

ACT HEALTH PROTECTION SERVICE

**MICROBIOLOGICAL
QUALITY OF
READY-TO-EAT FOODS**

JULY 2005– JUNE 2006

Report prepared by
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OBJECTIVE

- Determine the bacteriological status of ready-to-eat food products available on the ACT market.
- Determine the compliance of these products to Food Standards Australia New Zealand (FSANZ) Draft Guidelines for the Microbiological Examination of Ready-to-Eat Foods.

BACKGROUND

“Ready-to-Eat” (RTE) food is food that is ordinarily consumed in the same state as that in which it is sold or distributed and does not include nuts in the shell and whole, raw fruits and vegetables that are intended for hulling, peeling or washing by the consumers.”¹

Sandwiches, rolls, stir-fries, baked goods as well as various other RTE foods are widely available in approximately 250 of the 450 registered food establishments in the ACT. Due to the diverse nature and popularity of these foods it was considered prudent to perform ongoing surveys on these products in conjunction with the Environmental Health Section Premises Auditing Program of high-risk food producing establishments. See appendix A for a comparison with previous years.

STANDARDS

Samples collected for surveillance and monitoring purposes are often multi-component products for which there are no microbiological standards or guidelines. Interpreting the significance of the types and levels of reported microorganisms for these foods may therefore be difficult. The FSANZ Guidelines for the Microbiological Examination of Ready-to-Eat Foods (the Guidelines) identify four categories of microbiological quality ranging from satisfactory to potentially hazardous. Table 1 below details the recommended guidelines. This Table reflects both the high level of microbiological quality that is achievable for RTE foods in Australia and New Zealand and also indicates the level of contamination that is considered to be a significant risk to public health.

Table 1¹

Test	Microbiological Quality (CFU per gram)			
	Satisfactory	Marginal	Unsatisfactory	Potentially Hazardous
Standard Plate Count (SPC)				
Level 1*	<10 ⁴	<10 ⁵	≥10 ⁵	
Level 2*	<10 ⁶	<10 ⁷	≥10 ⁷	
Level 3*	N/A	N/A	N/A	
Indicators				
<i>Escherichia coli</i>	<3	3-100	>100	**
Pathogens				
Coagulase positive staphylococci	<10 ²	10 ² -10 ³	10 ³ -10 ⁴	≥10 ⁴ SET +ve
<i>Bacillus cereus</i>	<10 ²	10 ² -10 ³	10 ³ -10 ⁴	≥10 ⁴
<i>Salmonella</i> spp.	not detected in 25g			detected
<i>Listeria monocytogenes</i>	not detected in 25g	detected but <10 ² #		≥10 ² ##

NOTE:

*see below “Standard Plate Counts” for definition of level.

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

Foods with a long shelf life stored under refrigeration should have no *L. monocytogenes* detected in 25g.

The detection of *L. monocytogenes* in ready-to-eat-foods prepared specifically for “at risk” population groups (the elderly, immuno-compromised and infants) should also be considered as potentially hazardous.

SET +ve: Staphylococcus enterotoxin positive.

N/A – SPC testing not applicable. This applies to foods such as fresh fruits and vegetables (including salad vegetables), fermented foods and foods incorporating these (such as sandwiches and filled rolls).

Standard Plate Count (SPC)

The Standard Plate Count (SPC), also referred to as the Aerobic Plate Count or the Total Viable Count, is one of the most common tests applied to indicate the microbiological quality of food. The total count of viable microbes reflects the handling/ storage history of the food. Total counts may be taken to indicate the type of sanitary control exercised in the production, transport, and storage of the food. The significance of SPC, however, varies markedly according to the type of food product and the processing it has received. When the SPC testing is applied on a regular basis it can be a useful means of observing trends by comparing SPC results over time. Three levels of SPC are listed in Table 1 based on food type and the processing/ handling the food has undergone.

Level 1 – applies to ready-to-eat foods in which all components of the food have been cooked in the manufacturing process/preparation of the final food product and, as such, microbial counts should be low.

Level 2 – applies to ready-to-eat foods which contain some components which have been cooked and then further handled (stored, sliced or mixed) prior to preparation of the final food or where no cooking process has been used.

Level 3 – SPCs not applicable. This applies to foods such as fresh fruits and vegetables (including salad vegetables), fermented foods and foods incorporating these (such as sandwiches and filled rolls). It would be expected that these foods would have an inherent high SPC because of the normal microbial flora present.

