

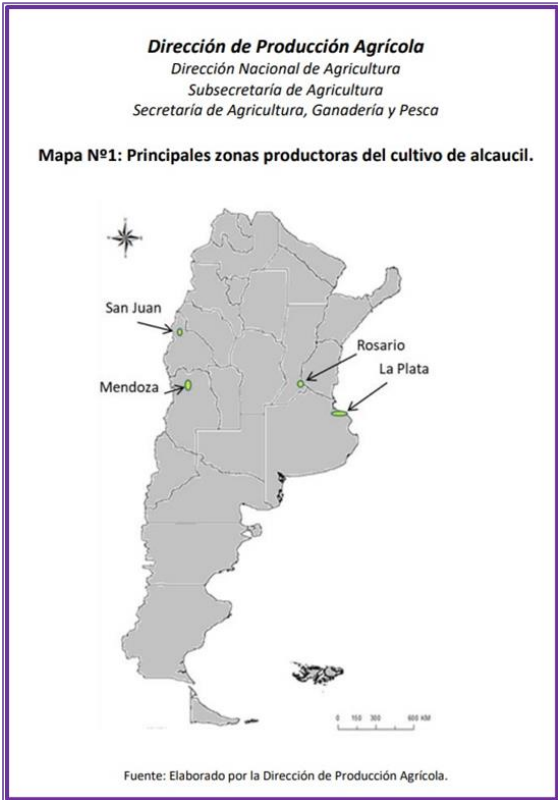
Determination of total free amino acids (FAAS) released during proteolysis of cheeses made with artichoke flower extracts as a substitute for rennet

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INTRODUCTION & AIM

Traditionally, cheeses are produced using chymosin, a milk-clotting enzyme. Rennet substitutes currently used in cheese production are enzymes from vegetable origin.



Artichoke (*Cynara scolymus* L.) from the horticultural belt of La Plata, Argentina, has been granted a Geographical Indication status under the name "Alcachofas platenses".



Artichokes that deviate from optimal products, when allowed to bloom due to flower protease composition, are excellent as raw material for vegetable rennet preparation.

Proteolysis, the key biochemical event that occurs during cheese ripening, impacts texture, flavour, aroma, and physicochemical parameters.

This work aims to study the total free amino acids (FAAs) released during the ripening of mini-cheeses made with artichoke flower extracts as the rennet.

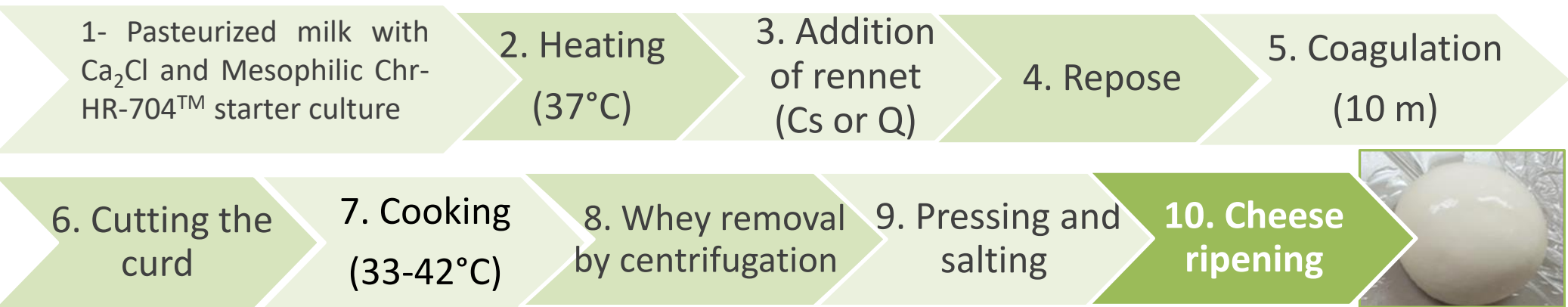
METHOD

1. Flower-enzyme extract

Frozen flowers of *C. scolymus* were ground into a fine powder, to which citric-citrate buffer was added and clarified, obtaining the enzymatic extract (EECs).



