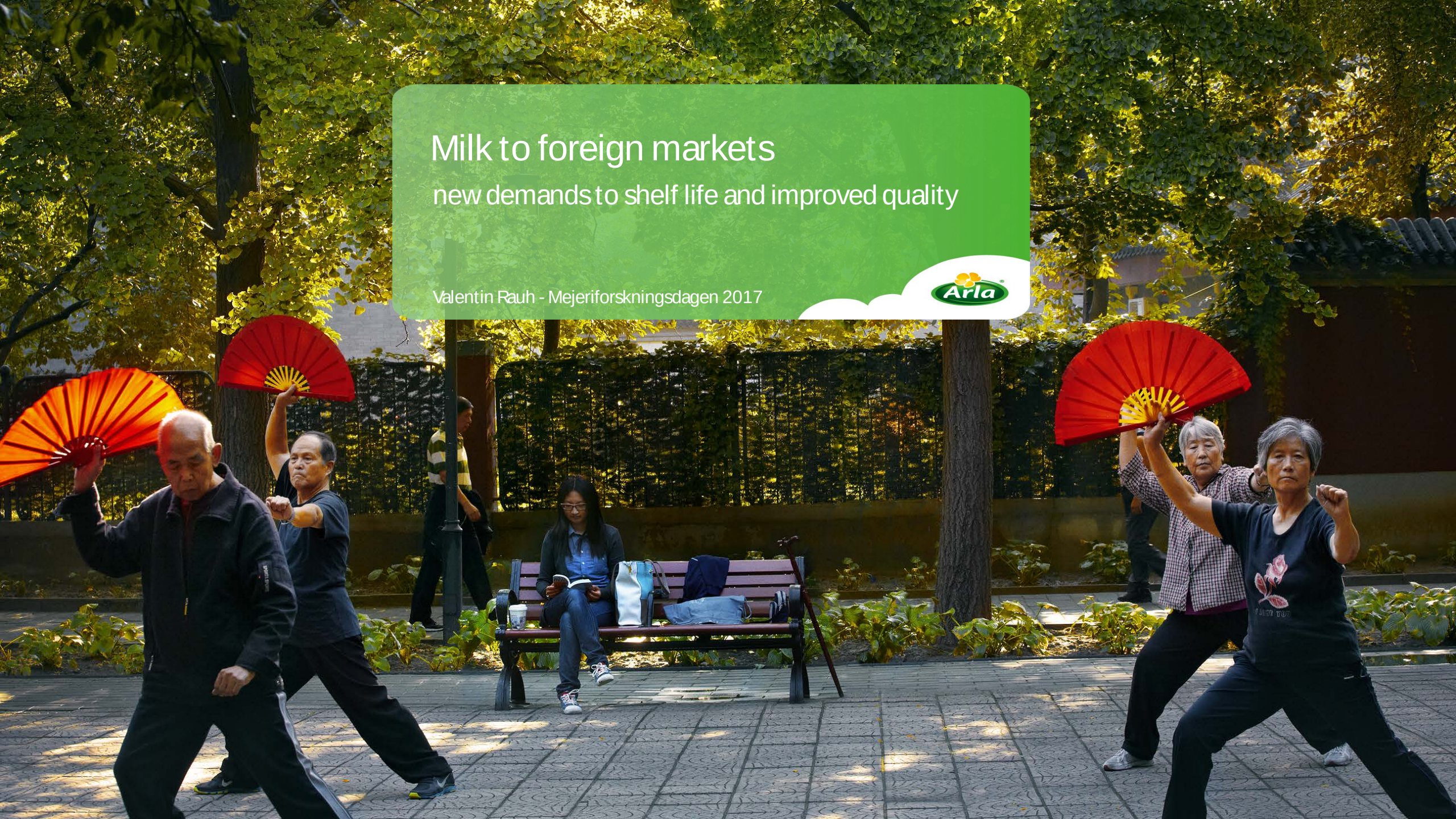


Milk to foreign markets

new demands to shelf life and improved quality

Valentin Rauh - Mejeriforskningsdagen 2017

Topics

Lactose hydrolysed milk

Transport and storage conditions

