

**ACT Health Protection Service**

**Microbiological  
Quality of ACT Bakery Products**



**July 2007– June 2008**

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## BACKGROUND/ OBJECTIVE

Bakery products are normally consumed in the same state they are sold and are considered to be 'Ready to Eat' (RTE) products. Bakery products are widely available in the ACT with bakers selling an extensive variety of products ranging from apple slices to meat pies. The survey of bakery products was undertaken for four reasons:

1. The popularity of these foods and the high levels consumed nationally. On average Australian households spend \$15 a week on bakery products (Australian Bureau of Statistics 2000);
2. Bakery products in the ACT have not been previously surveyed;
3. Determine the bacteriological status of bakery products available on the ACT market; and
4. To check the compliance of these products to Food Standards Australia New Zealand (FSANZ) Guidelines for the Microbiological Examination of Ready-to-Eat Foods December 2001 (Guideline).

## STANDARDS

There were a total of 118 samples analysed for a variety of microorganisms including *Escherichia coli*, coagulase positive *Staphylococci*, *Bacillus cereus* and *Salmonella*. The results were compared to the Guideline. The Guideline identifies four categories of microbiological quality ranging from satisfactory to potentially hazardous. Table 1 below is an excerpt from the Guideline. Table 1 indicates the level of contamination that is considered to be unsatisfactory or significant risk to public health for the microorganisms tested.

**Table 1 FSANZ Guidelines for the Microbiological examination of Ready to Eat Foods**

Test	Microbiological Quality (CFU per gram*)			
	Satisfactory	Marginal	Unsatisfactory	Potentially Hazardous
<b>Indicators</b>				
<i>Enterobacteriaceae</i>	<10 <sup>2</sup>	10 <sup>2</sup> -10 <sup>4</sup>	≥10 <sup>4</sup>	
<i>Escherichia coli</i>	<3	3-100	>100	**
<b>Pathogens</b>				
Coagulase positive <i>Staphylococci</i>	<10 <sup>2</sup>	10 <sup>2</sup> -10 <sup>3</sup>	10 <sup>3</sup> -10 <sup>4</sup>	≥10 <sup>4</sup> SET +ve
<i>Bacillus cereus</i>	<10 <sup>2</sup>	10 <sup>2</sup> -10 <sup>3</sup>	10 <sup>3</sup> -10 <sup>4</sup>	≥10 <sup>4</sup>
<i>Salmonella</i> spp.	not detected in 25g			detected

**NOTE:**

\* Colony Forming Units per gram (CFU per gram)

\*\* Pathogenic strains of *E. coli* should be absent.

SET +ve: *Staphylococcus enterotoxin* positive.

## SURVEY

This survey was conducted over two full three month periods to collect data during two seasons, 1 July 2007 to 31 October 2007 and 1 April 2008 to 30 June 2008. During these periods 118 samples were collected from 23 ACT bakeries. Five samples per bakery were

collected and three additional samples were collected from one premise that reported an unsatisfactory result. The samples were collected randomly by Health Protection Service (HPS) Environmental Health Officers and processed by the HPS Microbiology unit. The samples collected covered a wide range of the available bakery food types including meat pies, slices (vanilla and custard), chocolate éclairs, cream buns, custards tarts, cheese cakes and apple turnovers. All of the samples were tested for the hygiene indicators *Escherichia coli* (*E. coli*), *Bacillus cereus* (*B. cereus*), coagulase positive *Staphylococci*, and the food pathogen *Salmonella*. The survey collected multiple samples from single outlets and in general, outlets were only tested once with the exception of one outlet which was resampled due to an unsatisfactory result.

### Microbiological Method of Analysis

Samples were tested for the presence of:

- *Salmonella* species using AS 1766.2.5 (modified);
- *Bacillus cereus* using AS 5013.2;
- coagulase positive *staphylococci* using AS 1766.2.4; and
- *Escherichia coli* using AS 1766.2.3.

The sample preparation for *Escherichia coli*, coagulase positive *staphylococci* and *Bacillus cereus* consisted of:

- 25g of sample being homogenised with 225mL of 0.1% peptone diluent; with
- subsequent serial dilutions were prepared for use in enumeration.

