Lactose in milk – How can lactose concentration data be beneficial in management and breeding?

P. Løvendahl, M. Riis Weisbjerg

Speaker: Peter Løvendahl

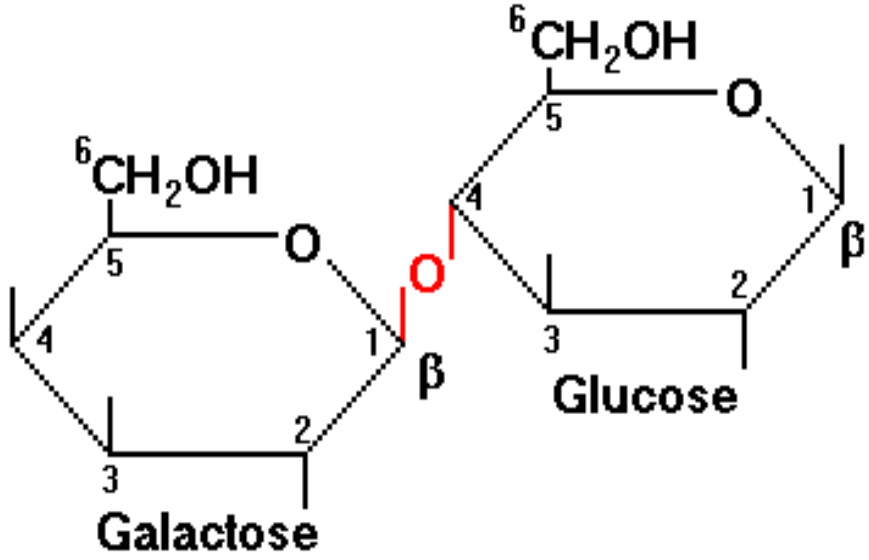
Lactose in milk – How can lactose concentration data be beneficial in management and breeding?

Peter Løvendahl and Martin Riis Weisbjerg

Dept. of Molecular Biology and Genetics, QGG

Dept. of Animal Science

AARHUS UNIVERSITY



Why is lactose percentage interesting?