Enzymes in UHT milk

Future needs

Lactose hydrolysed milk

Lactose hydrolysed milk

Effect of side activity in posthydrolysed milk

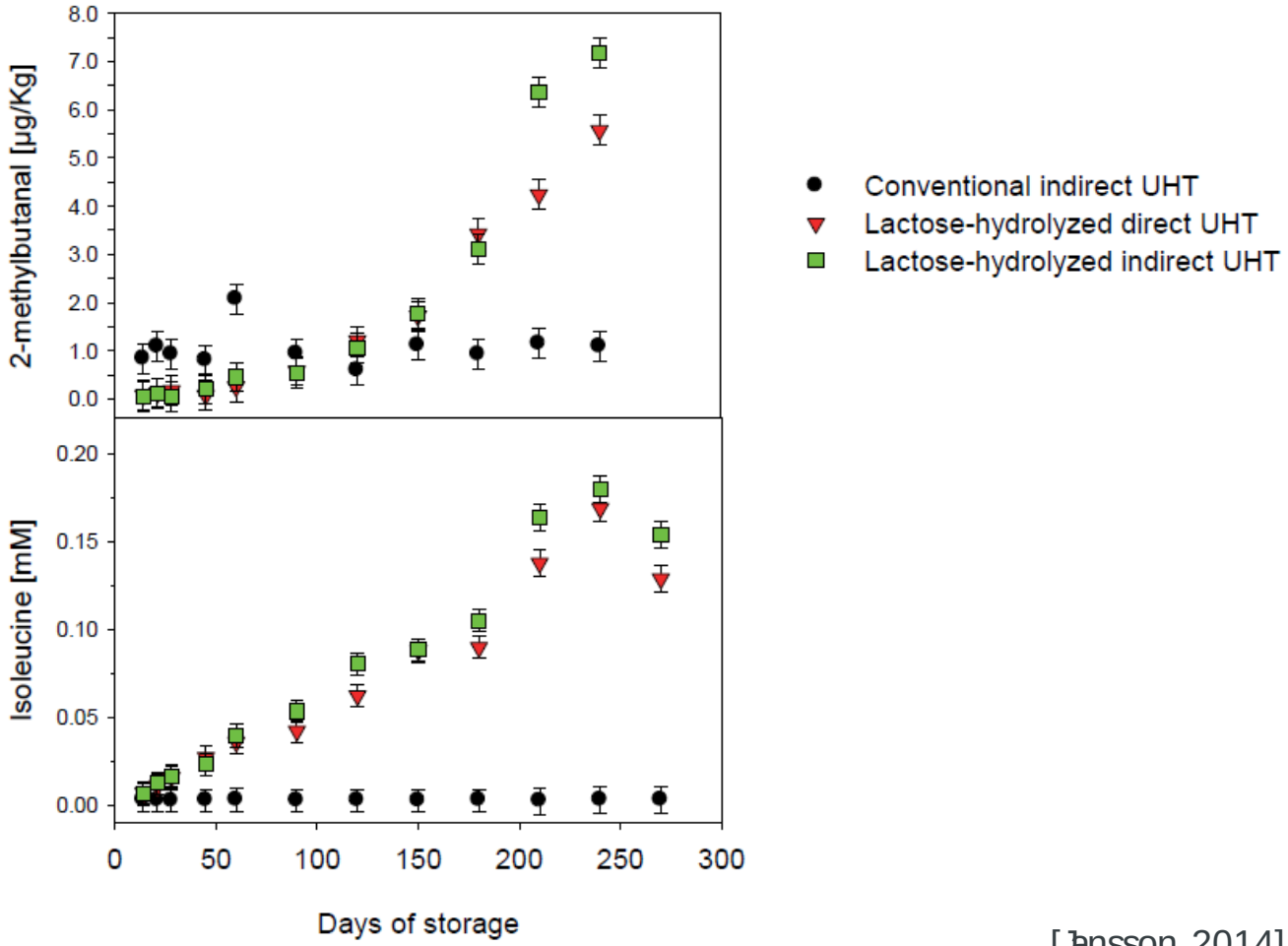
Proteolytic side activity of lactase preparations