***B. cereus* enumeration:** Spread plates (using a 100µl of each dilution) on a solid selective medium containing egg yolk and mannitol. Typical large, pink colonies, with or without lecithinase action were counted and a proportion of the colonies confirmed by a haemolysis test and spore staining. *B. cereus* cells are rods 4-5 µm long and 1-1.5 µm wide and stain red. The cells contain black-stained lipid globules. The spores stain green, are ellipsoidal in shape, central to sub central in position, and do not swell the sporangium.

**Coagulase positive *staphylococci* enumeration:** Spread plates (using a 100µl of each dilution) of Baird Parker medium were prepared in duplicate and incubated at 37°C/48h. Typical black colonies, with and without an egg yolk reaction surrounding the colony, were counted and a proportion confirmed by using a Staphurex latex agglutination test.

***Escherichia coli* enumeration:** Serial dilutions of 10<sup>-1</sup> to 10<sup>-3</sup> were dispensed in triplicate into test tubes of LT broth containing an inverted Durham tube and incubated at 37°C/48h. A loopful from each of the LT broths producing gas was inoculated into EC broth containing an inverted Durham tube and incubated at 44.5°C for up to 48h. A loopful from each EC broths producing gas were subcultured into tryptone water and incubated at 44.0 to 44.5°C/24h. Tubes indicating the presence of indole (by addition of Kovacs reagent) were used to determine an MPN count for *Escherichia coli*.

***Salmonella* detection:** 25g of sample was weighed out aseptically and homogenised with 225mL buffered peptone water (non-selective enrichment) and incubated at 37°C/16-20h. Aliquots were then transferred into Brain Heart Infusion broth (BHI) and incubated for 4h. DNA was extracted from 200µL of enriched BHI. This was screened for the presence of salmonella using a BAX cyber green PCR and a BIO-RAD I cycler. No confirmation testing was performed as there were no samples that screened positive.

## RESULTS / DISCUSSION

The microbiological quality of 118 bakery products from 23 bakeries across the ACT was assessed. A total of five products from each bakery were purchased and three additional samples were collected from one premise that reported an unsatisfactory result. The samples purchased were grouped into four categories (fresh cream filled, custard filled, non dairy based and other) according to the type of product and their ingredients. Raw results of analysis are attached at Appendix 1.

### ***E. coli***

All 118 samples were tested for *E. coli*. The results for the samples ranged between <3 - 23 cfu/g. The presence of *E. coli* in bakery foods is undesirable because it indicates that the food has possibly been prepared under poor hygienic conditions. Ideally *E. coli* should not be detected and as such a level of <3 cfu/g (the limit of the Most Probable Number test) has been set for satisfactory samples. 109 (95%) samples tested in this survey had <3 cfu/g of *E. coli* and met the satisfactory criterion. There were 6 (5%) samples in the marginal category of 3 -100 cfu/g. There were no samples in the unsatisfactory category.

### **Coagulase positive *Staphylococci***

All 118 samples were tested for coagulase positive *Staphylococci*, all samples were in the satisfactory category, i.e. <100cfu/g. The presence of a high number of coagulase positive *Staphylococci* in a RTE sample indicates contamination. This type of contamination is largely of human origin, practically originating from skin contact.

### ***B. cereus***

All 118 were tested for *B. cereus*. All but one sample was in the satisfactory category, i.e. <100cfu/g. One sample tested was found to be in the unsatisfactory range of 1000 - 10000 cfu/g with a reported count of 1100 cfu/g. Unsatisfactory level of *B. cereus* in cooked/processed food usually occurs as a result of inadequate temperature control or poor handling practices.

### ***Salmonella***

*Salmonella* was not detected in any of the 118 samples tested. Bakery foods should be free of *Salmonella* as consumption of food containing this pathogen may result in food borne illness.

## DISCUSSION

The results of the survey found that all samples were negative for *Salmonella*, and reported satisfactory results for coagulase positive *Staphylococci* and *E. coli*. One sample reported an unsatisfactory result for *B. cereus*. That particular establishment however did report satisfactory results for all of the other samples tested. The products from the unsatisfactory premise were subsequently re-sampled and the results complied with the Guideline.

