

1st Quarter National Survey 2001 (NS1):

Cakes and Pastries with Perishable Fillings and Toppings

Executive Summary

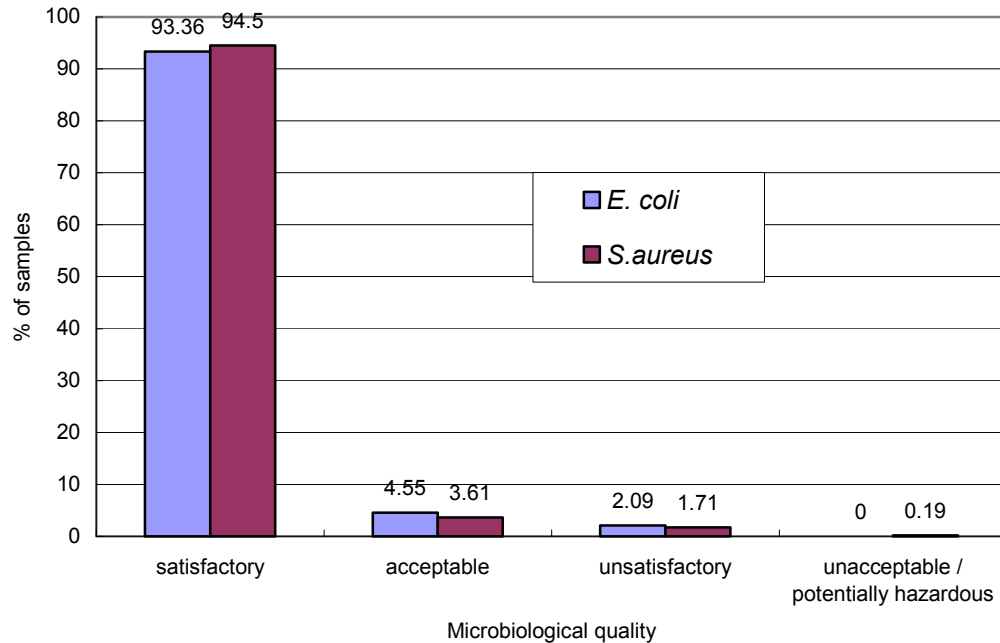
Background

- Cakes and pastries with perishable fillings and toppings were analysed for *Staphylococcus aureus* and *Escherichia coli*.
- These bacteria are commonly used in the microbiological evaluation of foodstuffs as indicators of poor hygiene and poor food handling practices.
- Sampling took place during January, February and March of 2001. A total of 527 samples were tested.

Results

- The following figure illustrates the main findings:

Figure 1: Microbiological quality of samples



- The presence of *S aureus* at unacceptable/potentially hazardous levels highlights the need for continued emphasis to be placed on good food handling practices at all stages during the processing and storage of these commodities

Report of 1st Quarter National Survey 2001 (NS1):

Cakes and pastries with perishable fillings and toppings

Summary

This study investigated the microbiological quality of cakes and pastries with perishable fillings and toppings. Sampling took place during the first three months of 2001. A total of 527 samples were analysed for *Staphylococcus aureus* and *Escherichia coli*. One sample (0.19%) a cream doughnut, was found to be unacceptable / potentially hazardous for *S. aureus* while 9 samples (1.71%) were found to be unsatisfactory for *S. aureus* and 11 different samples (2.09%) were unsatisfactory for *E. coli*.

Introduction

This study investigated the microbiological quality of cakes and pastries with perishable fillings and toppings from catering establishments and shops. Sampling took place during January, February and March of 2001. Samples were tested for *S. aureus* and *E. coli*.

Both *S. aureus* and *E. coli* are commonly used in the microbiological evaluation of foodstuffs as indicators of poor hygiene and poor food handling practices. *S. aureus* is commonly associated with the skin, nose and throat of healthy individuals. Under suitable conditions (such as those found in the fillings of bakery goods) this organism can multiply to dangerous levels. *E. coli* is an organism which forms part of the normal intestinal flora of humans and many animals. Not all strains of *E. coli* cause illness, however, some strains have been implicated in human diarrheal diseases and food poisoning outbreaks. Microbiological criteria involving *E. coli* are commonly used as an indicator of faecal contamination. Process failure and/or post process contamination by equipment, personnel or raw materials are possible causes for the presence of *E. coli* in heat-processed foods.