2. Formulation of miniature cheeses from bovine milk

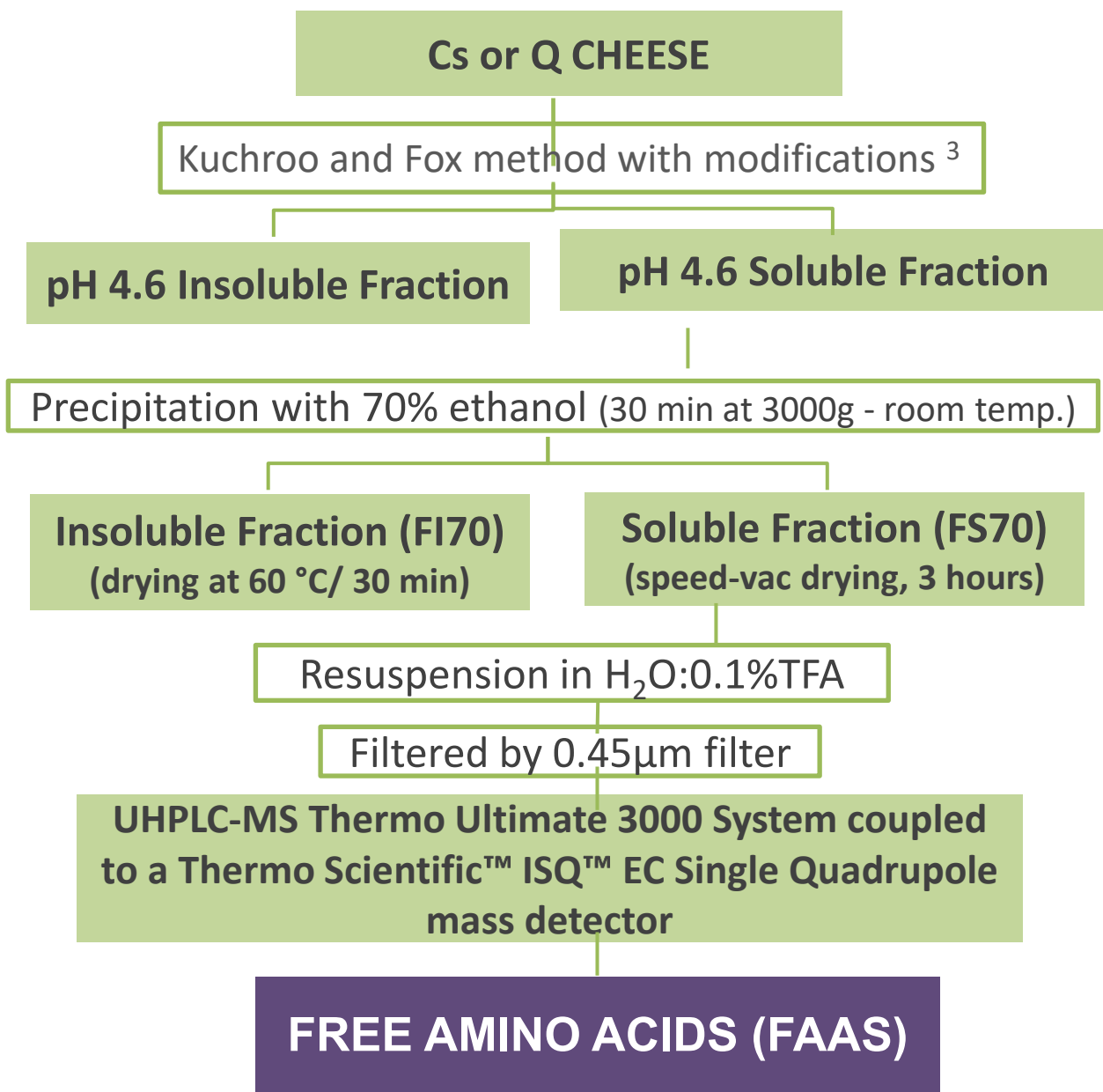


3. Physicochemical parameters

After one month of ripening, physicochemical analyses were performed.

PARAMETER	METHOD
pH	Lance-tip pH electrode (Hanna Instruments, Bs. Aires, Argentina).
Water Activity	Dew-point hygrometry (Aqualab series 3, Decagon Devices Inc., Pullman, WA, USA).
Colour	Com. Internationale de l'Éclairage L*, a*, and b* parameters with a handheld chromameter CR-400 (Konica Minolta, Sakura-machi, Hnoshi, Tokyo, Japan).
Moisture	Oven drying.
Protein	Micro-Kjeldahl method.
Fat	Schmid-Bondzynski-Ratzlaff method (ISO 1735 IDFS) ² .

4. Determination of free amino acids



RESULTS & DISCUSSION

Physicochemical parameters	Cs	Q
pH ^{7d}	4.73 ± 0.02 ^a	4.75 ± 0.03 ^a
pH ^{30d}	4.49 ± 0.02 ^a	4.58 ± 0.02 ^a
Water activity	0.963 ± 0.003 ^b	0.970 ± 0.001 ^a
Color ^a L*	97.2 ± 0.1 ^a	97.52 ± 0.03 ^a
a*	-2.35 ± 0.02 ^b	-2.96 ± 0.04 ^a
b*	16.7 ± 0.2 ^a	17 ± 1 ^a
Moisture %	58.2 ± 0.1 ^b	52.9 ± 0.1 ^a
Dry matter %	41.8 ± 0.1 ^b	47.1 ± 0.1 ^a
Moisture %/Dry matter %	1.395 ± 0.006 ^b	1.123 ± 0.006 ^a
Protein (g kg ⁻¹)	93.33 ± 0.030 ^b	132.89 ± 0.044 ^a
Prot F _{insol pH 4.6} (g kg ⁻¹)	78.47 ± 0.03 ^b	98.12 ± 0.03 ^a
Lipids (%)	14.7	8.7