Note: An examination of the microbiological quality of a food should not be based on SPC alone. The significance of high (unsatisfactory) SPC cannot truly be made without identifying the microorganisms that predominate or without other microbiological testing.

SURVEY

This survey was conducted between the 01 July 2005 and 30 June 2006. During this period 201 samples from 52 ACT retail outlets were collected randomly by Health Protection Service Officers and processed by the Australian Capital Territory Government Analytical Laboratory (ACTGAL). The samples were collected in such a manner as to cover a wide range of the available RTE food types including salads, sushi, pies, quiches, sandwiches, noodles, pasta, meats and desserts. All of the samples were tested for the hygiene indicators SPC, *E.coli*, coagulase positive *Staphylococci*, and the food pathogens *Salmonella* spp. and *Listeria monocytogenes*. Foods containing pasta or rice were also tested for *Bacillus cereus*. The survey collected multiple samples from single outlets and in general outlets were only tested once.

RESULTS / DISCUSSION

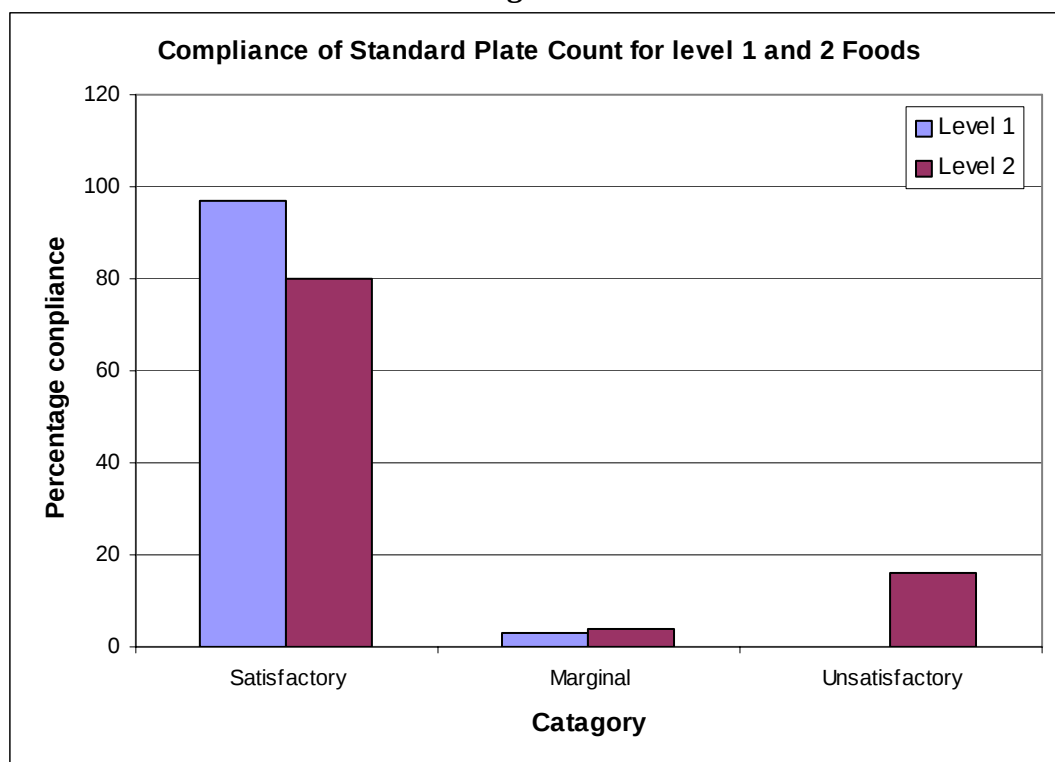
Standard Plate Counts (SPC)

All samples (201) were tested for SPC. The results for the samples ranged between <50 and 15,000,000,000 colony forming units per gram (cfu/g). A total of 33 of the RTE food samples were assessed as having to comply with the Level 1 SPC criterion, with counts ranging between <50 and 18,000 cfu/g. Of the 33 samples, 32(97%) were in the satisfactory category while 1 sample (3%) was in the marginal category. There were no samples in the unsatisfactory category.

A total of 50 samples were assessed as having to comply with the Level 2 SPC criterion. The results ranged between <50 and 1,300,000,000 cfu/g. 40 of these samples (80%) were in the satisfactory category. 2 samples (4%) were in the marginal category and 8 samples (16%) were in the unsatisfactory category. These unsatisfactory results were associated with other unsatisfactory or potentially hazardous results from the same establishment i.e. *E. coli*, *Listeria monocytogenes* and Coagulase Positive *Staphylococci*. As a result of these associated results, follow up inspections of the premises by Environmental Health Officers were conducted, which continued until the premises were deemed compliant.