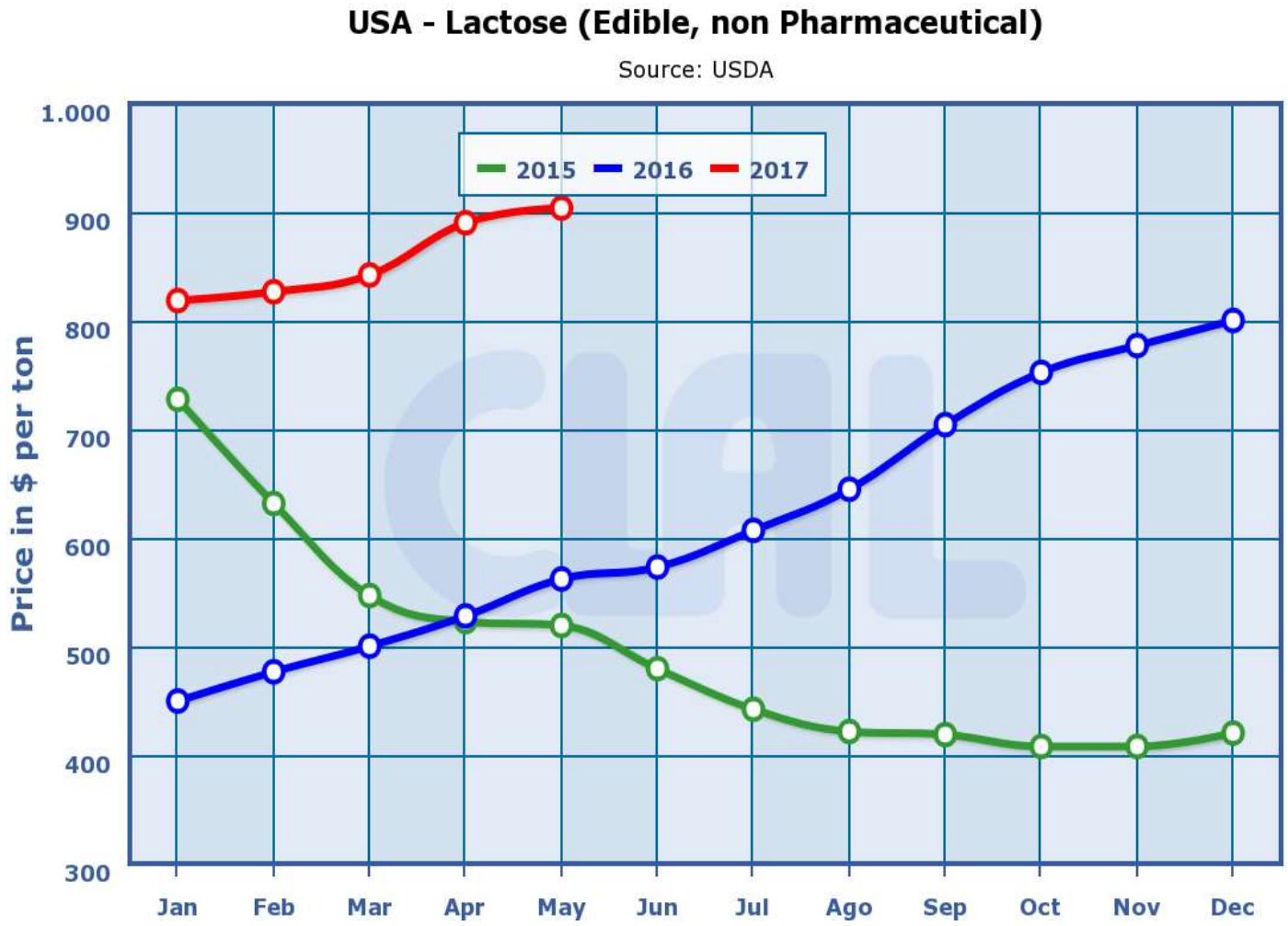
THIS TALK IS NOT ABOUT LACTOSE INTOLERANCE

- **Lactose is at 4.5 to 5.0 % of the milk weight**
- **Lactose is making up 18 to 25% of milk energy content**
- **Lactose is part of the ECM calculation**

- **Lactose used to be a worthless by-product, fed to pigs and calves**
- **More recently: Lactose has an increasing economic market value ☺**

Lactose has an increasing economic market value

- **Market price, USA**



Some dairy processors pay for lactose – others don't …

- **1000 kg milk, 4.2% fat, 3.4% Protein, 4.5% Lactose**

- **Campina:**
  pay for milk fat, protein and lactose – no cost for volume (transport)
  1000 kg, 3.0€ *42 kg fat + 6€ * 34 Kg protein + 0.6€ * 45 Kg lactose = 357€

- **Arla:**
  pay for kilo fat and protein – cost for volume (transport)
  1000 kg milk, 4.2% fat, 3.4% Protein, 4.50% Lactose
  Price = 3.72€ * 42 Kg Fat + 5.21€ * 34 Kg Protein **– 0.0133**€ * 1000Kg =
  320€ + expected bonus ~37€ = 357€ / t

www …. Arla … Campina

Some analyze test day samples – others not

- **Do: Austria, Finland, France, The Netherlands, …**
- **Not: Canada, Denmark, Sweden ….**
- Bulk tank samples usually follow same procedure

