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Endocrine and classical fertility traits of Swedish dairy cows based on in-line milk progesterone

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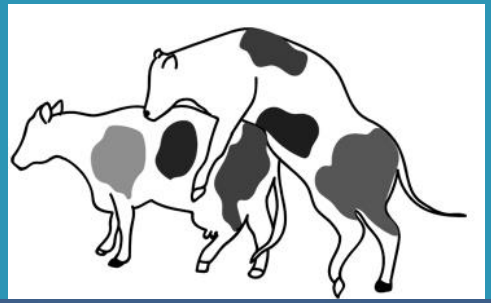

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Introduction

- Dairy cows in developed countries suffer a decline of fertility.
- In the last 30 to 50 yrs:
  - Animals showing oestrus (%): 80% to 50%
  - Duration of detected oestrus: 15 h to 5 h
  - CI increased by 25 days 1995 to 2010 in Dutch herds (Tenghe et al., 2015).

Trend of conception rate in Swedish dairy herd. Source: SDA (2008).

- 17.9% of culling reasons (Cattle Statistics, 2017)

❖Selection targeting only yield as cause (Gutierrez et al., 2006; Weigel, 2006)

➢High milk production negatively influences physiological pathways to establish pregnancy (Walsh et al., 2011).

➢Lactating cows suffer metabolic load and stress (Pryce et al., 2004).

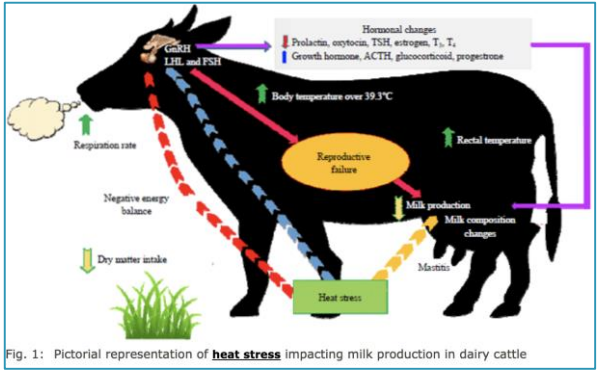
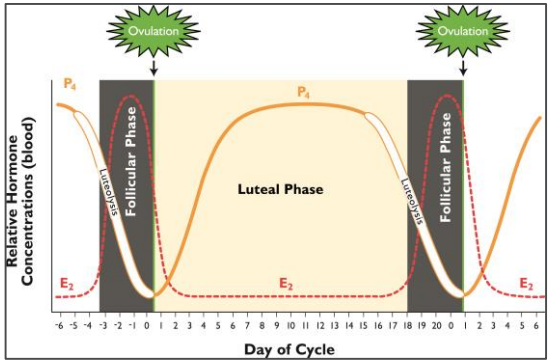


Fig. 1: Pictorial representation of **heat stress** impacting milk production in dairy cattle

- Past interventions for fertility - limited to classical traits
- Classical traits:
  - ❖ influenced by env't factors and mngt decisions
  - ❖ low h^2 estimates (Tenghe et al., 2015)
  - ❖ low rates of genetic gain
- Revising selection indices to functional traits (Walsh et al., 2011).

- Endocrine traits (EnT)-trait of choice.
  - Less affected by env't and mngt decisions
  - Reflect cows' physiology (Tenghe et al., 2015)
  - Provide accurate measurement of ovarian activity
  - Some EnT - strongly genetically correlated with MY in early lactation (Nyman et al., 2014) .