A total 118 samples were assessed as having to comply with the Level 3 SPC criterion. The SPC test is not applicable to these products. The results for these products ranged from as low as <50 to as high as 590,000,000 cfu/g. This is to be expected as these foods, (mostly raw fruits and vegetables or fermented foods) would have an inherently high SPC because of their normal microbial flora.

Figure 1.

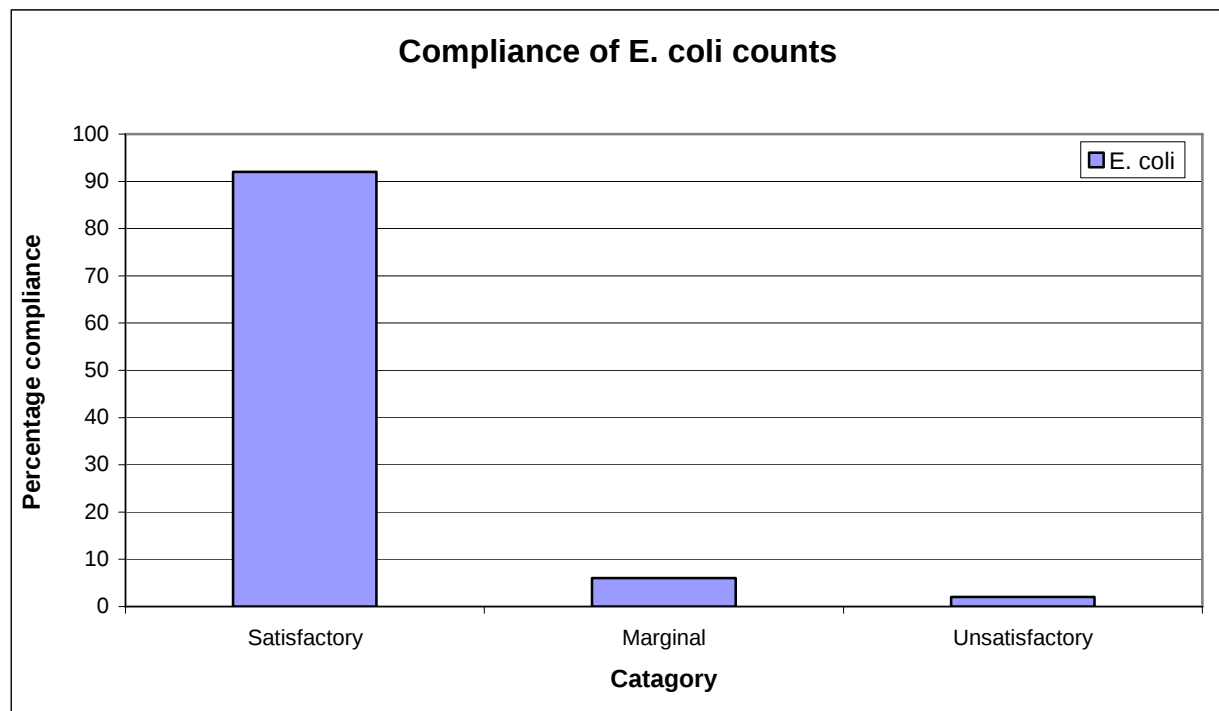


Escherichia coli

All samples (201) were tested for *E. coli*. Figure 2 represents the results for the three microbiological categories included in the Guidelines. The presence of *E. coli* in RTE 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. 185 (92%) of the samples had

<3 cfu/g *E.coli* and met the satisfactory criterion. There were 12 (5.9%) samples with *E. coli* in the marginal category i.e. from 3 to 100cfu/g. Levels exceeding 100 per gram are unacceptable and indicate a level of contamination which may have introduced pathogens or that pathogens, if present in the food prior to processing, may have survived processing.¹ A total of 4 (2%) sample had levels >100 cfu/g of *E. coli* and were considered unsatisfactory, these samples originated from two establishments. Resample from one of the establishments were not available on a revisit to the establishment, since then the establishment has ceased trading. The second establishment was investigated by Environmental Health officers on a number of occasions and is now compliant.