The presence of *S. aureus* and *E. coli* above a certain threshold (as specified in the FSAI microbiological guidelines ⁽²⁾) is indicative that the foodstuff is either unsatisfactory or unacceptable/potentially hazardous.

Specific objectives

- To examine the microbiological quality (*S. aureus* and *E. coli*) of cakes and pastries made with perishable fillings and/or toppings.
- To develop national survey methodology.

Method

Sample source: Samples were collected from 2 types of food business:

- Service sector (including restaurants, canteens, caterers and public houses)
- Manufacturers selling primarily direct to the final consumer (including bakers, confectioners).

[Food businesses are categorised in the Food Safety Authority (FSAI) Code of Practice No. 1 ⁽¹⁾].

Sample description: Cakes and pastries which:

- were prepared and / or sold loose on the premises and
- contained perishable fillings and / or toppings such as fresh cream, soya-based cream, custard and fresh fruit were sampled. Fillings or toppings such as glacé fruit and butter cream (consisting of butter / margarine, sugar, flour and flavouring) were excluded from this study.

Sample collection and analysis: Environmental Health Officers (EHOs) from the various health boards (Appendix 2) collected samples. The samples were analysed for *S. aureus* and *E. coli* in one of the 7 Official Food Microbiology Laboratories (OFMLs – Appendix 3) using an approved / standard method (methods accredited by the National Accreditation Board). Results were interpreted using the FSAI microbiological guidelines ⁽²⁾ and samples were categorised as satisfactory, acceptable, unsatisfactory or unacceptable / potentially hazardous as appropriate.

Results

Table 1: Microbiological quality (*S. aureus*)^Φ of samples according to health board

Health board ^Ή	Number of samples	Satisfactory < 20 cfu/g (%)	Acceptable 20 - < 100 cfu/g (%)	Unsatisfactory 100 - <10 ⁴ cfu/g (%)	Unacceptable / Potentially hazardous ≥ 10 ⁴ cfu/g (%)
ERHA	106	104 (98.11)	2 (1.89)	0 (0.00)	0 (0.00)
MHB	31	30 (96.77)	0 (0.00)	1 (3.23)	0 (0.00)
MWHB	35	33 (94.29)	2 (5.71)	0 (0.00)	0 (0.00)
NEHB	27	27 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)
NWHB	83	80 (96.39)	1 (1.20)	2 (2.41)	0 (0.00)
SEHB	81	78 (96.30)	2 (2.47)	1 (1.23)	0 (0.00)
SHB	104	87 (83.65)	11 (10.58)	5 (4.81)	1 (0.96)
WHB	60	59 (98.33)	1 (1.67)	0 (0.00)	0 (0.00)
TOTAL	527	498 (94.50)	19 (3.61)	9 (1.71)	1 (0.19)

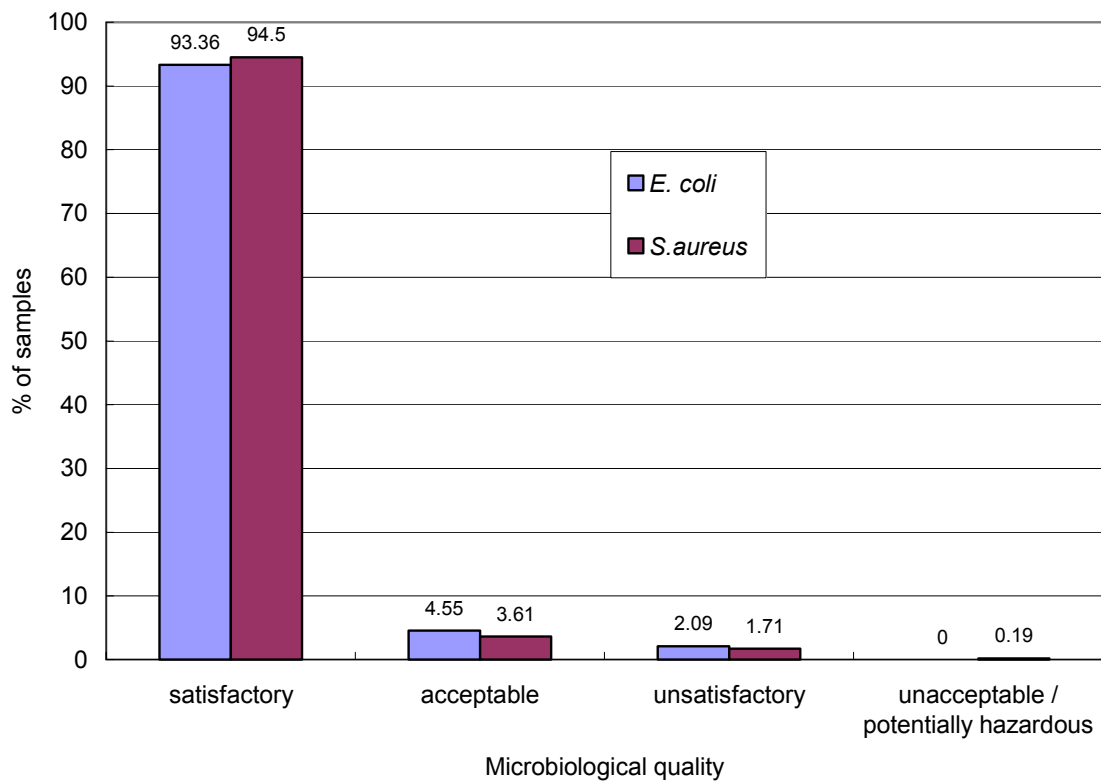
^Φ Microbiological quality was interpreted using the FSAI microbiological guidelines ⁽²⁾

