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SOME ASPECTS OF THE
MICROBIOLOGY
OF CHEESE RIPENING
INVESTIGATED USING
ASEPTIC MANUFACTURING
TECHNIQUES

A thesis presented in partial fulfilment of the requirements
for the degree of Doctor of Philosophy in Food Technology at
Massey University

Keith Willis Turner

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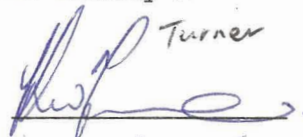
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ABSTRACT

The effect of non-starter lactic acid bacteria (NSLAB) on the texture and flavour development in cheese was investigated using Cheddar cheese matured in impermeable cheese barrier bags. Cheeses made normally in open vats (and contaminated with adventitious NSLAB) were compared with NSLAB-free cheeses.

To produce NSLAB-free cheeses, two totally enclosed cheese-making vats were designed and constructed. These vats were sterilized by soaking overnight with Iodophor, then steam flushed for 1 hour. This procedure was sufficient to exclude NSLAB but did not produce complete sterility as evidenced by the growth of bacillus-type organisms in UHT-treated milk incubated in the sterilized vats.

The thermal death characteristics of representative strains of NSLAB showed that most species would not survive milk pasteurization temperatures. However, two species, Lactobacillus casei var casei and Leuconostoc lactis were sufficiently resistant that, if present as the dominant flora of a raw milk, they could survive into the curd. Therefore, for aseptically manufactured cheeses, the milk was obtained by careful milking of the cows, to avoid NSLAB contamination. In the pasteurized vat-milks, the total bacterial count was routinely less than 1 cfu/mL.

A panel of tasters was trained to determine the texture and flavour of the cheeses using attribute scaling techniques. Six textural and 5 flavour attributes were defined, and the intensities of these were monitored in the cheeses at various ages up to 9 months.

The aseptic cheese-making procedure effectively eliminated NSLAB contamination from the cheeses. However, when cheeses in bags were matured for long periods, a surface flora of adventitious NSLAB developed, apparently by contamination during sampling. Despite all sampling precautions, the only method found to satisfactorily prevent this contamination was waxing of the cheese surfaces prior to bagging. It was also observed that in adventitiously contaminated cheeses, the count of NSLAB in the surface 1-2 mm was at least 10 times the count in the remainder of the cheese.

The texture and flavour of Cheddar cheeses made without NSLAB and matured at 10 C for 9 months could not be distinguished from cheeses with adventitious NSLAB matured under the same conditions. In equivalent cheeses matured at 15C, the textures were again identical but the cheeses with NSLAB had greater intensities of sharpness and sulphide than the cheeses without NSLAB. Thus, starter alone appears to be the predominant contributor of those compounds which produce Cheddar cheese flavour and NSLAB, although present, do not normally contribute to flavour production.

In a final part, the growth and citrate utilizing capabilities of three leuconostoc organisms were determined in a washed-curd cheeses. Again, NSLAB-free cheeses were made since there are

currently no effective means of differentiating between leuconostoc and NSLAB organisms, and NSLAB organisms can also utilize citrate. While all three strains were capable of rapid growth to levels around 10^7 cfu/mL in RSM, only one grew significantly in the cheeses. This strain was capable of fermenting citrate in the absence of a carbohydrate energy source and removed the citrate present in brine-salted cheeses within 1 month at either 10 C or 15 C.

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