Variation in lactose %

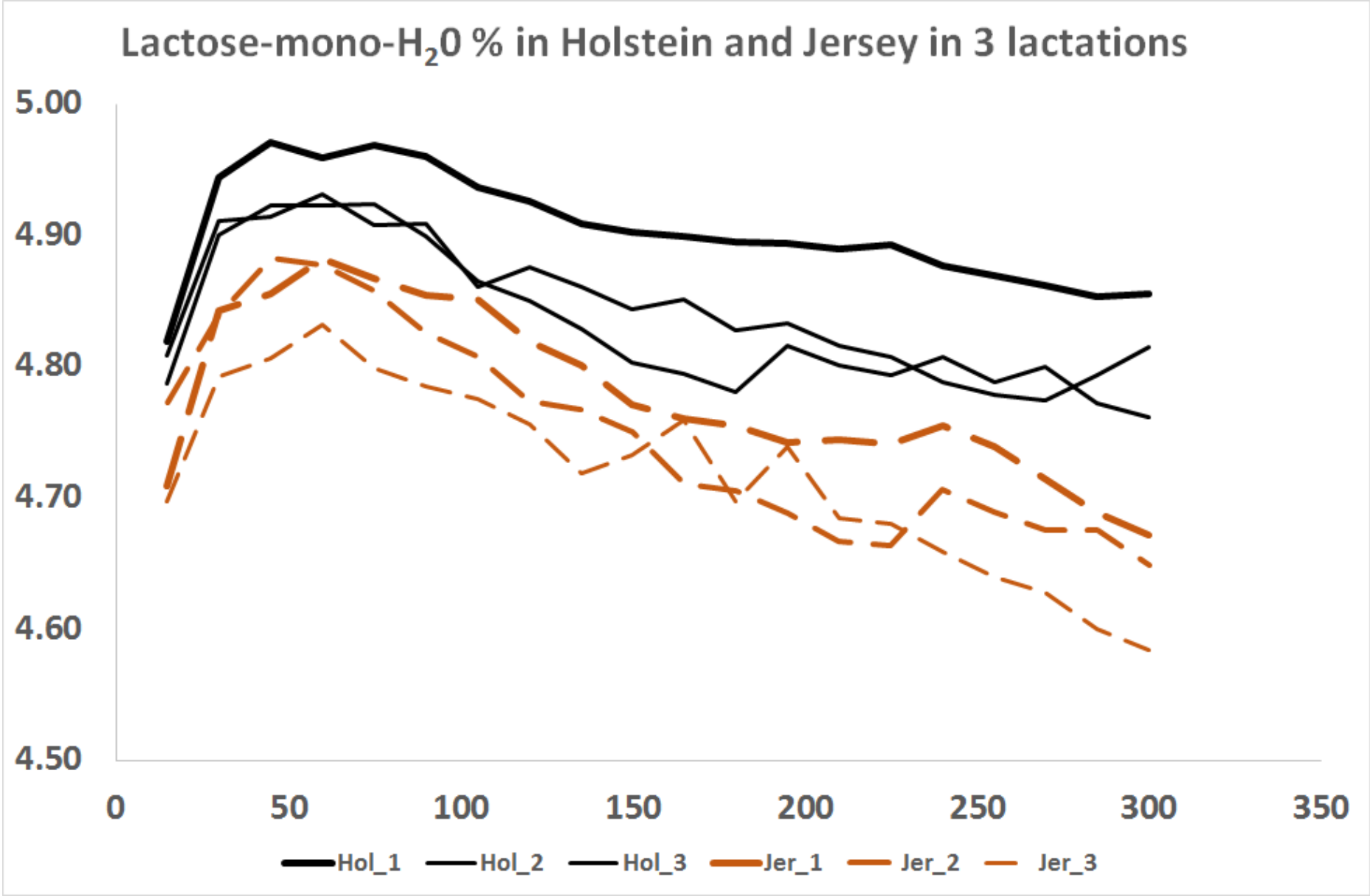
Normal variation and biological effects

Holstein - Parity 1	Mean	P_05%	P_95%
Lactose %	**4.97**	**4.49**	**5.44**
Protein %	**3.54**	**2.97**	**4.19**
Fat %	**4.20**	**3.17**	**5.49**
Milk Kg	**28.3**	**17.3**	**39.0**

- **How can lactose be changed?**
  - Feeding strategies ?
  - Genetic strategies ?
  - Correlations to other traits ?

