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Unsuspected role of pH in the development of texture and functionalities in Swiss-cheese

R. Richoux^{1*}, L. Aubert-Frogerais¹, J. R. Kerjean¹, V. Gagnaire²

¹ ACTALIA Dairy Products, BP 50915, F-35009 Rennes Cedex

² UMR 1253 STLO, INRA-Agrocampus Ouest, 65 rue de Saint-Brieuc, F-35000 Rennes

*r.richoux@actalia.eu

The α_{s1} -casein hydrolysis has been shown to greatly influence the texture and functionalities of hard cooked cheese. This hydrolysis can be performed by the proteinases of thermophilic lactobacilli since rennet, also implied, is denatured during the cooking step.

However, it is unclear whether these changes are only due to the proteolytic activity of lactobacilli, the pH decreases or both.

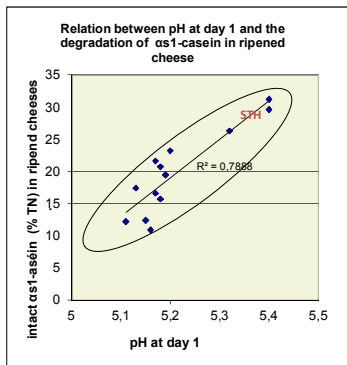
Material and methods

Small-scale Swiss-cheeses were made from pasteurized and microfiltered (1.4 μ m) milk using various combinations of starters:

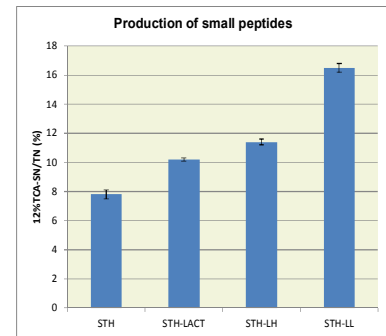
- *Streptococcus thermophilus* + *Lactobacillus helveticus* (ST-LH cheeses)
- *S. thermophilus* + *Lb delbrueckii subsp lactis* (ST-LL cheeses)
- *S. thermophilus* alone (STH cheeses) : pH at day 1 =5.40 since *S. thermophilus* does not metabolize the galactose moiety of lactose
- *S. thermophilus* alone in enriched lactose cheesemilk (STH-LACT cheeses): pH at day 1 similar to that of the cheeses made in presence of lactobacilli species (pH range 5,15-5,25)

Proteolysis (urea-PAGE, 12%TCA-NS/NT), firmness (extrusion force) and functionalities (chewiness, stretchability) were measured.

Results

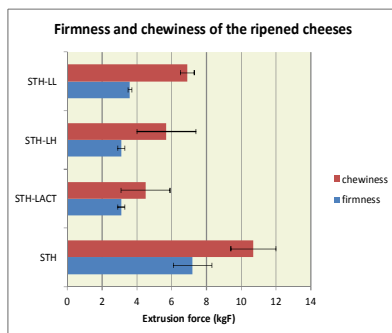


Proteolysis

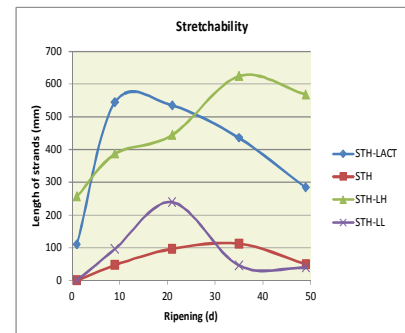


- α_{s1} -casein hydrolysis in ripened cheeses was strongly correlated with the cheese pH at day 1,
- Intact α_{s1} -casein had similar content in all cheeses except in STH cheeses with *S. thermophilus* alone that showed higher values.

- As expected, the production of small peptides greatly depends on the lactobacilli species used; higher 12%TCA-SN/TN values observed in STH-LL cheeses,



Functionalities



- Higher chewiness of melted cheeses and firmness in STH cheeses that contained higher intact α_{s1} -casein content,

- Higher stretchability in STH-LH and STH-LACT : lower pH and lower small peptides content.
- High pH (STH) or high amount of small peptides (STH-LL) yielded to poor stretchability,

Conclusions : the decrease in pH due to the high acidifying activity of the lactobacilli plays a key role in the texture of raw and melted Swiss-cheese. Besides the pH, the proteolytic activity of lactobacilli is also a determinant factor for stretchability