↓

Release of amino acids

↓

Enhanced formation of Maillard off flavours and bitter peptides



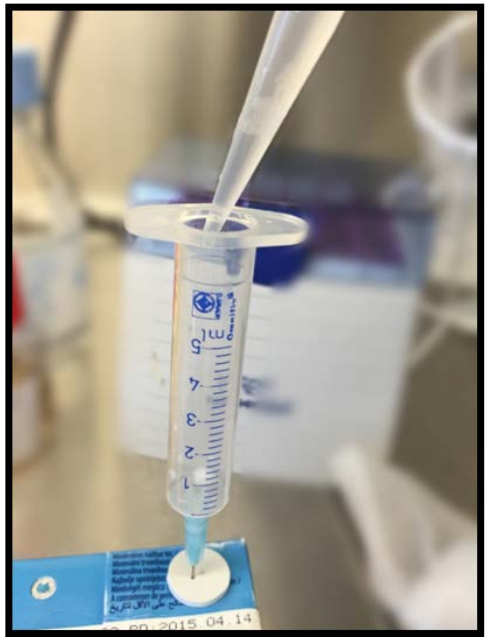
[Jansson, 2014]

Lactose hydrolysed milk
Side activity testing

- Collaboration with Aarhus University
- Quick test for proteolytic side activity

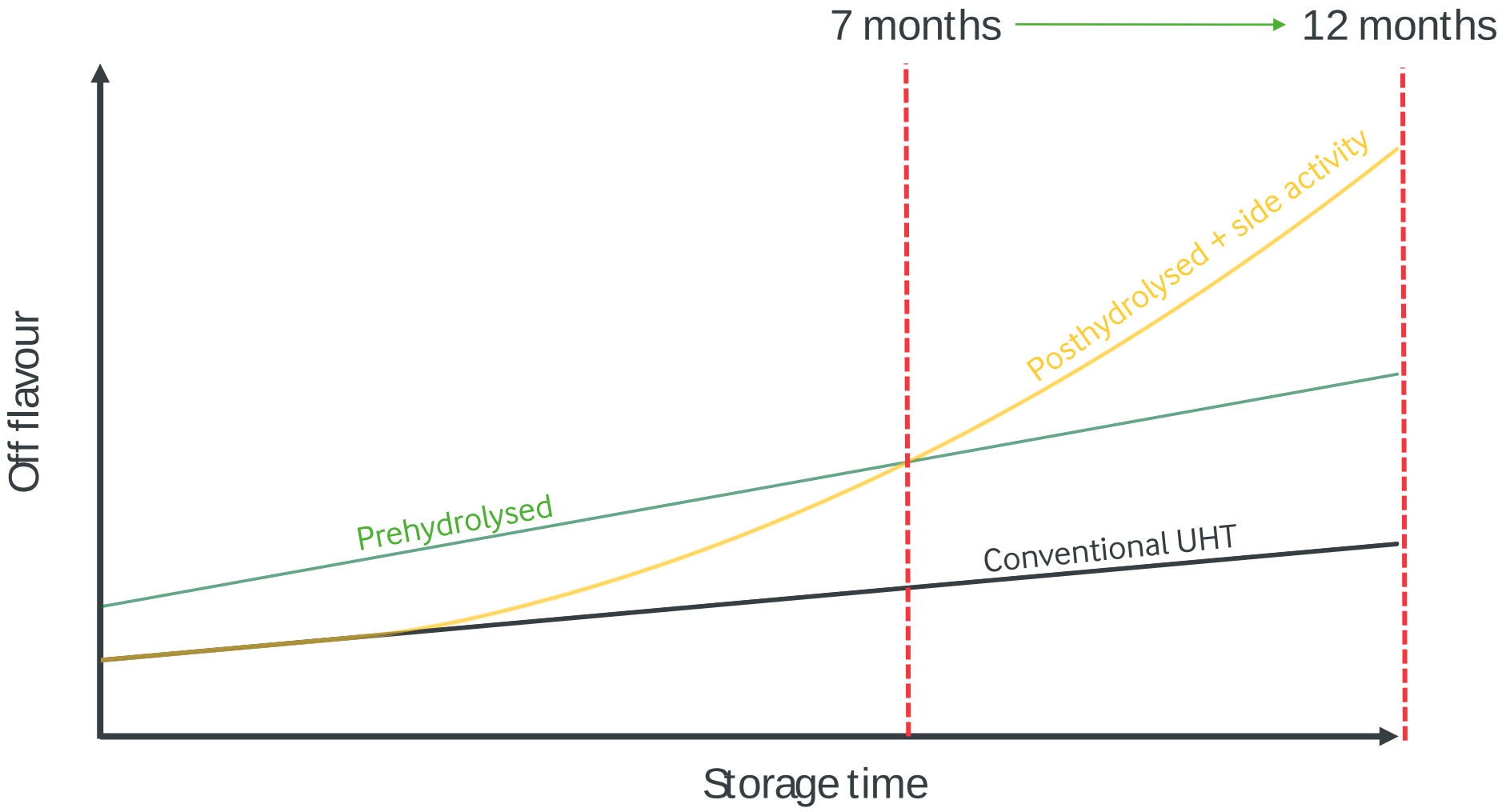
- Testing of commercial lactase preparations
  - Large difference in proteolytic activity
  - All preparations showed side activity

