

Genetic parameters of ability to tolerate once-daily milking in a Holstein x Normande population

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Introduction

A dairy cow well adapted to once daily-milking (ODM) has:

- **Low** relative milk yield **loss** when:
TDM (twice daily-milking) → ODM (once daily-milking)
- **Strong** milk **recovery** when:
ODM (once daily-milking) → TDM (twice daily-milking)



The aim of the study was to investigate:

- **Genetic variability** of relative milk yield loss and recovery
- And their genetic **relationships** with previous milk **fat and protein contents** (before switching cows to ODM and back to TDM) in order to evaluate predictive ability of milk composition

Materials and methods

Experimental design:

- 368 Holstein X Normande dairy cows in 2nd lactation
- Stage of lactation: <80 DIM (n=111); 80 – 90 DIM (n=148); >90 DIM (n=109)
- Age at first calving: 2 years (n=199); 3 years (n=169)
- 19 groups for 7 years (n=7 to 26)

Treatment: 3 periods



Measurements:

- Milk yield at each milking
- Milk fat and protein contents at each milking for:
TDM1: d-5; ODM: 4d/wk (from Monday to Thursday); TDM2: d30

Analysed traits:

- Relative milk loss: $RML = [(Milk_{ODM} - Milk_{TDM1}) / Milk_{TDM1}] * 100$
- Relative milk recovery: $RMR = [(Milk_{TDM2} - Milk_{ODM}) / Milk_{ODM}] * 100$
with $Milk_{TDM1}$, $Milk_{ODM}$, $Milk_{TDM2}$: average milk yield/d during TDM1, ODM and TDM2
- Milk composition:
 - ✓ FC_{TDM1} , PC_{TDM1} : milk fat and protein contents on d-5
 - ✓ FC_{ODM} , PC_{ODM} : averaged daily milk fat and protein content during ODM

Genetic parameters:

Performed by REML using VCE6.0; statistical model for each trait:

$$y = X\beta + Za + e$$

where y : vector of observations,

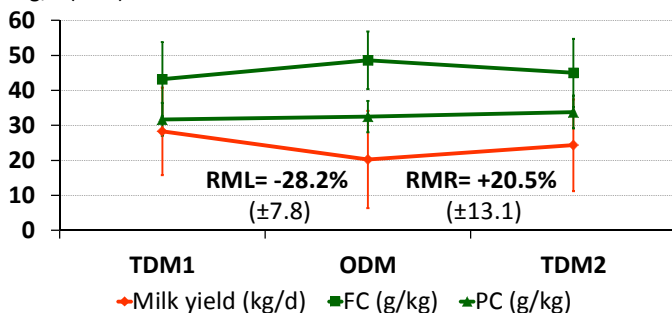
β : vector of fixed effects: stage at lactation, age at first calving, group;

a : vector of random genetic effects $N(0, A\sigma_a^2)$;

e : vector of random errors $N(0, I\sigma_e^2)$; X and Z : incidence matrices.

Results

- **Phenotypic results:** Milk yield averaged 28.3 kg/d during TDM1 (± 5.4); it decreased by 8 kg/d (± 2.9) during ODM and increased by 4.0 kg/d (± 2.5) when switched back to TDM



- **Heritability (■) of relative milk loss and recovery, and genetic correlation:**

	RML	RMR
RML	0.26 (± 0.08)	-0.43 (± 0.13)
RMR		0.43 (± 0.06)

- **Genetic correlations with milk composition during control periods:**

	RML	RMR
FC_{TDM1}	0.28 (± 0.15)	FC_{ODM} 0.24 (± 0.18)
PC_{TDM1}	0.50 (± 0.13)	PC_{ODM} -0.59 (± 0.08)

Conclusion

- Although based on a small crossbred population, this study has shown that **the 2 components** of the ability to ODM are **under genetic control**:

- ✓ Heritability: moderate for relative milk loss and high for relative milk recovery
- ✓ Partial genetic relationship between them: cows with higher milk yield loss enable to recover more milk
- ✓ Milk composition (especially PC) is partially genetically related to the ability to ODM: a high PC during TDM1 or ODM is respectively associated with a lower relative milk loss, and a lower relative milk recovery