not undergo any cooking step is the suspected source of infection.
	2005	Bakery	14	-	7	0	Mixed bakery products	<i>Salmonella</i> Typhimurium 197	Soiled and damaged eggs on premises. Trace back of eggs not possible
SA	2001	Bakery	16	16	3	0	Custard tart with strawberries & jelly glaze	<i>Salmonella</i> Typhimurium 126	9/16 cases statistically linked to bakery. Unable to link other 7 to bakery
	2002	Bakery	22	20	7	1	Cream and custard filled cakes and buns	<i>Salmonella</i> Typhimurium 99	Statistical evidence. Piping bags in the bakery were reused and used for both sausage meat and cream.
		Bakery	8	2	0	0	Potato meat pie	<i>Clostridium perfringens</i>	Pathogen isolated from pie.
	2003	Bakery	6	6	1	0	Cheesecake	<i>Salmonella</i> Typhimurium 4	Statistical evidence.
	2004	Bakery	13	13	-	0	Cream filled cakes	<i>Salmonella</i> Typhimurium 108	Statistical evidence and pathogen isolated from cakes.
Tas	2004	Bakery	50	9	0	0	Savory and sweet pastries; cakes; cheesecake	Norovirus	Ill food handlers source of infection.
	2005	Bakery	~70	70	-	0	Cream filled and iced cakes	<i>Salmonella</i> Typhimurium 135a	Large outbreak involving two bakeries. Introduction of <i>Salmonella</i> into bakery undetermined.
VIC	2002	Bakery	10	10	1	0	Cream filled cakes	<i>Salmonella</i> Typhimurium U290	Statistical evidence.
<b>Total</b>			<b>243</b>	<b>174</b>	<b>23</b>	<b>1</b>			

The recent outbreak in Tasmania highlights the need for action to reduce the risk of food borne illness arising from poor food preparation practices in bakeries. Bakery-associated outbreaks are often large and serious, as the products allow *Salmonella* to grow to high concentrations.

Foods prepared in bakeries are at higher risk of contamination due to the nature and handling of bakery products. Some factors leading to contamination are that bakery products are:

- handled following cooking, i.e. to ice or fill products;
- made of ingredients that allow growth of bacteria, such as cream and custard;
- filled using single use piping bags that are re-used;
- often left unrefrigerated for long periods of time;
- made in premises where *Salmonella* contaminated meat and eggs are not properly separated from ready-to-eat products;
- use of non-purpose built premises.

To assist small bakeries producing higher risk products and to minimise the risk of outbreaks the Department of Health with the assistance of the food special interest group of the Australian Institute of Environmental Health have prepared a targeted inspection and education program.

Councils EHOs were asked to implement this program of inspections in a twelve month period beginning in March 2006 to ensure that safe operating practices are employed and construction standards meet legal requirements. Quarterly reports from Councils are being collated to track the results of the inspections.

## Previous surveys

ACT Health conducted two surveys into the microbial quality of unrefrigerated desserts. The first survey was conducted in 1997 with a total of 68 samples of various unrefrigerated desserts being collected from 32 different outlets.<sup>i</sup> The samples were assessed for hygiene quality by the Standard Plate Count (SPC), *E. coli* and coagulase-positive *Staphylococcus aureus* analyses and for specific food pathogens such as *B. cereus* and *Salmonella* spp.

The SPC, *E. coli* and *B. cereus* results indicate a problem associated with inadequate practices for storing and handling sampled desserts. This problem appears to be premises specific as detection of pathogens and/or quality indicator organisms was predominantly restricted to multiple samples collected from the same premises.

The follow up survey in 1999 identified that while the microbial quality of unrefrigerated desserts in the ACT improved they still had the potential to be a risk to the public's health.<sup>ii</sup>

Department of Human Services Victoria supplied funding to Dunn Son & Stone, Public Analysts, in 2001 to conduct a challenge testing study of custard and cream products with *Bacillus cereus*, Coagulase positive *Staphylococci* and *Escherichia coli* at ambient temperatures to test the 2hr/4hr rule introduced by the FSANZ Food Safety Standards (Standard 3.2.2 Food Safety Practices and General Requirements).<sup>iii</sup>

The study found that over a four hour time period 13.0% of samples were found to sustain the growth of either *Bacillus cereus*, Coagulase positive *Staphylococci* or *Escherichia coli* and that over an eight hour time period 34.8% of samples sustained bacterial growth. The Study concluded that custard and cream based products should conform to the 2/4 hour rule.