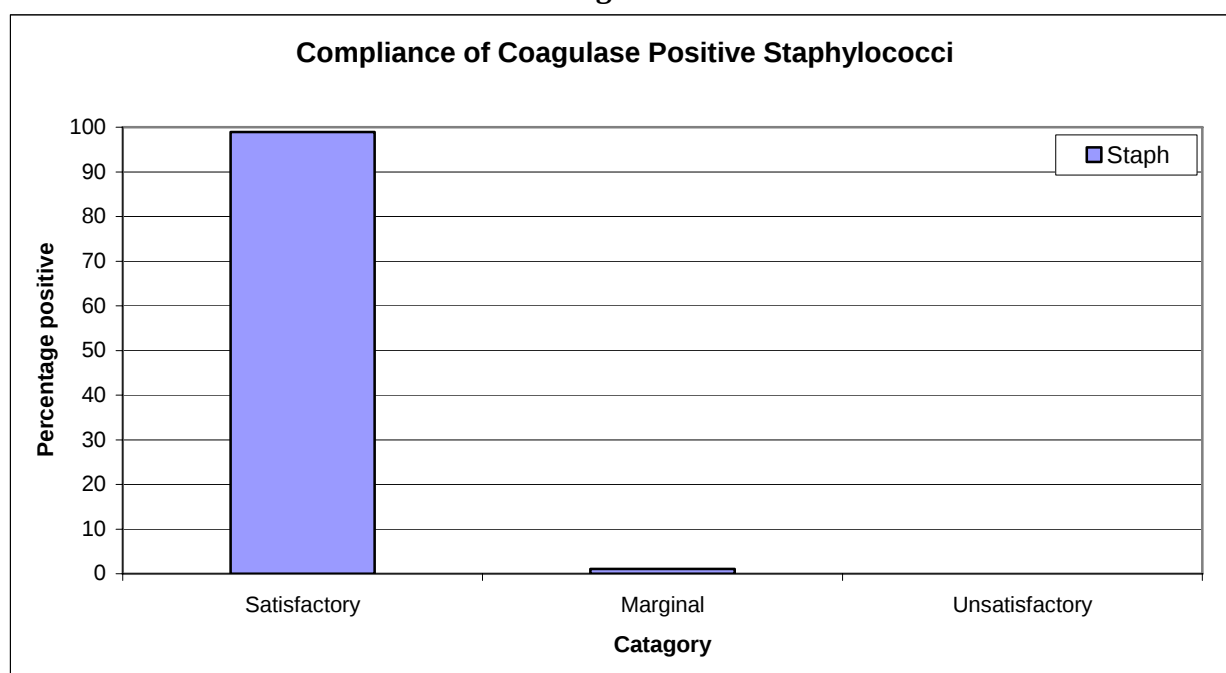
Figure 2.



Coagulase positive *Staphylococci*

201 RTE samples were tested for coagulase positive *Staphylococci*, with positive results ranging from 50-250cfu/g. 198 (98.5%) of the samples were in the satisfactory category, i.e. <100 cfu/g, while 3 samples (1.5%) were in the marginal category i.e.100-1000cfu/g. All three of the marginal samples had satisfactory *E. coli* counts with two of three having unsatisfactory Standard Plate Counts. There were no samples in the unsatisfactory category i.e.1000 – 10000cfu/g or Potentially Hazardous category i.e. greater than 10000 cfu/g for coagulase positive *Staphylococci*. See Figure 3. The presence of coagulase positive *Staphylococci* indicate that handling and/or time/temperature abuse of a food is likely to have occurred due to improper procedures during food preparation.

Figure 3



***Salmonella* spp.**

Salmonella spp. was not detected in any of the 201 samples tested. RTE foods should be free of *Salmonella* as consumption of food containing this pathogen may result in food borne illness.

Listeria monocytogenes

201 samples were analysed for *Listeria monocytogenes*. 198 (98.5%) of the samples were satisfactory i.e. *Listeria monocytogenes* was not detected, whereas 3 (1.5%) samples were positive for *Listeria monocytogenes*. These three positive samples consisted of a rice paper roll, egg and lettuce sandwich and a Caesar wrap. Follow up samples were requested for semi quantitative analysis and received for each of these samples. Two of the resamples were negative for *Listeria monocytogenes*. The premises making the foods were inspected by Environmental Health Officers and found to be compliant. The third resample tested recorded a semi quantitative count of 1 –9 cfu/gram. This proprietor of this establishment had a formal letter sent to him and was inspected by Environmental Health Officers on a number of occasions until compliance was established. All of three establishments are currently compliant.