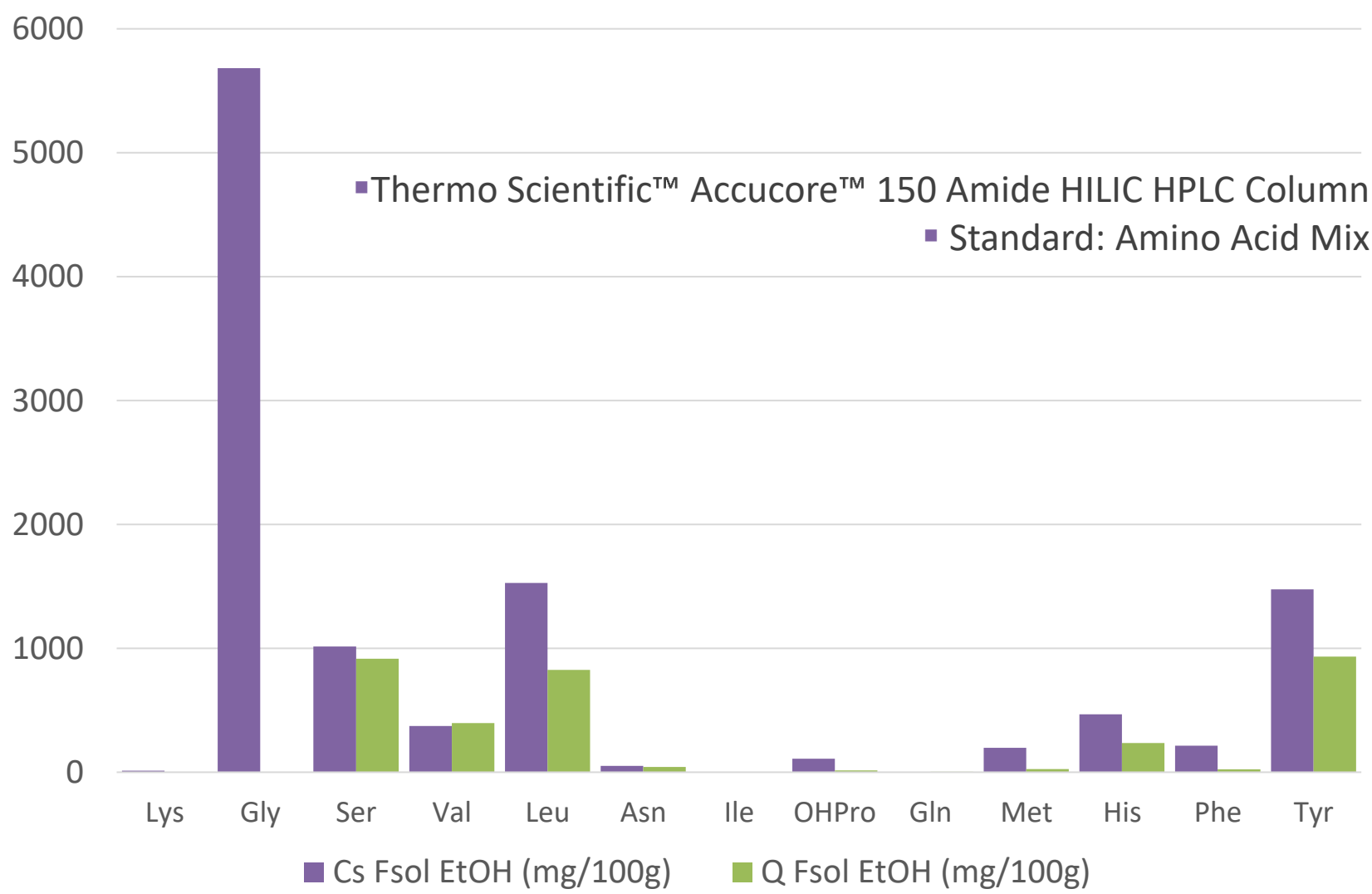
Cs, Cheese renneted with *C. scolymus* flower extract.
Q: Cheese renneted with chymosin (control).

All the cheeses were made on the same day, and the analysis was performed after 1 month of ripening, except for the pH, which was also measured 7 days after manufacturing (pH^{7d}).

The results represent the mean ± SD. Treatments followed by the same letter do not differ significantly (p > 0.05).

- A higher moisture content and a higher wet matter/dry weight ratio were observed in Cs- cheese compared to the control, possibly due to the greater proteolytic activity of the vegetable rennet.
- The parameter a* (Hunter parameters) on Cs cheeses showed less negative value (-a* [green], +a*[red]), which could be attributed to the colour of the floral extract.

Free Amino Acids



- The Cs-cheese FS70 showed higher FAA than the control.
- Gly, the most abundant amino acid in the Cs-cheese FS70 was not found in Q-cheese FS70.
- Other amino acids well represented in both FS70 cheeses were essential amino acids Leu and non-essential amino acids Tyr and Ser.
- The presence of Gly in Cs-cheese may contribute to its flavour profile, as glycine imparts a sweet taste and can attenuate perceptions of saltiness and bitterness.

CONCLUSION

- Using extracts of artichoke flowers that were not harvested due to their visual appearance enabled the production of a semi-hard cheese exhibiting distinctive characteristics. The FAAS profile was different to control cheeses, being Gly the most abundant FAA in Cs-cheeses.

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