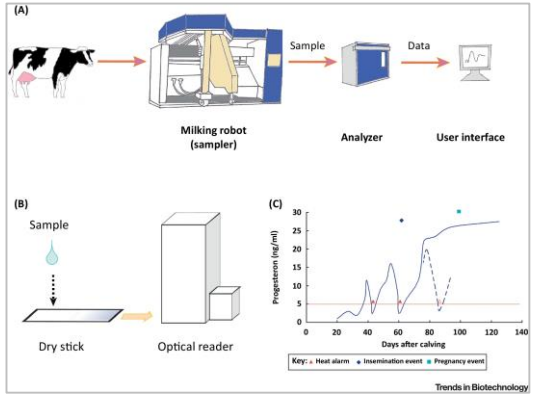
- Current initiative to improve fertility of the Nordic dairy herds
- Finnish dairy herd fertility evaluation (Häggman et al., 2018)

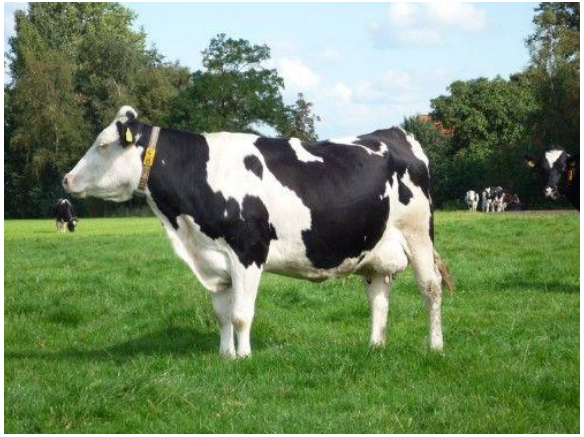
Objective:

- Aim of the study was to assess endocrine and classical fertility traits of Swedish dairy herds based on in-line milk progesterone records

Material and methods

- SR and SH cows from 14 herds
- The samples - collected by DeLaval Herd Navigator (HN)
- The actual P4 records were used





Data handling

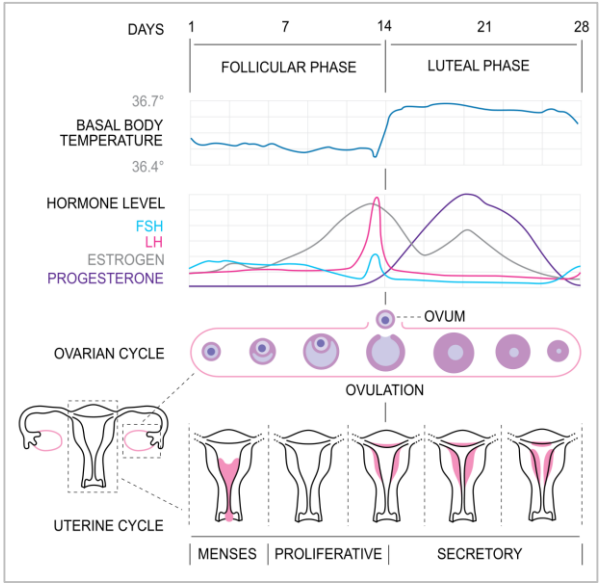
- 5ng/ml P4 concentration was used as a threshold.

Filtering criteria (FC)

❖Lactation retained: if interval from calving to end of herd recording was ≥ **60**days