^Ή See Appendix 2 for details of health boards

Table 2: Microbiological quality (*E. coli*)^Φ of samples according to health board

Health board ^Ψ	Number of samples	Satisfactory < 20 cfu/g (%)	Acceptable 20 - < 100 cfu/g (%)	Unsatisfactory ≥ 100 cfu/g (%)
ERHA	106	95 (89.62)	8 (7.55)	3 (2.83)
MHB	31	30 (96.77)	1 (3.23)	0 (0.00)
MWHB	35	31 (88.57)	2 (5.71)	2 (5.71)
NEHB	27	24 (88.89)	2 (7.41)	1 (3.70)
NWHB	83	82 (98.80)	1 (1.20)	0 (0.00)
SEHB	81	73 (90.12)	7 (8.64)	1 (1.20)
SHB	104	98 (94.23)	3 (2.88)	3 (2.88)
WHB	60	59 (98.33)	0 (0.00)	1 (1.67)
TOTAL	527	492 (93.36)	24 (4.55)	11 (2.09)

Figure 1: A comparison of the microbiological quality (*S. aureus* vs. *E. coli*)^Φ of samples



^Φ Microbiological quality was interpreted using the FSAI microbiological guidelines ⁽²⁾

^Ψ See Appendix 2 for details of health boards

Table 3: Details of samples unsatisfactory and unacceptable / potentially hazardous for *S. aureus*^φ

<i>S. aureus</i> cfu/g	Microbiological quality	Sample description	Date sample taken	Health board ^ω
1.20 x 10 ²	Unsatisfactory	Strawberry cheesecake	12/02/01	MHB
1.44 x 10 ²	Unsatisfactory	Tiramisu	08/02/01	SHB
4.00 x 10 ²	Unsatisfactory	Lemon & cream pastry	25/01/01	SHB
5.00 x 10 ²	Unsatisfactory	Cream doughnuts	08/01/01	NWHB
6.10 x 10 ²	Unsatisfactory	Cream slices	08/01/01	NWHB
8.00 x 10 ²	Unsatisfactory	Cream slice icing sugar	27/03/01	SHB
1.10 x 10 ³	Unsatisfactory	Pavlova	15/02/01	SEHB
3.00 x 10 ³	Unsatisfactory	Custard slice	27/03/01	SHB
5.40 x 10 ³	Unsatisfactory	Chocolate éclair	27/03/01	SHB
1.10 x 10 ⁴	Unacceptable / potentially hazardous	Cream doughnut	27/03/01	SHB

Table 4: Details of samples unsatisfactory for *E. coli*^φ

<i>E. coli</i> cfu/g	Sample description	Date sample taken	Health board ^ω
1.1 x 10 ²	Éclair	09/02/01	SEHB
1.2 x 10 ²	Cream slice	27/03/01	ERHA
1.3 x 10 ²	Custard slice	06/03/01	MWHB
1.5 x 10 ²	Fresh cream cake croissant	09/01/01	ERHA
2.1 x 10 ²	Cream flaky pastry	30/01/01	SHB
2.2 x 10 ²	Cream doughnut	20/03/01	NEHB
2.7 x 10 ²	Coffee slice	06/03/01	MWHB
3.5 x 10 ²	Custard and cream slice	12/03/01	SHB
6.0 x 10 ²	Éclair with fresh cream	08/02/01	SHB
7.4 x 10 ²	Cream cake	31/01/01	ERHA
3.5 x 10 ⁴	Éclairs x 3	19/02/01	WHB