Data from Danish Cattle Research Centre

- **Breed**
- **Age**
- **Lactation stage**



Data from Danish Cattle Research Center

ECM or FPCM? Role of Lactose%

ECM *= kg_milk / 3140 **

*(383*fat_% + 242*protein_% + 157*lactose_% + 20.7)*

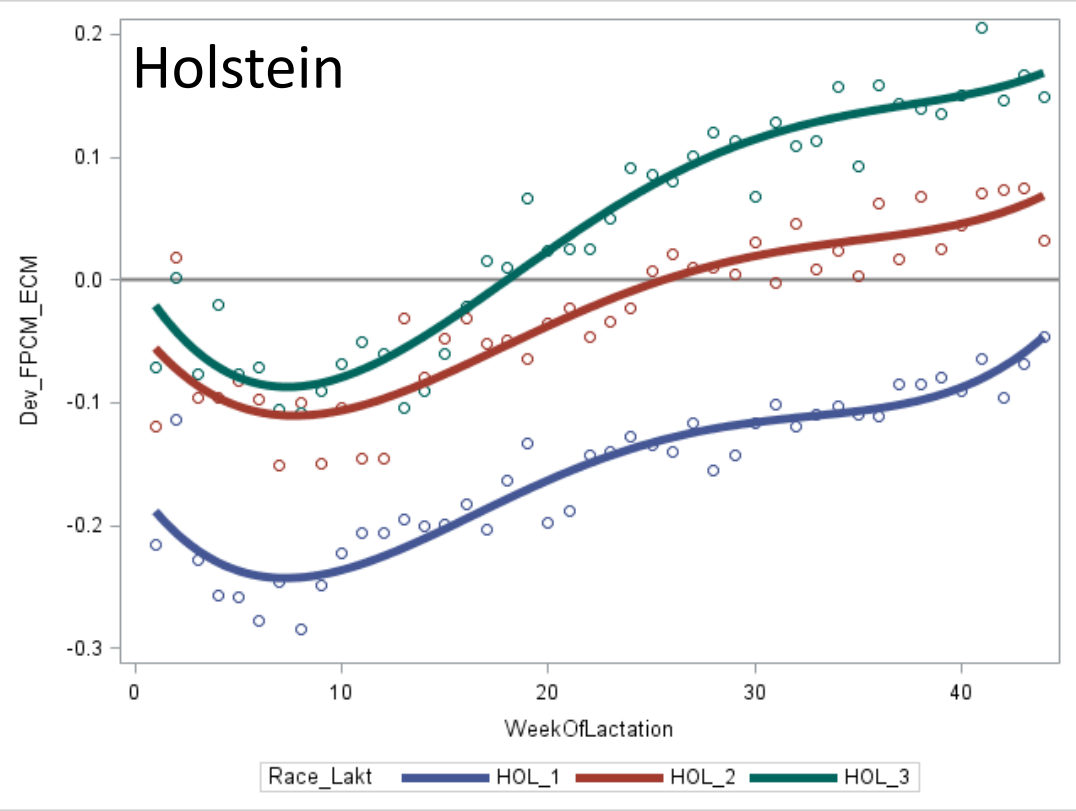
