

Ewes' Milk Urea Concentration methods' optimization, by difference in pH and Mid-Infrared Spectroscopy (MIRS)

Methods currently used to measure Milk Urea Concentration (MUC) in ewe's milk rely on cow's milk methods.

However the dairy matrices between those species differ. Thus, this project aimed at:



Concerning the reference method, the repeatability, reproducibility and accuracy were evaluated on 25 samples of individual ewe milk, from Lacaune and Bascobéarnaise breeds, analysed by Actalia Cécalait (Poligny – France) from December

- 1. Verifying the reference method adequation (enzymatic method using difference in pH ISO 14637 / IDF 195:2004).
- 2.Verifying the routin method, based on a prediction from cow milk Mid Infra-Red Spectra (MIRS), to determin ewe's milk urea concentration.
- 3.Optimising, the routine method by developping a specific ewe's milk predictive SMIR equation for MUC.

2021 to January 2022.

Concerning the routine method, the analyses were conducted by the interprofessional lab Agrolab's (Aurillac, France), every month from January to June 2022. The data included 2 datasets:

- 260 samples from individual ewe milk (a single flock, for each area: Corse, Nouvelle-Aquitaine and Occitanie, representing around 20 animals per month and per flock),
- 401 samples from bulk tank milk (around 20 flocks respectively for each area).

This original protocol enabled to maximize the existing ewe milk variability, as recommended by De Marchi *et al.* (2014)¹. It was meant to optimize the ewes' MUC predictive model, as the seasonal, geographical, breeds (Lacaune, Basco-béarnaise, Manech tête rousse et noire, Corse), intra and inter-flock variability were taken into account. Every Verimilk was measured by infrared on Foss electric analysers and compared to the reference method (ISO 14637 / IDF 195:2004), by Agrolab's Aurillac. Then, the specific ewe milk predictive MUC equation was established by Partial Least Square regression as described by El Jabri *et al.* (2019)².

RESULTS

Reference method: The reference method was validated as such; calibration matched for cow milk as well as for sheep milk, regarding the performances of repeatability, reproducibility and accuracy.

Routine method: The cow's MUC predictive equation did not give a good precision for ewe's milk, as it only accounted for 76% of the ewe's milk variability (coefficient of determination, R^2 = 0.76). The Residual Standard Deviation RSD (S_{y,x}) was then of 53 mg/I MUC *vs*. 35 mg/I for the cow's MUC predictive equation applied to cow milk.

	Model (type of predic- tive SMIR equation)	Predictive equation based on cow milk	Predictive equation based on cow milk	Predictive equation based on cow milk	Predictive equation based on ewe milk
	Analysed milk	COW	GOAT	EWE	EWE
	RSD (S _{y,x})	35 mg/l ³	40 to 59 mg/l ³	53 mg/l	34 mg/l



With the specific ewe's milk model, applied to individual and bulk tank milk samples, the performance was equivalent to the cow's milk model applied to cow milk samples. A greater variability, 90%, was included in the ewe's milk predictive SMIR equation (coefficient of determination of external validation, $R^2_{(v)} = 0.90$), applied to ewe's milk samples. The RSD in external validation ($S_{y,x(v)}$) was improved 34 mg/l, with the specific ewe's predictive SMIR equation *vs*. 53 mg/l with the cow's milk predictive equation applied to ewe's milk samples.

CONCLUSION

MUC management can closely be related to ewe's feed optimization, animal health, and final dairy products quality. Thus, developing specie-specific MUC predictive model by SMIR would neatly improve urea's precision in routine analysis for ewe's milk, may it be individual milk or bulk tank milk samples.

¹ DE MARCHI *et al.*, 2014. Invited review: Mid-Infrared spectroscopy as phenotyping tool for milk traits. Journal of Dairy Science. 97 (3), 1171-1186 ² EL JABRI M. *et al.*, 2019. Comparison of Bayesian and partial least squares regression methods for mid-infrared prediction of cheese-making properties in Montbéliarde cows. Journal of Dairy Science. 102, 6943-6958 ³ Actalia Cécalait, Trossat P. 2014, MUC evaluation in goats milk by MIRS method





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