The SA Department of Health has conducted two sampling surveys in the last three years. In 2002-2003, 35 sweet baked goods containing custard or cream were sampled and tested for *Salmonella sp.* There were no positive results.

A small survey was performed in July 2003. 18 samples were sampled, temperature recorded and tested for SPC, coliforms, yeast, mould, *Listeria sp.*, *Salmonella sp.*, *Staph. aureus* & *B. cereus*. No *Salmonella sp.*, *Staph aureus* or *B. cereus* were detected. One sample had high coliform levels. Approx. 50% of samples had high standard plate counts and approx. 50% of samples had high yeast counts.

## Benchmark Survey

During the period April-Jun 2006, the Department carried out a benchmark microbiological survey in metropolitan and country areas (the subject of this report). The aim of the survey was to establish the prevalence of pathogens and hygiene indicator organisms in a selection of at risk sweet baked goods and use the data as a measure of bakery hygiene standards prior to full implementation of the targeted inspection program.

### What foods were tested?

There are approx. 500 small bakeries in South Australia, that have been identified as potentially fitting the at risk category. This number may be less as the specific target is manufacturing bakeries.

Using the 1997 ACT survey results as a guide, where 30% of samples had unacceptable standard plate count results, to provide 95% confidence, samples needed to be taken from 20% or approximately 100 bakeries. The choice of bakery was based on obtaining a representative sample across rural and urban areas, across traditional bakeries and continental patisserie style bakeries.

98 bakeries in 26 council areas were visited and two or three samples of sweet pastries with fresh cream or custard fillings and cold set cheesecakes, depending on the product range available on the day were purchased for microbiological analysis.

The sample consisted of whole product – cream bun, custard tart, similar products containing fresh cream, mock cream or custard. Imitation cream and butter cream containing no milk protein are not considered high risk, as they do not support the growth or toxin production of pathogenic bacteria. Cold set cheesecakes were also sampled and tested, but not baked ones.

### What did we test for?

Products were tested for *Salmonella sp.*, SPC (Standard plate count) coagulase positive *Staph. aureus* and *E. coli* as these bacteria provide an indicator for hygienic food handling practices and cross contamination. The samples were sent to IMVS Food & Environmental laboratory and Australian Standard methods were used. Results were compared against the acceptability criteria in the FSANZ guidelines for ready to eat food.

## Survey Results

### Assessment of results

There are no mandated microbiological limits for cream or custard filled products in the Food Standards Code.<sup>iv</sup>

The guidelines for the microbiological examination of ready-to eat foods<sup>v</sup> provided the criteria against which the test results were measured (Table 2).

**Table 2:**

Test	Satisfactory	Marginal	Unsatisfactory / Potentially Hazardous
SPC	< 10 <sup>6</sup>	10 <sup>6</sup> – 10 <sup>7</sup>	≥10 <sup>7</sup>
<i>E. coli</i> #	<3	3 –100	≥100
Coag+staph	<100	100 –10,000	≥10,000
<i>Salmonella</i> sp.	Not detected in 25g		Detected

## Results Data

290 samples were taken from 98 bakeries. There were no detections of *Salmonella* sp. and no unsatisfactory levels of Coagulase positive *Staphylococcus aureus* in any products tested.

There were 41 products with unsatisfactory Standard plate counts and two products with unsatisfactory *E. coli* counts. The results have been analysed by product type in Table 3.

