A STUDY OF SOME ASPECTS OF THE QUALITY AND YIELD OF CHEDDAR CHEESE MADE FROM MILK CONCENTRATED BY ULTRAFILTRATION

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ABSTRACT

Ultrafiltration (UF) is a concentration and separation process which operates at the molecular level. It has been successfully applied to certain soft cheese varieties with the primary advantage of increased yields. When applied to Cheddar, which is a hard variety, problems are encountered. These are lack of flavour and texture development, lack of economically viable yield increase and practical problems in handling of UF curd.

An investigation was undertaken to study the application of UF technology to the manufacture of Cheddar cheese. The emphasis was on the biochemical and biophysical problems in UF Cheddar and the possible yield advantages in making the product.

Results suggest that UF per se does not contribute to problems in the quality of UF Cheddar. No major problems were encountered in the cheesemaking process or in final cheese quality when cheese was made from 2:1 UF retentate using conventional method and equipment. There were, however, no yield advantages. When 3:1 and 5:1 retentates were used, some modification in the method of manufacture, particularly in the cutting time and cutting device, was necessary. The quality of cheese obtained from 3:1 retentate was found to be inferior while that from 5:1 retentate was comparable with respect to the control cheeses.

The biochemical and biophysical problems associated with the quality of UF Cheddar could be overcome to a large extent by adjusting the amount of starter and rennet added on the basis of quantity of milk prior to UF. This yields Cheddar of normal one-day pH but with residual rennet concentration much higher than that in the conventional product. The higher level is probably required to overcome the 'dilution' effect of the extra whey proteins present in the UF product. This 'dilution' effect may be partly due to

the difficulty of rennet diffusion in UF Cheddar and partly a result of a decrease in concentration of flavour compounds due to the presence of extra whey proteins. The results show that substantial savings in rennet are not possible in cheesemaking from 5:1 UF retentate. The results also suggest that it is possible to make UF Cheddar with a required residual rennet concentration by regulating the amount of rennet added to the retentate and draining the whey at a predetermined pH.

The yield advantage in cheesemaking from 5:1 retentate (if UF Cheddar is made to normal MNFS of 53.5%) was limited to 4% largely because only one third of the whey proteins of UF milk was retained in the cheese. Theoretical analysis of mass balance data indicated that this yield advantage could be improved to about 6% by reducing 'fines' losses and to about 8% by decreasing fat losses as compared with the conventional process.

Given the current state of UF cheesemaking technology, it is possible that reductions in losses in conventional cheese-making plants may prove to be a more profitable method of increasing yields of Cheddar cheese than the use of UF cheesemaking methods.

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LIST OF ABBREVIATIONS USED

(in alphabetical order)

Abbreviation	Full form
BSA	Bovine serum albumin
Ca/P	Calcium/phosphorus
Ca/SNFNS	Calcium in solids-not-fat-not-salt
CF	Concentration factor
CFU	Colony forming unit
CN	Casein nitrogen
DF	Diafiltration
NCN	Non-casein nitrogen
NPN	Non-protein nitrogen
NSLAB	Non-starter lactic acid bacteria
RCT	Rennet clotting time
SD	Standard deviation
Sl	Slightly
SNF	Solids-not-fat
SNFNS	Solids-not-fat-not-salt
TN	Total nitrogen
UF	Ultrafiltration
WP	Whey protein
WPN	Whey protein nitrogen
WPSM	Whey protein supplemented milk
WPSR	Whey protein supplemented 2:1 retentate
α−La	Alpha lactalbumin
β−Lg	Beta lactoglobulin
FDM	Fat in dry matter
MNFS	Moisture in non-fat solids
RU	Rennet Units
S/M	Salt in moisture
WPC	Whey protein concentrate