FPCM *= kg_milk / 3140 **

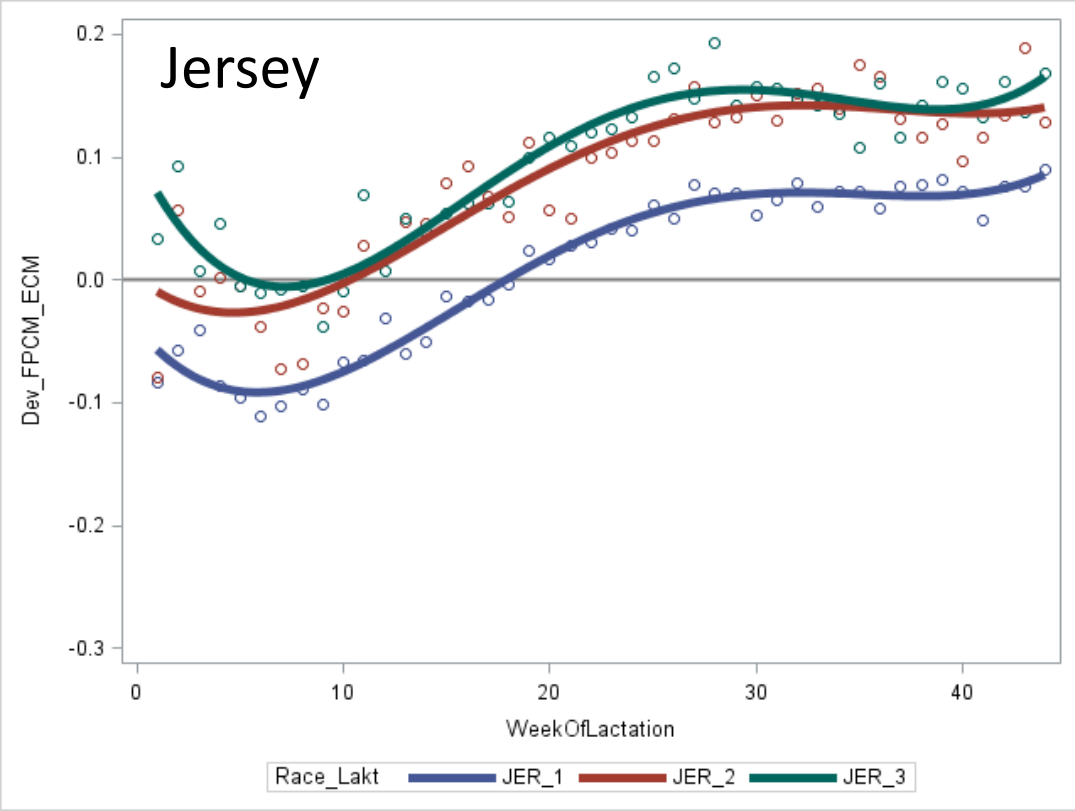
*(383*fat_% + 242*protein_% + 783.2)*

Formulas from Sjaunja et al. 1990.

When is FPCM deviating from ECM?

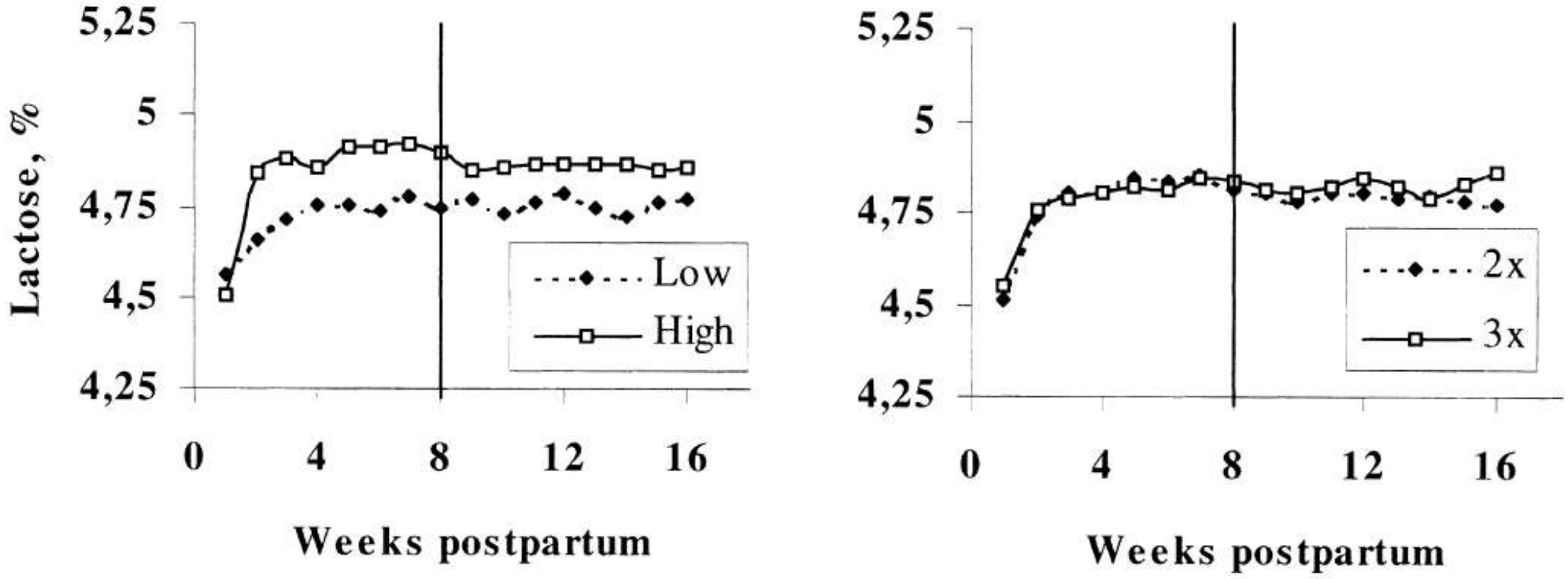
- **Parity**
- **Lactation stage**
- **Breed**