**Table 3:**

Product type	No. of samples	Unsatisfactory SPC	Unsatisfactory E coli	Total unsatisfactory
Baked custard tarts	51	0	0	0
Cont. vanilla slice	22	3 (14%)	0	3 (14%)
Soft custard only	12	3 (25%)	0	3 (25%)
Soft custard + fruit	22	3 (14%)	0	3 (14%)
Soft custard + cream	9	1 (11%)	0	1 (11%)
Cream + fruit	26	4 (15%)	1 (4%)	5 (19%)
Cream filling only	128	26 (20%)	1 (1%)	27 (21%)
Cheesecake only	12	0	0	0
Cheesecake + fruit	8	1 (13%)	0	1 (13%)
<b>TOTAL</b>	<b>290</b>	<b>41 (14%)</b>	<b>2 (1%)</b>	<b>43 (15%)</b>

29% of bakeries had one or more products with unsatisfactory standard plate counts and a further 2% of bakeries while having satisfactory SPCs had unsatisfactory counts of *E. coli*.

- 2 bakeries had unsatisfactory counts on all three product samples taken.
- 10 bakeries had unsatisfactory counts on two product samples.
- 18 bakeries had unsatisfactory counts on only one product sample.

## Discussion of results

Based on the criteria in Table 2, no unsatisfactory results obtained for plain baked custard tarts (n = 51) or plain cold set cheesecakes (n = 12).

Plain baked custard tarts have no further ingredients added after cooking. Samples of this product type were taken at both ambient and refrigerated storage and the average Standard plate count of 8,000 org/gram appeared to have no significant difference due to storage temperature.

There was some concern before the survey was conducted that the egg based nature of these fillings could be of particular concern, but the results would seem to indicate that the baking

temperature required to achieve a proper set of the filling is sufficient to reduce bacterial counts significantly and constitutes a good control step.

The only other product range with comparable results was plain cold set cheesecakes, but the average standard plate count was higher at 525,000 org/gram. These products may be slightly inhibitory to bacterial growth due to lower pH. But caution in interpreting the results is required as it was a fairly small sample and there is no control step to reduce or eliminate bacteria. Refrigerated storage and hygienic handling and preparation are still essential.

All other filling types including compound fillings, eg custard + fruit, had relatively similar rates of unsatisfactory standard plate count at 11 – 25% (total 14%). The only two products with unsatisfactory *E coli* counts contained cream but it is hard to draw any particular significance from this.

Twelve of the 30 bakeries with one unsatisfactory test result had more than one unsatisfactory test result (40%). And of the other 18, four had other product samples with marginal standard plate counts (a further 13%). This seems to indicate that in over 50% of bakeries unhygienic preparation practices were having an effect on the quality of products across the product range.

It was note worthy that in 82% of bakeries where at least one cream filled product in a bakery had unsatisfactory standard plate counts other cream products also had unsatisfactory or marginal standard plate counts. Reports from council inspections indicate that there are still considerable issues in the bakery sector regarding reuse, cleaning and sanitation of piping bags and this statistic seems to confirm that.

Councils were supplied with the details of the individual bakeries sampled in their jurisdiction and the product test results for bakeries with at least one unsatisfactory result. This information can be useful in assisting bakeries to identify areas for improvement in their hygienic practices and was seen as being of assistance to the ongoing targeted program of inspection and education for risk reduction in small bakeries.

## Conclusion

The 30% levels of unsatisfactory results are comparable to results obtained from similar surveys in other jurisdictions and highlight the need for the targeted inspection and education program presently underway, in order to address the potential food safety risk from hygienic practice issues suggested by these results.

It is envisaged that in 12 – 18 months time this survey will be repeated, providing an extra indicator for the success or otherwise of the concurrent inspection / education program on the microbiological quality of sweet baked goods in SA.

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<sup>i</sup> [ACT Health - Microbial Quality of Unrefrigerated Desserts](#) 1997

<sup>ii</sup> [ACT Health - Microbiological Quality of Unrefrigerated Desserts - 1999](#)

<sup>iii</sup> [A challenge testing study of Custard & Cream Products](#) Dunn, Son & Stone 2001

<sup>iv</sup> [Standard 1.6.1 - Microbiological Limits for Foods](#)

<sup>v</sup> [Guidelines for Microbiological examination of Ready to Eat food, FSANZ 2001](#)