- Rapid evaluation of new lactases and their risk for off flavour generation
- Ability to choose right lactase for right application



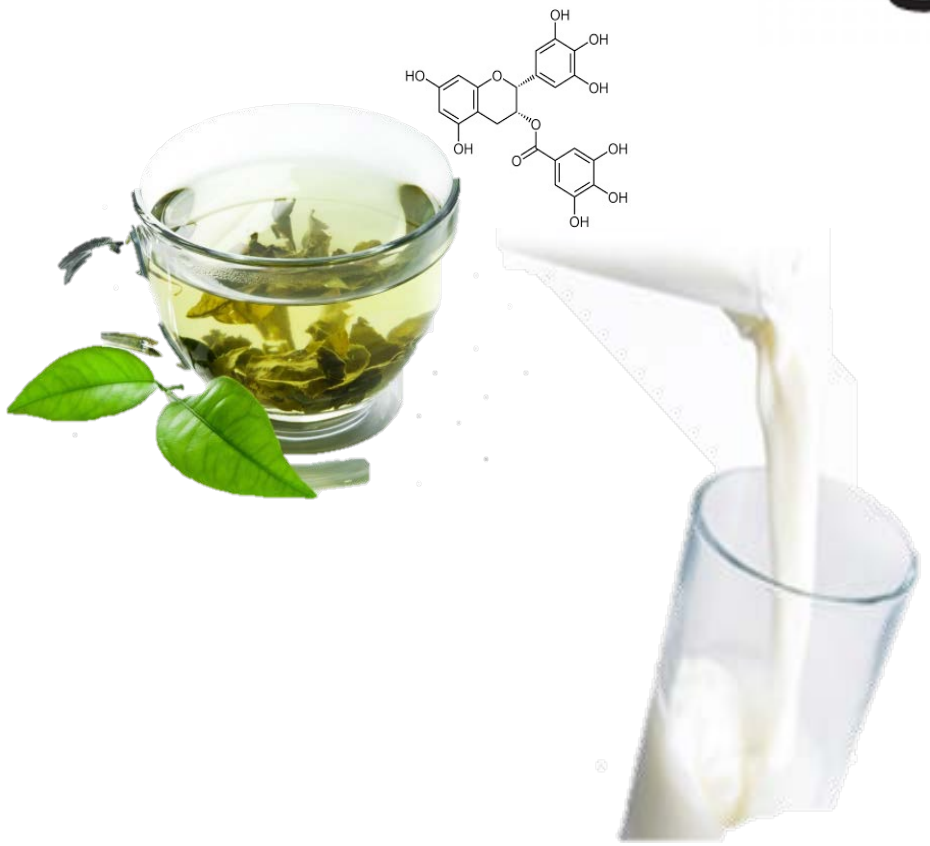
Lactose hydrolysed milk

Off flavour development



Lactose hydrolysed milk
Inhibiting Maillard reactions

- Pelum: **P**olyphenol **E**nriched **L**actosefree **U**HT **M**ilk
- Plant polyphenols can inhibit Maillard reaction
- Aim:
  - Understanding the interactions between polyphenols and milk components for a possible reduction in off-flavor formation
  - Storage trial to evaluate effect of polyphenols in lactose free UHT milk