^φ Microbiological quality was interpreted using the FSAI microbiological guidelines ⁽²⁾

^ω See Appendix 2 for details of health boards

S. aureus:

- 94.50% (n = 498) of samples were satisfactory, 3.61% (n = 19) acceptable, 1.71% (n = 9) unsatisfactory and 0.19% (n = 1) unacceptable / potentially hazardous for *S. aureus*.
- The unacceptable / potentially hazardous sample and 3 of the unsatisfactory samples for *S. aureus* were taken on the same day from a premise in the SHB area. Further examination revealed that these 4 samples were from the same supplier. These results were subsequently linked to poor hygiene in the supplier's premises.
- 2 of the remaining 6 unsatisfactory samples for *S. aureus* were taken on the same day from a premise in the NWHB area. The other 4 unsatisfactory samples were taken from different premises around the country.

E. coli:

- 93.36% (n = 492) of samples were satisfactory, 4.55% (n = 24) acceptable and 2.09% (n = 11) unsatisfactory for *E. coli*. The 11 unsatisfactory samples were taken from 11 different premises throughout the country.

Combined:

- Unsatisfactory counts for *E. coli* and unsatisfactory or unacceptable / potentially hazardous counts for *S. aureus* were never found in the same sample.
- Only one premises tested had a sample which was unsatisfactory for *E. coli* and a different sample which was unsatisfactory for *S. aureus*. Both samples were taken on the same day.

Overall:

- 3.99% (n = 21) of all samples were either unsatisfactory for *S. aureus* or *E. coli* or were unacceptable / potentially hazardous for *E. coli*.

Discussion

Using the FSAI microbiological guidelines ⁽²⁾ 1.90 % (n =10) of samples tested were found to be either unsatisfactory ($10^2 - <10^4$ cfu/g) or unacceptable / potentially hazardous ($\geq 10^4$ cfu/g) for *S. aureus*. However, this finding maybe somewhat exaggerated because 40% of these samples were derived from one supplier where poor hygiene practices were subsequently discovered. A similar study undertaken by the Public Health Laboratory Service (PHLS) in the UK on the microbiological quality of ready-made foods ⁽³⁾ found a *S. aureus* count of $>10^2$ cfu/g in 0.5% of desserts and cakes tested. An *E. coli* count of $> 10^2$ cfu/g was found in 3% of all samples tested by the PHLS ⁽³⁾ compared to 2.09% of samples in this study.

The findings of this study are reassuring in terms of the number of samples satisfactory for *S. aureus* (94.50%) and *E. coli* (93.36%). However, to ensure that microbiologically safe products reach the consumer it is imperative that high levels of hygiene are achieved and then maintained at all stages through out the food chain. Both the food handler and the non-food handler (whose duties and responsibilities can impinge on food safety) have a significant role to play in this area. It is essential that they are adequately trained, are aware of their responsibilities in terms of food safety and ensure that good hygiene and food safety practices are followed at all times.

There were a number of limitations to this study:

- No correlation was made between the composition of the samples (e.g. cakes and pastries with or without cream) and their microbiological status, however from Tables 3 & 4 it can be seen that both *S. aureus* and *E. coli* were prevalent at unsatisfactory levels in a wide range of samples. The PHLS study ⁽³⁾ found that *E. coli* was more prevalent in samples containing cream. Similarly, a Spanish study on the analysis of pastries for a range of organisms (*E. coli*, *S. aureus*, *Salmonella*, *Shigella*, *Clostridium*, yeasts and moulds) found that products containing cream had the highest level of contamination (80%). This was followed by those containing fruit (72.4%), chocolate (63.5%), other products (56.9%) and confectioners cream (44.9%) ⁽⁴⁾.
- The storage temperature of the samples *in situ* was not monitored. Non-conformances to recommended storage temperatures could allow numbers of these microorganisms to reach dangerous levels.

Limitations of this nature maybe addressed in further surveillance studies.

Overall, this study highlights the necessity for industry to maintain good hygiene practices at all stages throughout the food chain i.e. from manufacture to retail. Such practices should form part of a food safety management system based on the principles of HACCP.

Bibliography

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