Natural variation of milk salts as predictor for **UHT stability**?

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Introduction

Quality and stability of ultra-high temperature processed (UHT) milk is increasingly being linked to the raw milk quality and composition. Variations in milk salts, especially **calcium** and **citrate** have been associated with heat- and storage stability of UHT milk, along with protein content.

Objective

This study investigates the relationships between calcium, citrate, and total protein in relation to buffering capacity in individual milk samples.

Materials and methods

- ***Fresh milk*** from Jersey and Holstein cows were collected from an experimental research farm. All cows were in mid lactation with total protein content ranging from 3.07-5.88%. Following analyses were performed after 1-2 days of storage at 4°C:
- ***Overall milk composition*** by Milkoscan FT120
- ***Calcium balance*** - Ionic calcium by ion selective electrode and total and serum calcium by potentiometric titration.
- ***Total citrate*** by Milkoscan FT120.
- ***Buffering capacity*** by monotonic acid titration.

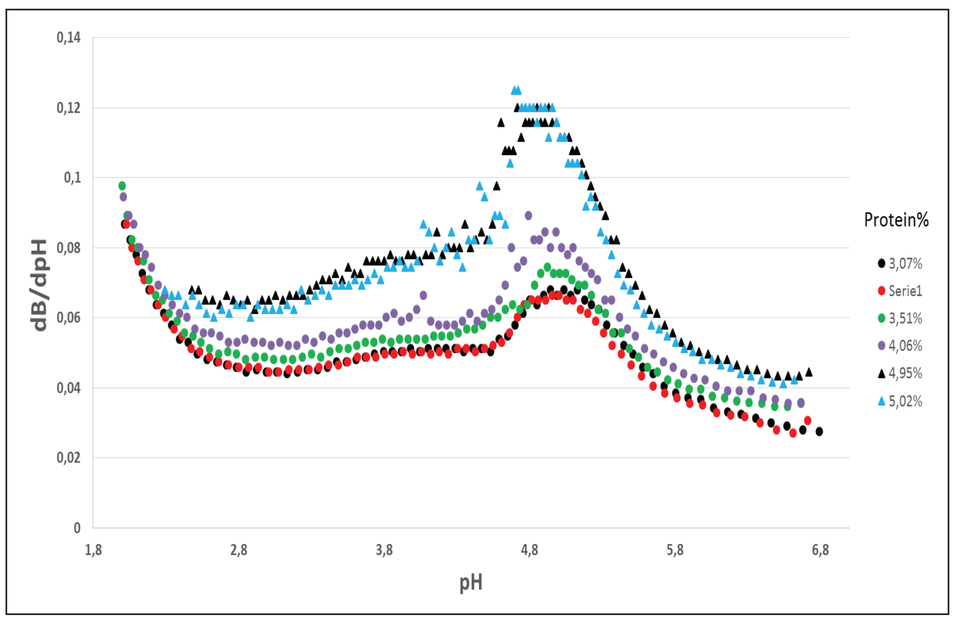

Figure 1. Buffering capacity for individual cow's raw milk samples with varying total protein content as a function of pH by titration.

- ***Buffering capacity*** of individual milk samples with variation in total protein content is shown in **figure 1**. Maximum buffering capacity increases as total protein increases (pH 3-4). Increase in calcium, and specially calciumphosphate (pH 4.8) also contributes to increase in buffering capacity.

  UHT stability tests have shown that high levels of total protein, citrate and calcium increases sedimentation. It could therefore be argued that high buffering capacity has no beneficial effect of UHT stability.

Table 1. Selected individual samples with variation in protein concentration, salt content and distribution, along with pH and max. buffering capacity (BC max)

Cow no.	Protein (%)	Total citrate (%)	Total calcium (%)	Serum calcium (mg/L)	Micellar calcium (mg/L)	Ionic calcium (mM)	Serum calcium (% of total)	Micellar calcium (% of total)	pH	BC max (dB/dpH)
1	3.07	0.22	1338.15	508.32	829.83	4.07	37.99	62.01	6.81	0.09
2	3.14	0.19	1363.50	469.69	893.80	4.04	34.45	65.55	6.74	0.09
3	3.51	0.20	1440.92	474.95	965.96	3.73	32.96	67.04	6.72	0.10
4	4.06	0.24	1615.47	581.09	1034.38	3.94	35.97	64.03	6.65	0.10
5	4.95	0.33	2358.05	677.20	1680.85	3.08	28.72	71.28	6.70	0.12
6	5.02	0.30	2328.63	648.42	1680.20	3.15	27.85	72.15	6.71	0.13

Results and discussion

Salt distribution is shown in table 1. A linear relationship between protein, total and micellar calcium. Serum calcium decreases as pro- tein increases. Lower levels of micellar calcium give less stable ca- sein micelles. However, as increase in protein decreases UHT sta- bility, this effect might not be significant.

Future analyses

Further analyses will include UHT processing and storage tests on individual milk samples with variations in protein, pH, citrate and mineral distribution. This will give additional under-standing of the raw milk composition and how this affects the storage stability of UHT milk.

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