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Enzymes in UHT milk

Enzymes in UHT milk

Bacterial enzymes - contamination

Farm/ Milking

Raw milk storage and transport

Raw milk in dairy

Pasteurized milk in dairy

UHT

- Problem in final product
  - If contamination of milk by bacteria
  - If bacteria can grow under cold storage conditions
  - If bacteria secret enzymes
  - If the enzymes are heat resistant
  - If shelf life is long enough for residual enzymes to do damage

BUT if it happens, the whole production is spoiled

Enzymes in UHT milk

Outcome

Growth of *Pseudomonas weihenstephanensis*, *Pseudomonas proteolytica* and *Pseudomonas* sp. in raw milk: Impact of residual heat-stable enzyme activity on stability of UHT milk during shelf-life

Proteolysis of casein micelles by heat-stable protease secreted by *Serratia liquefaciens* leads to the destabilisation of UHT milk during its storage

Thermostability of peptidases secreted by microorganisms associated with raw milk

Enzymes in UHT milk

PhD project Lund University

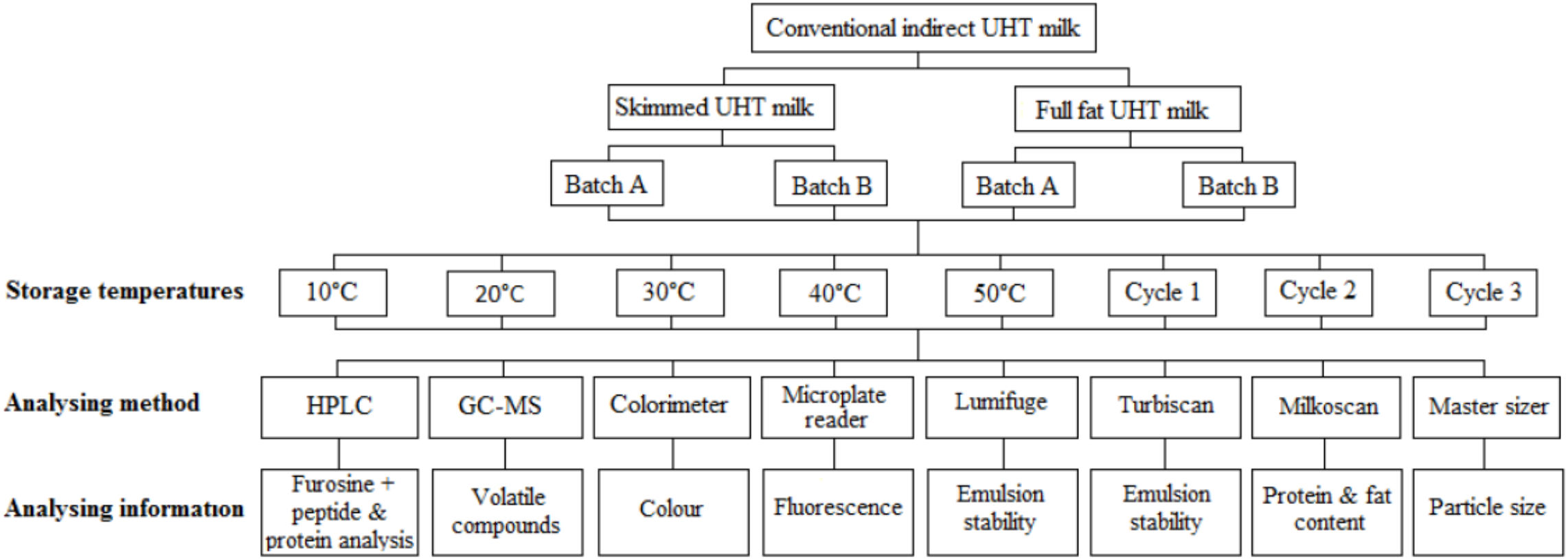
Milk quality and increased shelf-life of milk

To increase the profitability of milk production, it is required that milk and dairy products can be stored for a long time. The shelf-life of milk is controlled by quality parameters, such as enzymatic changes in the milk. These impair the shelf-life by giving rise to taste, odor and product defects, which in turn gives a higher waste.