Data from Danish Cattle Research Center

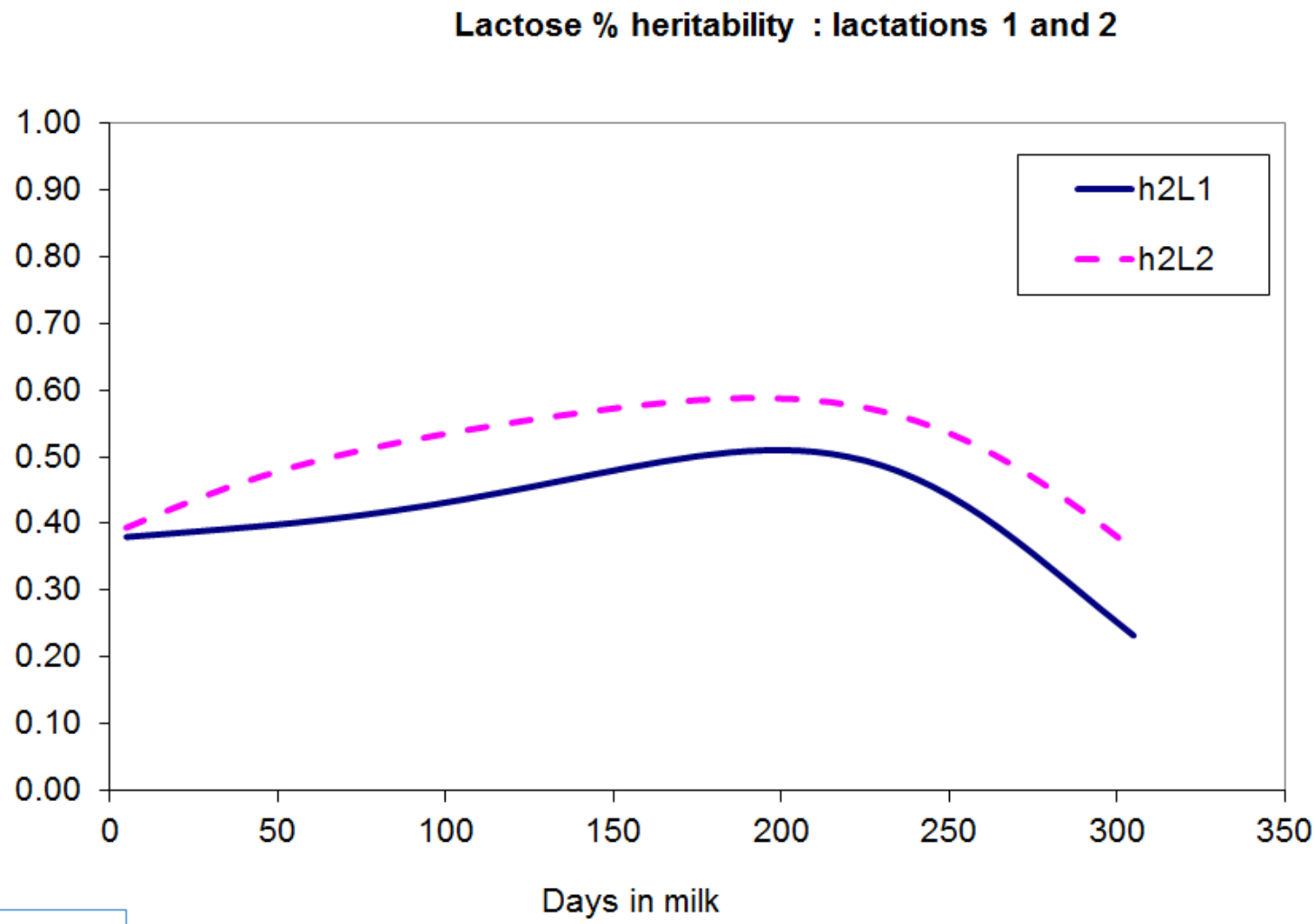
Feeding effects – Milking frequency effects



More concentrates > higher lactose; no effect of milking frequency

Andersen et al 2003, Livestock 81:119-128

Genetic variation in lactose % - highly heritable!