## CONCLUSION

From the survey conducted it appears that the microbiological quality of the bakery foods sold in the ACT is good. Only one sample (0.8%) was unacceptable and recorded a result in the unsatisfactory category. A small number of samples (5%) recorded counts in the marginal range for *E. coli*. In conclusion, the results of this survey show a very high level

of compliance with the Food Standards Australia New Zealand Guidelines for the Microbiological Examination of Ready-to-Eat Foods December 2001.

## **BIBLIOGRAPHY**

1. Australian Bureau of Statistics. 2000. *6535.0 - Household Expenditure Survey, Australia: Detailed Expenditure Items, 1998-99*. Retrieved August 27, 2011, from Australian Bureau of Statistics website.
2. Food Standards Australia New Zealand Guidelines for the Microbiological Examination of Ready-to-Eat Foods December 2001.

## Appendix 1.

Assessment: S = satisfactory, M = marginal and U = unsatisfactory.

Sample Type	Sample Name	<i>E. coli</i>	<i>B. cereus</i>	Staph	<i>Salmonella</i>	Assessment
Fresh cream filled	Chocolate Éclair	< 3	< 50	<50	Absent	S
non-dairy based	Vanilla Slice	< 3	<50	<50	Absent	S
non-dairy based	Apple Turnover	< 3	< 50	<50	Absent	S
Fresh cream filled	Chocolate Éclair	< 3	< 50	<50	Absent	S
non-dairy based	Vanilla Slice	< 3	< 50	<50	Absent	S
Others	Sausage Roll	< 3	50	<50	Absent	S
Others	Meat Pastie	< 3	< 50	<50	Absent	S
non-dairy based	Vanilla Slice	< 3	1,100	<50	Absent	U
Custard filled	Custard Tart	< 3	< 50	<50	Absent	S
Fresh cream filled	Cream Bun	< 3	< 50	<50	Absent	S
Custard filled	Custard Tart	< 3	< 50	<50	Absent	S
Custard filled	Custard Tart	< 3	< 50	<50	Absent	S
Fresh cream filled	Chocolate Éclair	< 3	< 50	<50	Absent	S
Custard filled	Custard Tart	< 3	< 50	<50	Absent	S
non-dairy based	Lemon Meringue	< 3	< 50	<50	Absent	S
Others	Apple Sponge	< 3	< 50	<50	Absent	S
Others	Paris Brest	< 3	< 50	<50	Absent	S
Custard filled	Custard Tart	< 3	< 50	<50	Absent	S
non-dairy based	Bee Sting Bun	< 3	< 50	<50	Absent	S
Fresh cream filled	Cream Horn	< 3	< 50	<50	Absent	S
Fresh cream filled	Chocolate Éclair	< 3	< 50	<50	Absent	S
Custard filled	Custard Tart	< 3	< 50	<50	Absent	S
Others	Puppy Roll	< 3	< 50	<50	Absent	S
Fresh cream filled	Cream Bun	< 3	< 50	<50	Absent	S
Fresh cream filled	Apple Turnover with Cream	< 3	< 50	<50	Absent	S
Fresh cream filled	Chocolate Éclair	<3	<50	<50	Absent	S
Fresh cream filled	Cream Bun	<3	<50	<50	Absent	S
Fresh cream filled	Crème Pie	<3	<50	<50	Absent	S
Fresh cream filled	Cheese Cake	7	<50	<50	Absent	M
Fresh cream filled	Custard Tart	<3	<100	<50	Absent	S
Others	Cheese Cinnamon Slice	<3	<100	<50	Absent	S
Fresh cream filled	Éclair	<3	<100	<50	Absent	S
Custard filled	Custard Tart	<3	<100	<50	Absent	S
Custard filled	Portuguese Custard Tart	<3	<100	<50	Absent	S
Others	Fruit Flan	<3	<100	<50	Absent	S
Others	Vanilla Slice	<3	<50	<50	Absent	S
Others	Apple Turnover	<3	<50	<50	Absent	S
Others	Apple & Cream Tart	9	<50	<50	Absent	M
Others	Lemon and Custard Tart	<3	<50	<50	Absent	S