Transport and storage

Transport and storage

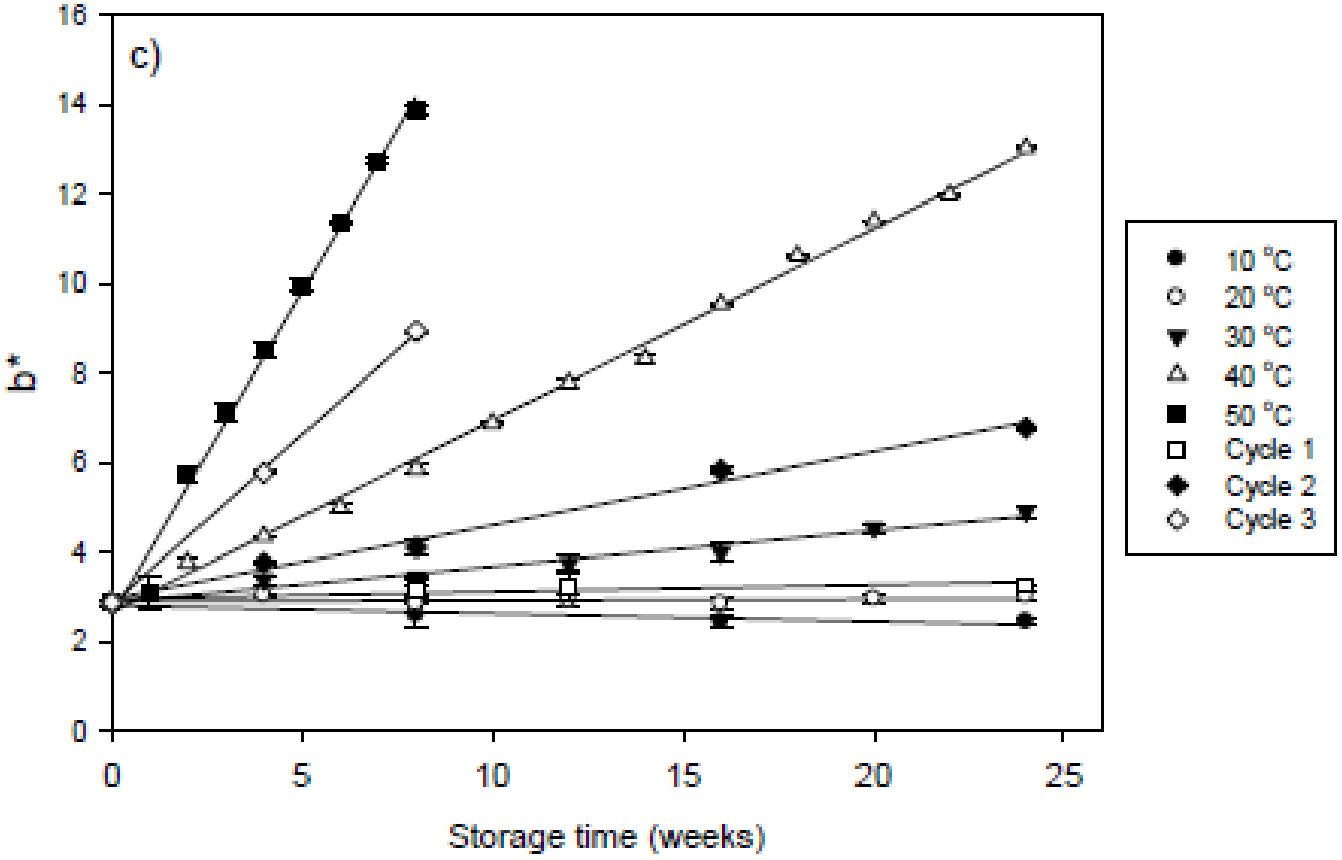
Accelerated shelf life test of UHT milk

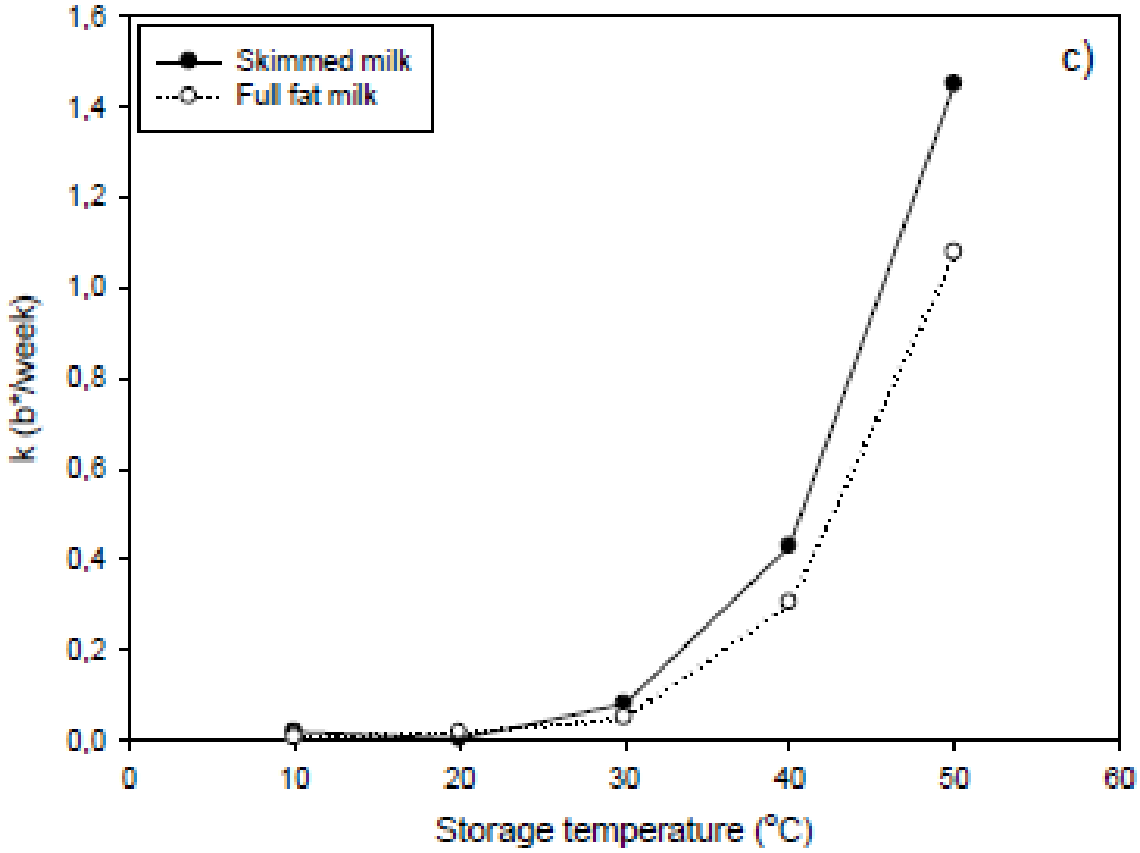


[Sunds, 2016]

Transport and storage

Browning of UHT milk





[Sunds, 2016]

Transport and storage

Key outcomes

- No significant changes at 10 and 20 °C, some changes after storage at 30 °C
- Major changes at 40 and 50 °C
  - Colour changes
  - Maillard reaction products
  - Lipid oxidation products
  - New reactions compared to 20 °C, e.g. sugar degradation

- Faster reactions during temperature cycling compared to average temperature
- Colour analysis was an easy and robust method for Maillard reaction

Accelerated or ambient storage?

Transport and storage
Started activities

- New initiatives regarding transportation and distribution
- Rethinking storage and shelf life tests
- Exploring optimal balance between storage temperature and shelf life
- New approaches for accelerated shelf life tests needed

Future research needs

- Analysis of contamination by psychrotrophs
  - Bacteria vs enzymes vs DNA/ RNA
  - Analysis prior to production
- Extended cold storage
  - Microbial spoilage
  - Impact on structure and functionality
- Accelerated shelf life testing
  - Validated protocol
  - Methods and knowledge for functionality of different products

Future research needs
Recombination

- Powder functionality
  - Solubility
  - Wettability
  - Crystallization
  - Enzyme activity
  - Formulation for specific products
- Powder shelf life
  - Impact on functionality
  - Off flavour generation