THE INFLUENCE OF STARTER STREPTOCOCCI AND OTHER MICROORGANISMS ON CHEDDAR CHEESE FLAVOUR, WITH SPECIAL REFERENCE TO PROTEOLYSIS

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Francis Gabriel Martley

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A B S T R A C T

The investigation was undertaken to determine the features of different strains of lactic streptococci (starters) associated with good or poor flavour development in Cheddar cheese. An attempt was made to differentiate the roles of the starter streptococci, other microorganisms and rennet, particularly with respect to the influence of their relative proteolytic activities on the acceptability of the cheese and the formation of bitterness.

An improved agar medium was developed for the detection of proteolytic organisms in total bacterial counts, and used to assess the bacteriological quality of the milk received for cheesemaking over two dairying seasons. In spite of wide variations in the quality of the milk, the proteinases of the raw milk flora had no significant influence on the development of flavour, or off-flavours such as bitterness, in cheeses made with specific "non-bitter" or "bitter" starters.

Starter strains which characteristically made good-flavoured cheese possessed either one or both of the following features: (i) low rate of cell division at the temperature of cheesemaking which resulted in relatively low numbers of cells being produced; (ii) low proteolytic activity as determined in pasteurized skim milk (PSM) cultures in the presence of 4 or 5% NaCl.

Although the total quantities of free amino acids varied between cheeses having either good flavour or bitter or "burnt" flavour defects, the proportions of individual free amino acids formed by proteolysis of the casein were very similar in all the cheeses. This suggested that the specificities of the proteinases of the different starter strains used to make these cheeses were

not markedly different.

A comparison of proteolysis by starter strains and by rennet in PSM under similar conditions suggests that the starters, and particularly the more active strains, contribute significantly to overall proteolysis during cheesemaking and in the young cheese, but to a lesser extent in the later stages of cheeseripening.

A possible pathway of casein breakdown is suggested to explain the roles of rennet and starter in determining whether or not bitterness will be found in cheese. It is suggested that rennet proteolysis of the casein forms a pool of predominantly high MW non-bitter peptides. The extent to which the precursors are degraded by the starter proteinases determines the level of bitter peptides in the cheese.

Good-flavoured cheese is associated with a low level of starter proteolysis, while more extensive proteolysis by the "bitter" starters of the non-bitter precursor peptides results in the formation of bitterness. "Burnt" off-flavours in cheese associated with the use of certain starter strains probably reflect a further degree of starter proteolysis and the accumulation of relatively high levels of amino acids. The increase in the intensity of bitterness in cheese when higher levels of rennet are used presumably results from the production of greater amounts of precursor peptides available for subsequent degradation to bitter peptides by the starter proteinases.

The level of starter proteinase in the cheese appears to be the most important factor determining the development of bitterness. However, it is likely that the salt-in-moisture levels in the cheese will also exert some control on the development of

bitterness since NaCl inhibited proteolysis by both rennet and starter proteinases.

It is concluded that it should be possible to exert considerable control on cheese flavour merely by regulating the maximum population of starter streptococci, and hence the level of starter proteinase, attained during cheesemaking. Such control would be important in reducing the incidence or intensity of bitterness in Cheddar cheese.

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"An Improved Agar Medium for the Detection of Proteolytic Organisms in Total Bacterial Counts" by F.G. Martley, S.R. Jayashankar & R.C. Lawrence (1970) J. appl. Bact. 33, 363.

"Typing of Coagulase-Positive StaphyTococci by Proteolytic Activity on Buffered Caseinate-Agar, with Special Reference to Bacteriophage Nontypable Strains" by F.G. Martley, A.W. Jarvis, D.F. Bacon & R.C. Lawrence (1970) Infec. Immun. 2, 439.

"The Rapid Screening of Milk Samples for Proteolytic and Total Bacterial Counts" by R.C. Lawrence, F.G. Martley, Joy G. Teese & D.F. Newstead (1970) N.Z. Jl Dairy Sci. Technol. 5, 22.

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