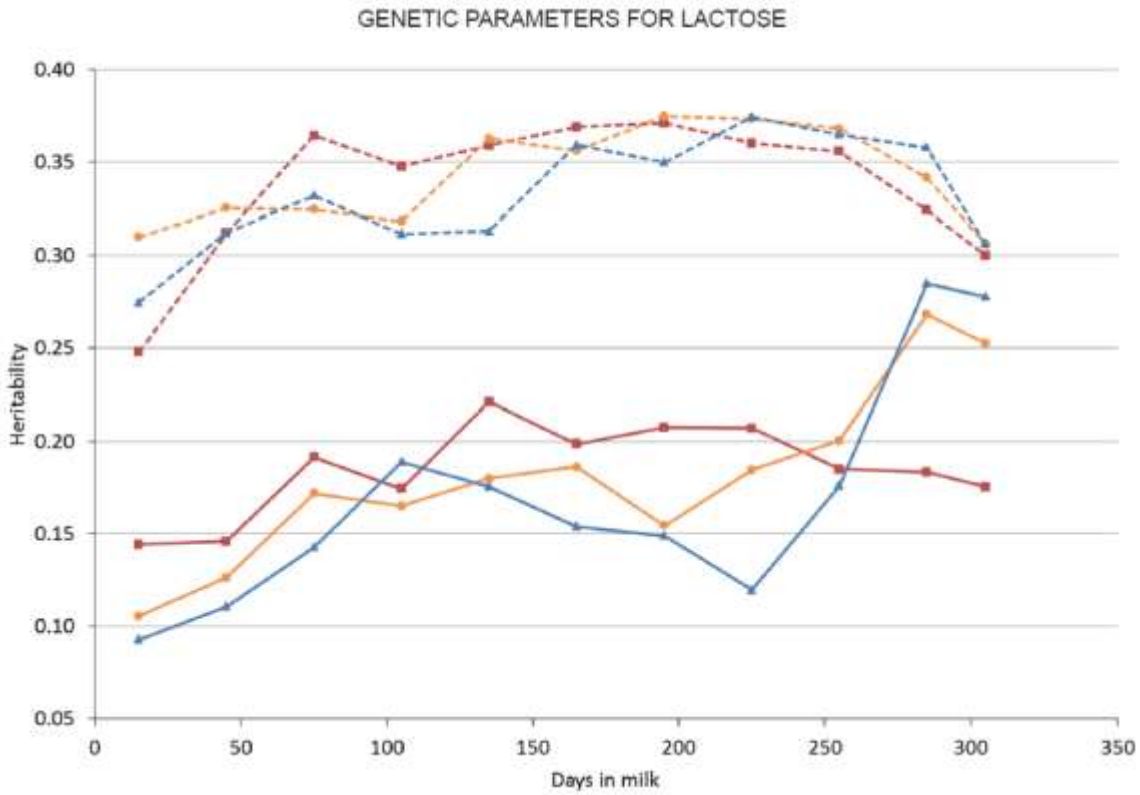
Løvendahl, Su, and Friggens 2003

J. Dairy Sci. 100:3754–3766
https://doi.org/10.3168/jds.2016-11952

Genetic parameters for lactose and its correlation with other milk production traits and fitness traits in pasture-based production systems

M. Haile-Mariam*[1] and J. E. Pryce*†
*Biosciences Research Division, Department of Economic Development, Jobs, Transport and Resources, Agribio, 5 Ring Road, La Trobe University, Bundoora, VIC 3083, Australia
†School of Applied Systems Biology, La Trobe University, Bundoora, VIC 3083, Australia

- **High heritabilty for % lactose**
- **Lower h^2 for Kg Lactose / d**



Side effects?

- **Correlations to mastitis? –**
  - Low lactose% correlates to somatic cell count – but not strongly

- **Other correlations – not described in large data sets!**

Summing up…

- **Technical advances and changes in demand gives more market value to lactose – but payments may not reflect value!**
- **Lactose % follow lactation curve for liquid milk**
- **Lactose % varies less than protein %**
- **Feeding more concentrates and more protein gives higher lactose%**
- **Genetic selection for higher lactose % is possible**
- **Side effects of higher lactose % are favourable or neutral**
- **Test-day data only available in few countries**
- **Adding lactose to ”standard panel” is inexpensive and simple –**
- **Go and do it!**

Conclusions and what to do..

- **Lactose has economic value for dairy processors**
- **Lactose % is an important part of the energy output from cows**
- **Lactose % may be changed through feeding or through genetic selection - if we want to do so!**

- **Lactose % measurements can be easily implemented in test day recording schemes and genetic evaluations when data is there!**

Questions …