Ministry of Food, Agriculture and Fisheries
Danish Institute of Agricultural Sciences

Are time-budgets of dairy cows affected by genetic improvement of milk yield?

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Reality of modern dairy cow life: is that a good cow-life ?

Welfare issues – impact from genetic selection ?

- Restricted lying time causes stress-responses, phenotypic results
- Are needs for lying changed ?
  - Probably not, (maybe increased)…
- Are some cows more sensitive to "time-shortage" than others?
  - Plasticity, *reaction norms*

This talk is about …

- Time budgets
  - Individual and genetic variation
  - Side effects of selection for higher yield ?
  - Possible origin for stress ?
- How to alleviate such problems ?

Old fashioned cow-life?

Time budgets

Time Budget experiment

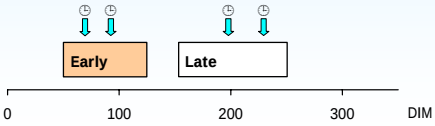
The time budget tells how much of the 24 hours is used to each of a range of important behaviours: *Eating, Lying, Milking, Walking, Waiting* etc.

Aims:

1. Individual and genetic variation, t, h^2
2. Correlate TB traits and milk yield, $r_{individual}$

Design of experiment

- 220 First lactation Holstein cows
- Nucleus Herd
- TMR feeding *ad lib.*
- 2X milking
- Time budgets in early and in late lactation
- Repeated observations of time budgets



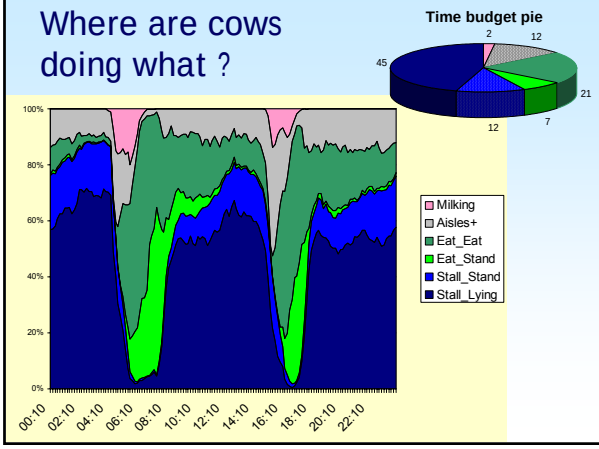
Recording time budgets

~20 cows in each "Batch" marked clearly

Scanning 24 h, 10 minute intervals, (144 points)

- **Behaviour:**
  - Lying
  - Eating
  - Standing + Walking + Drinking
- **Location:**
  - Stalls
  - Aisles
  - Feed gates
  - Milking parlour or collection area
- **Zone in barn** – help tracking and checking

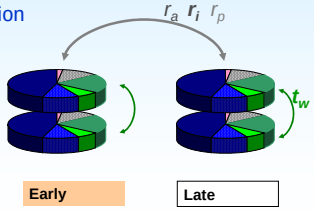
Where are cows doing what ?



Modelling time budgets

- Eating time, Lying time, ..
  - Also: bouts, number, duration …
- Two-trait repeatability model
  - Early and Late lactation

Y = b*(DIM)
Date of observation
Animal-permanent
Animal-genetic
residual

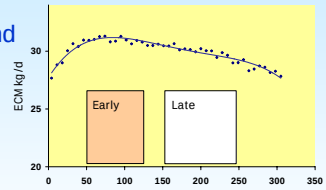


Parameter estimates

Trait	Lact.	h^2	r_a	t_{within}	$r_{individual}$	r_p
Eating	Early	0.13	0.85	0.44	0.82	0.42
	Late	0.14		0.58		
Idle at feedgates	Early	0.13	0.33	0.36	0.86	0.25
	Late	0.07		0.28		
Lying	Early	0.02	0.77	0.25	0.76	0.25
	Late	0.00		0.44		
Stand in stall	Early	0.23	0.83	0.43	0.76	0.35
	Late	0.14		0.49		
Aisles	Early	0.10	1.00	0.26	0.67	0.19
	Late	0.13		0.31		

Modelling yield - ECM

- 1 record / 3 weeks
- Two states: Early and Late
- Repeatability model within state



ECM = *b *(Days in milk)*
Date of recording
Animal-permanent (repeated animal)
Animal-genetic
Residual

Genetic parameters, milk yield

Trait	Lact.	h^2	r_a	t_{within}	$r_{individual}$	r_p
ECM yield	Early	0.12	0.99	0.73	0.86	0.66
	Late	0.12		0.79		

Relationships, two trait models: Time Budget with ECM Yield

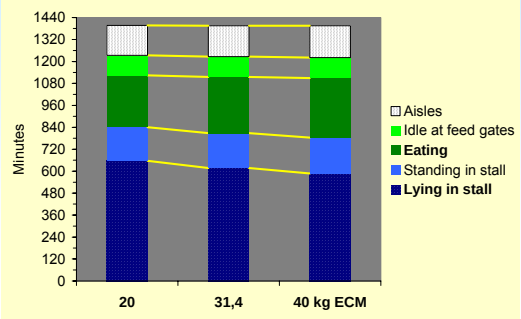
$$\begin{pmatrix} TB \\ ECM \end{pmatrix} = Xb + Z_1a_1 + Z_2a_2 + Q_{TB}c + Q_{ECM}c + I_{TB}\varepsilon + I_{ECM}\varepsilon$$

Individual correlations, r_i ECM yield with Time budget traits

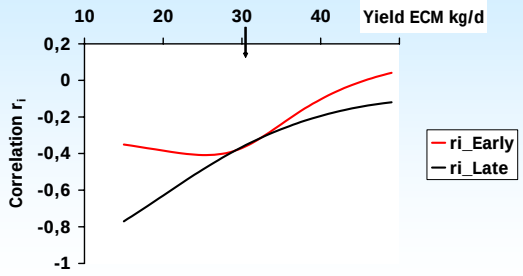
Trait	Lact.	h^2	t_{within}	ECM early $r_{individual}$
Eating	Early	0.13	0.44	0.23
Idle at feedgates	Early	0.13	0.36	0.00
Lying	Early	0.02	0.25	-0.25
Stand in stall	Early	0.23	0.43	0.04
Aisles	Early	0.10	0.26	0.06

☹ Too small an experiment for estimation of genetic correlations

Consequences of increased yield
→ More eating time and Less lying time



Trade-off: Eating or Lying time?
reaction norm approach –



Summing up results

- Time budget traits have low to intermediate heritability
- Lying time have almost no genetic variation
- High yield takes more eating time and leaves less time for lying
- Trade off between lying time and eating time becomes more difficult at high yield ...
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