Foods in which all components have been cooked in the final food preparation, or have received some other listericidal treatment, should be free of *Listeria monocytogenes*. The detection of *L. monocytogenes* in such foods indicates the food was inadequately cooked or the food was contaminated post preparation. The detection of high levels ($>10^2$ cfu/g) of *Listeria monocytogenes* in RTE foods that have not undergone a listericidal treatment indicates a failure of food handling controls and is also considered a public health risk. Ready to Eat foods prepared specifically for “at risk” populations should be free of *L. monocytogenes*. None of the RTE foods in this survey were prepared specifically for “at risk” populations.

***Bacillus cereus* (Tested for in RTE foods containing rice only)**

40 samples contained rice or pasta and were tested for *B. cereus*. 37 (92.5%) of samples tested were satisfactory with i.e. <100 cfu/g. 1 (2.5%) sample in the marginal category i.e. 100 -1,000cfu/g

and 1 (2.5%) one in the potentially hazardous. The sample was a Pork Mince roll that also had an unsatisfactory *E. coli* count. A resample of this item was requested but was not available on a revisit to the establishment. Since then the establishment has ceased trading.

CONCLUSION

In general the microbiological quality of the Ready-to-eat foods sold in the ACT is good. Overall the results are comparable to those found in the previous four years. The percentage of Satisfactory and Marginal samples for Coagulase positive Staphylococci in 2005-6 are comparable to the 2004-5 year. The percentage of Satisfactory samples for *Listeria monocytogenes* is the highest so far. The percentage of Satisfactory samples for *Salmonella sp.* have been very consistent, with only one isolation in the last five years.

BIBLIOGRAPHY

1. Guidelines for the microbiological examination of ready-to-eat foods FSANZ Dec 2001

APPENDIX A

COMPARISON TO PREVIOUS SURVEYS: 2001–2002, 2002–2003, 2003–4, 2004 –2005 and 2005 –2006

One can be seen from Tables 1 and 2 below that the quality of RTE foods varies depending on the test. The percentage of satisfactory samples in both the SPC Level 1 and 2 categories have improved in the 2004–5 year and now stand at the best of the five years of testing.

Table 1

Comparison of Standard Plate Counts (rounded)

	Satisfactory%						Marginal%						Unsatisfactory%				
Year	5-6	4-5	3-4	2-3	1-2	0-1	5-6	4-5	3-4	2-3	1-2	0-1	5-6	4-5	3-4	2-3	1-2
Level 1	86	87	86	60	67	78	3	8	14	23	12	9	11	5	0.0	16	20
Level 2	87	75	67	58	67	69	7	13	14	26	15	17	7	13	19	17	18

Table 2

Comparison between the Microbiological Quality indicators

%	2005-6				2004-5				2003-2004				2002-2003				2001-2002			
	Sat	Marg	Unsat	Pot. Haz	Sat	Marg	Unsat	Pot. Haz	Sat	Marg	Unsat	Pot. Haz	Sat	Marg	Unsat	Pot. Haz	Sat	Marg	Unsat	Pot. Haz
<i>E. coli</i>	92	6.0	2.0		89.7	9.7	0.6		92.4	6.1	1.4		86	11	3		97.4	0.5	2.1	
<i>Staphylococcus</i>	98.5	1.5	0.0		98.9	1.1	0.0	0.0	95.7	4.3	0.0	0.0	84	10.1	4.8	3	97.8	0.9	1.3	0
<i>Salmonella</i> spp.	100			0.0	100			0.0	100			0.0	99.5			0.5	100			0
<i>Listeria monocytogenes</i>	98.5	1.5			93.3	6.7			96.3	3.7			97.8	2.2			93.5	6.50		
<i>Bacillus cereus</i>	92.5	2.5	0.0	2.5	96	4.0	0.0	0.0	95.5	0.0	0.0	4.5	88	12	0.0	0.0	98.1	0.0	1.9	0.0

Sat – Satisfactory, Unsat – Unsatisfactory, Marg – Marginal, Pot. Haz – Potentially Hazardous.



Not applicable

The results over the last five years have, in general been very good, with greater than 90% of the samples in the satisfactory category.

The percentage of Satisfactory and Marginal *E. coli* samples in 2005-6 were comparable to previous years.

The percentage of Satisfactory and Marginal samples for Coagulase positive Staphylococci in 2005-6 are comparable with previous years.

The percentage of Satisfactory and Marginal samples for *B. cereus* in 2005-6 was coming close to the highest level so far.

The percentage of Satisfactory samples for *Listeria monocytogenes* is the highest so far.

The percentage of Satisfactory samples for *Salmonella* sp. have been very consistent, with only one positive sample in the last five years.