

COLIFORM ORGANISMS IN QUEENSLAND CHEDDAR CHEESE

It has been shown that coliform organisms gradually die out in cheddar cheese, where the pH is low (Yale 1943; Crossley 1946). However, these authors have also shown that when initial contamination is high coliform organisms persist in cheese for many months.

Samples of cheese submitted for grading from 19 Queensland factories were examined for incidence and types of coliform organisms. The grading comments for texture have been compared with the coliform counts.

Methods

Samples of cheddar cheese between 14 and 28 days old were taken at the grading floor, using the normal cheese trier. The cheese were graded at the time of sampling and grading results recorded.

Subsamples for bacteriological analysis were taken from inside the plugs by breaking off the end to expose a fresh surface and inserting a sterile metal borer inside the plug. A sterile metal plunger was used to transfer the sample to a tared bottle. The sample was weighed, then ground in a mortar with sterile sand and sufficient diluent to give a 1 in 10 dilution. Coliform counts were made on desoxycholate agar, and at the same time total bacterial counts on nutrient agar and yeast counts on yeast salt agar (British Standard methods No. 895, 1940) were made. Representative colonies were picked from the desoxycholate plates and purified by dilution and plating three or four times on nutrient agar. The isolates were then classified according to the report of the Coli-aerogenes Sub-committee of the Society for Applied Bacteriology (1956).

Results

Thirty samples of cheese from 19 factories were examined. The results of bacteriological tests and grading are shown in Table 1. No moulds were found in any sample.

Coliform organisms were present in all but 1 sample and *Escherichia coli* type I organisms in 21 of the 30 samples. For the majority of samples all isolates were of the same type, but in 3 samples 2 different types were obtained. The numbers of coliform organisms per gram varied greatly among the samples, and in 2 samples of 2nd and 3rd quality cheese extremely high counts were obtained. These cheese had open texture and in these 2 cases the openness may have been caused by the coliforms which were present.

TABLE 1
RESULTS OF BACTERIOLOGICAL TESTS AND GRADING OF 30 SAMPLES OF CHEESE

Grading	Texture	Coliform Count (g-log)	Types Isolated	Total Bacterial Count (g-log)	Yeasts (g)
1st	.. good	1.3	<i>E. coli</i> I	4.8	50
1st	.. fairly	1.5	<i>K. aerogenes</i> I	4.9	170
1st	.. slightly open	1.7	<i>E. coli</i> I	4.8	40
1st	.. slightly open	3.2	<i>Cit. freundii</i> I, <i>K. aerogenes</i> I ..	4.7	2,200
1st	.. slightly open	1.5	<i>E. coli</i> I	3.3	140
1st	.. slightly open	1.9	<i>K. aerogenes</i> I	4.5	<10
1st	.. slightly open	3.4	<i>E. coli</i> I	4.3	40
1st	.. slightly open	<1		4.5	290
1st	.. slightly open	2.0	<i>E. coli</i> I	4.7	20
1st	.. slightly open	1.5	<i>Cit. freundii</i> I	4.1	70
1st	.. slightly open	3.5	<i>E. coli</i> II	5.2	40
1st	.. slightly open	2.6	<i>E. coli</i> I	4.7	20
1st	.. slightly open	1.5	<i>K. aerogenes</i> I	5.3	20
1st	.. slightly open	1.0	<i>E. coli</i> I	4.6	270
1st	.. slightly open	2.2	<i>E. coli</i> I, <i>K. aerogenes</i> I ..	5.5	1,400
1st	.. slightly open	4.6	<i>E. coli</i> I	6.6	90
1st	.. slightly open	4.6	<i>E. coli</i> I	6.6	380
1st	.. slightly open	2.4	<i>E. coli</i> I	6.5	360
1st	.. slightly open	2.8	<i>E. coli</i> I	5.7	130
2nd	.. fairly good ..	3.5	<i>E. coli</i> I	5.5	60
2nd	.. fairly good ..	2.4	<i>K. aerogenes</i> I	4.1	270
2nd	.. slightly open	3.2	<i>E. coli</i> I	3.3	390
2nd	.. slightly open	1.9	<i>E. coli</i> I, <i>Cit. freundii</i> I ..	4.3	310
2nd	.. slightly open	3.9	<i>E. coli</i> I	4.8	340
2nd	.. slightly open	2.3	<i>E. coli</i> I	5.5	10
2nd	.. slightly open	1.6	<i>E. coli</i> I	6.6	70
2nd	.. open ..	6.4	<i>E. coli</i> II	6.6	170
3rd	.. open ..	2.9	<i>E. coli</i> I	4.3	60
3rd	.. open ..	6.2	<i>E. coli</i> I	6.3	50
3rd	.. open ..	1.3	<i>E. coli</i> I	4.2	140

The relationship between texture and presence of coliform organisms is shown in Table 2. With the exception of the 2 counts greater than 10^6 per gram, the range of coliform counts was similar irrespective of the texture of the cheese.

TABLE 2
RELATIONSHIP BETWEEN TEXTURE OF CHEESE AND PRESENCE OF COLIFORM ORGANISMS

Texture	No. of Samples	No. Containing Coliform Organisms	Range of Coliform Counts (-log)	No. Containing <i>E. coli</i> Type I
Good or fairly good	4	4	1.3-3.5	2
Slightly open	22	21	1.0-4.6	16
Open	4	4	1.3-6.4	3
Total	30	29	1.3-6.4	21

Discussion

Coliform organisms were present in 97 per cent. and *E. coli* type I organisms in 70 per cent. of the samples. This incidence is very similar to that reported by Crossley (1946) for cheese in the first month of ripening. As many of the cheese examined in these tests had high coliform counts, coliform organisms could be expected to persist in the cheese for many months. *E. coli* type I was the predominant coliform organism in many of these samples.

With the exception of the two samples which had coliform counts greater than 10^6 per gram in association with open texture and degrading, there was no evidence that the cheese quality was related to the coliform contamination. Yale (1943) stated that counts up to 57,000 per gram curd had no effect on cheese quality. Several samples of first grade quality cheese were found in the present tests to have more than 1000 coliforms per gram.

REFERENCES

- CROSSLEY, E. L. (1946).—The coliform flora of milk and dairy products. *J. Dairy Res.* 14:233.
- REPORT (1956) COLIFORM SUB-COMMITTEE. *J. Appl. Bact.* 19:108.
- YALE, M. W. (1943).—Significance of the coliform group of bacteria in American cheddar cheese. *J. Dairy Sci.* 26:766.

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