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Lysis of mesophilic and thermophilic starter strains in UF cheeses

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Introduction

It has been shown that starter lysis in cheese results in an increase in the concentration of free amino acids and an improvement in sensory characteristics (Hannon *et al.*, 2003). However, in cheeses made from Ultra-Filtered (UF) milk, proteolysis and flavour development were shown to be far slower compared to traditional cheeses (Bech, 1993; Spangler *et al.*, 1989). The absence of starter lysis has been cited as a possible explanation. Saboya *et al.* (2002) first confirmed the absence of commercial *Lactococcus* starter lysis in UF-cheeses and also demonstrated that lysis of *Lactococcus lactis* AM2, known to be highly autolytic, was completely inhibited. The aim of this work was to confirm that the absence of lysis of mesophilic starters occurs for several known autolytic (AM1, AM2, US3) and non-autolytic (AM2-C, Z144) lactococcal starter strains, and to investigate whether lysis of thermophilic starter strains (*Lb. helveticus*: LH1, LH32, LH303; *Lb. delbrueckii* subsp. *lactis* LL14, LL51; *St. thermophilus* Z-1358) are influenced in the same way in UF-cheese.

Materials and Methods

UF cheeses: cheeses were made from UF retentate (FCV 6) of microfiltered milk (0.8 µm, Sterilox, G.P.) using starter systems shown in Figure 1. A control cheese containing cell free extract added to the retentate was also made in each case as a positive control. For cheeses made with thermophilic starters, strains required the presence of *St. thermophilus* Z-1358 to acidify the milk.

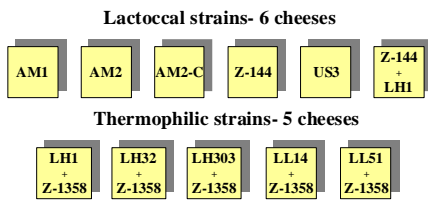


Figure 1: Starter systems used to make UF-cheeses.

Cheeses analysis:

- (i) cell viability by enumerations
- (ii) assaying for the intracellular enzyme, lactate dehydrogenase (L-LDH)
- (iii) immunodetection with species-specific antibodies:
 - Pep-X for lactococcal strains,
 - D-LDH for thermophilic strains.

Results

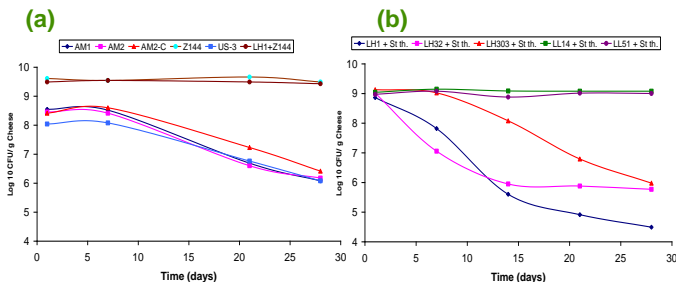


Figure 2: Cell viability:

- (a) decreased for all lactococcal strains except Z-144.
- (b) decreased for all *Lb. helveticus* strains (LH1, LH32, LH303) but not for *Lb. delbrueckii* strains (LL14 or LL51).

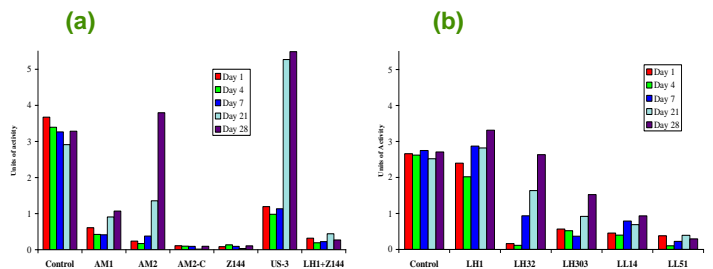


Figure 3: Activity of L-LDH in cheese aqueous extracts:

- (a) Increase in L-LDH activity after day 21 for autolytic strains AM2 and US3.
- (b) Detection of L-LDH by day 1 for LH1, after day 7 for LH32 and day 28 for LH303. No increase in L-LDH activity was observed for *Lb. delbrueckii* subsp. *lactis* LL14 or LL51.

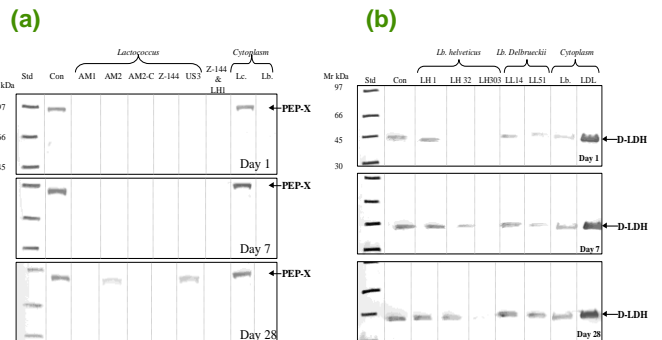


Figure 4: Confirmation of lysis by immunodetection:

- (a) No Pep-x band detected in any lactococcal cheeses by day 1 or day 7. Pep-x band detected for autolytic strains AM2 and US3 only at day 28.
- (b) D-LDH band detected for LH1 by day 1, LH32 by day 7 and LH303 by day 28. Bands detected for *Lb. delbrueckii* subsp. *lactis* LL14 or LL51 from day 1 indicating low level of lysis.

Conclusions and perspectives

- i) Inhibition of lysis of all lactococcal strains was confirmed up to 21 days of ripening, possibly due to inhibition of phage induction in UF-cheese.
- ii) Lysis of thermophilic lactobacilli observed early in ripening.
- iii) Lysis of *Lc. lactis* and thermophilic lactobacilli in UF-cheese involves different mechanisms.
- iv) Lysis of *St. thermophilus* was not observed (data not shown).
- v) The role of the cheese matrix on lysis inhibition has now to be elucidated.

References

Hannon *et al.*, (2003), *International Dairy Journal*, 13, 313-323; Bech, A.M., (1993), *International Dairy Journal*, 3, 329-342; Spangler *et al.*, (1989), *Milchwissenschaft*, 44, 189-203; Saboya, *et al.*, XXVI Congress International de Laiterie, Paris 24-27 September 2002 (Poster).