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**What effect does the level of production
-Cow-Herd-Cheese Vat -have on the relationship
between the detailed physico-chemical composition and
the cheese-making properties of milk?**

M El Jabri, O Rolet-Répécaud, Y Gaüzère, S Gavoye, E Notz, C Laithier, V
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► **To cite this version:**

M El Jabri, O Rolet-Répécaud, Y Gaüzère, S Gavoye, E Notz, et al.. What effect does the level of production -Cow-Herd-Cheese Vat -have on the relationship between the detailed physico-chemical composition and the cheese-making properties of milk?. 10th Cheese symposium, Apr 2018, Rennes, France. . hal-03678937

HAL Id: hal-03678937

<https://hal.science/hal-03678937v1>

Submitted on 25 May 2022

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What effect does the level of production - Cow-Herd-Cheese Vat - have on the relationship between the detailed physico-chemical composition and the cheese-making properties of milk?

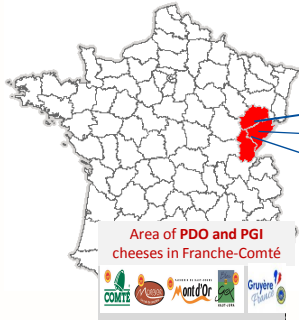
M. El Jabri¹, O. Rolet-Répecaud², Y. Gaüzère³, S. Gavoye⁴, E. Notz⁵, C. Laithier¹, V. Wolf⁶, G. Miranda⁷, A. Delacroix-Buchet⁷, E. Beuvier²

¹Institut de l'élevage, France ; ²URTAL, INRA, Poligny, France ; ³ENILBio de Poligny, France; ⁴Actalia, France; ⁵Centre Technique des Fromages Comtois, France ; ⁶Conseil Elevage 25-90, France ; ⁷GABI, INRA, Jouy-en-Josas, France

Objective

To investigate the relationship between the detailed composition and the cheese-making properties (CMAPs) of milk at three levels of production (cow, herd, cheese vat). This study was conducted in Franche-Comté, leading French PDO region, and targeted milk produced by Montbéliarde cows (95% of cows milked in Franche-Comté and 2nd French dairy breed).

Material and Methods



Milk Samples

- 250 individual milks
- 100 herd milks
- 70 dairy vat milks

Physico-chemical composition

Main composition:

- Dry matter
- Fat & protein content
- Lactose
- pH & Dornic acidity

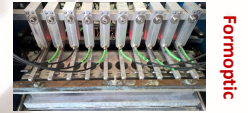
Detailed composition and characteristics:

- Major lactoproteins
- Nitrogenous fractions
- Size of casein micelles
- Minerals

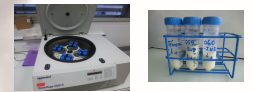
Cheese-making properties (CMAP)

Milk coagulation properties (at pH 6.60 & 6.45)

- Rate of gel formation (Tg10)
- Gel firmness at clotting time (aR)



Laboratory Curd Yield in Dry Matter (%)



Statistical analyses

Fat/Protein rating classes were performed and introduced as a random variable in a mixed effect model. This approach allowed to highlight the most relevant variables in detailed composition which contribute significantly in the explanation of CMAPs.

Results

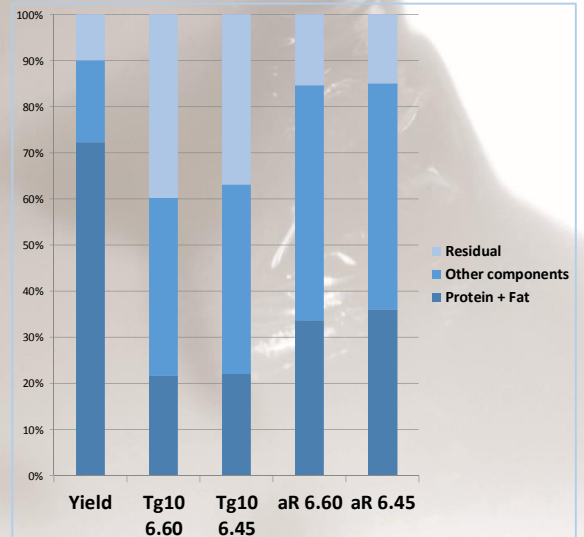
Links between detailed composition and CMAPs of milk

Level	CMAP	SD %	Ca	P	Na	K- casein	α _{s2} - casein	α _{s1} - casein	α-lacta	Size of casein micelles
Individual	Yield	9.9	0.33	/	/	/	/	/	/	-0.25
	Tg10 _{6.60}	50.2	0.52	/	/	0.55	/	/	/	/
	Tg10 _{6.45}	41.8	0.44	/	0.28	/	/	/	/	-0.41
	aR _{6.60}	22.9	0.34	0.40	/	/	/	/	/	-0.47
	aR _{6.45}	20.9	/	0.39	/	/	/	/	/	-0.50
Herd	Yield	3.5	/	-0.17	/	/	/	/	/	/
	Tg10 _{6.60}	19.2	/	/	/	/	/	0.38	-0.24	/
	Tg10 _{6.45}	17.4	0.25	/	/	/	/	/	/	/
	aR _{6.60}	7.2	/	/	/	/	/	/	/	-0.35
	aR _{6.45}	7.0	/	/	/	/	/	/	/	-0.29
Vat	Yield	2.4	/	/	-0.11	/	-0.56	/	/	/
	Tg10 _{6.60}	15.8	/	/	/	/	/	/	-0.29	/
	Tg10 _{6.45}	16.4	/	/	/	/	/	/	/	/
	aR _{6.60}	4.5	/	/	/	/	/	/	/	/
	aR _{6.45}	6.0	/	/	/	/	/	/	/	-0.57

SD: standard deviation; /: no link

α-lacta: α-lactalbumin

% variation CMAPs and composition of milk (Individual milks only)



Conclusion

The number of explanatory variables decreases with the mix of milks (in connection with a lowest standard deviation of CMAP results). Statistical effects differ according to the level. Size of casein micelles and calcium content have most often a significant effect. Components of milk (calcium, size of casein micelles, etc.), other than protein or fat, explain from 17.7% to 51.0 % CMAP variations of individual milks.

Acknowledgements : This study was funded by the French Ministry of Agriculture, Agro-food and Forest, the French Dairy Interbranch Organization (CNIEL), the Regional Union of Protected Designation cheeses of Franche-Comté (URFAC) and the Regional Council of Bourgogne Franche-Comté, under the project FROM'MIR,



Contact : eric.beuvier@inra.fr