Others	Portuguese Tart	<3	<50	<50	Absent	S
Fresh cream filled	Caramel Tart with Cream	<3	<50	<50	Absent	S
Fresh cream filled	Apple Turnover with Cream	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Fresh cream filled	Chocolate Éclair	<3	<50	<50	Absent	S
Others	Apple Crumble Slice	<3	<50	<50	Absent	S
Others	Chocolate Éclair	<3	<50	<50	Absent	S
Others	Cheese Cake	<3	<50	<50	Absent	S
Others	Apple Turnover	<3	<50	<50	Absent	S
Fresh cream filled	Cream Bun	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Fresh cream filled	Chocolate Éclair	<3	<50	<50	Absent	S
Custard filled	Custard Éclair	<3	<50	<50	Absent	S
Custard filled	Custard Slice	<3	<50	<50	Absent	S
Custard filled	Custard Pie	<3	<50	<50	Absent	S
Custard filled	Cream Bun	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Others	Vanilla Slice	<3	<50	<50	Absent	S
Fresh cream filled	Apple Turnover with Cream	15	<50	<50	Absent	M
Others	Chantilly Éclair	<3	<50	<50	Absent	S
Others	Cannelloni	4	<50	<50	Absent	M
Others	Pecan Pie	<3	<50	<50	Absent	S
Fresh cream filled	Vanilla Slice	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Others	Cheese Cake	<3	<50	<50	Absent	S
Fresh cream filled	Cream Bun	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Custard filled	Custard Éclair	<3	<50	<50	Absent	S
Fresh cream filled	Chocolate Éclair	<3	<50	<50	Absent	S
Fresh cream filled	Cream Bun	<3	<50	<50	Absent	S
Others	Quiche	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Others	Raspberry and Almond Tart	<3	<50	<50	Absent	S
Others	Passionfruit Tart	<3	<50	<50	Absent	S
Others	Lattice Danish	<3	<50	<50	Absent	S
Others	Pecan Tart	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Others	Vanilla Slice	<3	<50	<50	Absent	S
Others	Apple Crumble	<3	<50	<50	Absent	S
Others	Apple Turnover	<3	<50	<50	Absent	S
Others	Dutch Slice	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Others	Almond Croissant	<3	<50	<50	Absent	S
Others	Apple Tart	<3	<50	<50	Absent	S
Others	Hummingbird Slice	<3	<50	<50	Absent	S
Others	Fruit Frangipani	<3	<50	<50	Absent	S

Others	Chocolate Éclair	15	<50	<50	Absent	M
Others	Chocolate Éclair	23	<50	<50	Absent	M
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Others	Vanilla Slice	<3	<50	<50	Absent	S
Others	Vanilla Slice	<3	<50	<50	Absent	S
Others	Choc Swiss	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Others	Chocolate Tart	<3	<50	<50	Absent	S
Others	Apple Tart	<3	<50	<50	Absent	S
Others	Vanilla Slice	<3	<50	<50	Absent	S
Others	Potato Pie	<3	<50	<50	Absent	S
Others	Meat Pastie	<3	<50	<50	Absent	S
Others	Sausage Roll	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S
Others	Apple Truffle	<3	<50	<50	Absent	S
Others	Lamb Moussaka Pie	<3	<50	<50	Absent	S
Others	Cheese, Bacon Quiche	<3	<50	<50	Absent	S
Others	Vegetable Pie	<3	<50	<50	Absent	S
Others	Chicken Vegetable Pie	<3	<50	<50	Absent	S
Others	Beef and Kidney pie	<3	<50	<50	Absent	S
Others	Apple Turnover	<3	<50	<50	Absent	S
Fresh cream filled	Cream Bun	<3	<50	<50	Absent	S
Others	Bee sting Bun	<3	<50	<50	Absent	S
Others	Beef Pie	<3	<50	<50	Absent	S
Others	Vanilla Slice	<3	<50	<50	Absent	S
Fresh cream filled	Chocolate Éclair	<3	<50	<50	Absent	S
Fresh cream filled	Cream Bun	<3	<50	<50	Absent	S
non-dairy based	Apple Slice	<3	<50	<50	Absent	S
non-dairy based	Apple Pie	<3	<50	<50	Absent	S
Custard filled	Custard Tart	<3	<50	<50	Absent	S