❖P4 samples taken before 20 DIM/lactation were excluded

❖ Lactations started P4 recording after 35 DIM were excluded

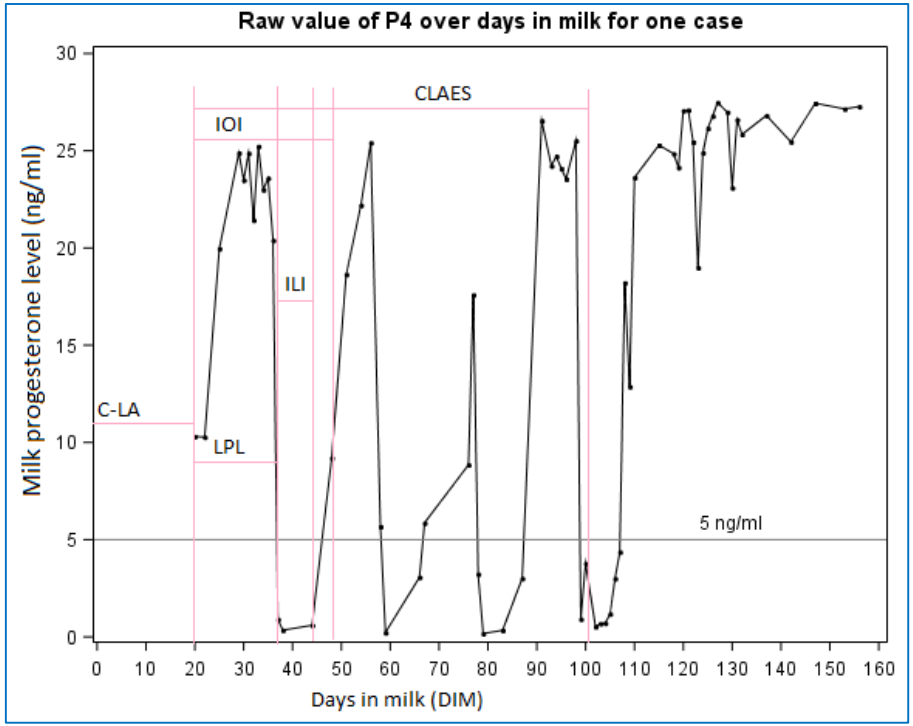


Retained observations, lactations and number of cows after filtering criteria

	P4-samples	%P4	Lact.	%Lact.	Cows	%Cows
Start data:	286,321	100	5371	100	3653	100
Herd FC:	243,072	85	4154	77	3094	85
Lact FC:	210,403	73	3466	65	2645	72

Traits evaluated

Endocrine traits:



Defining endocrine fertility traits from milk progesterone curve

Classical traits:

- Caving to first insemination (CFI)
- Calving to last insemination (CLI)
- First to last insemination (FLI)
- Calving interval (CI)

Model employed:

$Y_{ijkl} = m + B_i + P_j + S_k + e_{ijkl}$; where,

m= Overall mean;

B = Breed (i=1&2)

P = Parity (j=1 to 5);

S = Season (k=1 to 4)

e = Random error

Results

Least square means (days) from analysis of endocrine fertility traits

Factor	C-LA	ILI	IOI	LPL
Overall	34.9	6.9	23.7	11.5
Parity	***	***	***	**
1	32.7^{c}	5.5^{c}	20.8^{c}	9.1^{c}
2	33.9^{bc}	7.2^{ab}	24.2^{ab}	11.5^{ab}
3	34.1^{bc}	7.4^{ab}	24.0^{ab}	12.3^{ab}
4	37.1^{a}	7.6^{a}	26.1^{a}	12.6^{ab}
≥5	36.8^{ab}	6.6^{abc}	23.6^{abc}	11.8^{abc}
Breed	***	NS	***	**
SR	36.2^{a}	6.7	22.3^{b}	10.3^{b}
SH	33.7^{b}	7.1	25.2^{a}	12.7^{a}
Season	***	NS	NS	NS
Winter	35.4^{b}	7.0	24.1	11.8
Spring	37.8^{a}	7.0	24.2	12.0
Summer	32.9^{c}	6.6	22.8	11.1
Autumn	33.6^{bc}	6.9	23.9	11.0

Least square means (days) from analysis of classical fertility traits

Factor	CFI	CLI	FLI	CI
Overall	91.2	153.1	61.9	386.2
Parity	*	NS	NS	*
1	88.1^{b}	157.3	69.2	378.0^{b}
2	90.1^{ab}	158.0	67.9	385.5^{a}
3	93.4^{a}	155.6	62.2	389.2^{a}
4	92.2^{ab}	145.9	53.8	389.9^{a}
≥5	92.4^{ab}	148.7	56.3	388.7^{a}
Breed	***	**	NS	**
SR	88.6^{b}	146.6^{b}	58.1^{b}	382.0^{b}
SH	93.9^{a}	159.6^{a}	65.7^{a}	390.5^{a}
Season	***	***	***	***
Winter	95.4^{a}	142.7^{b}	47.8^{bc}	394.2^{a}
Spring	92.5^{ab}	129.5^{c}	37.0^{c}	393.0^{a}
Summer	87.7^{c}	145.5^{b}	57.8^{b}	371.4^{c}
Autumn	89.8^{bc}	194.6^{a}	104.9^{a}	386.4^{b}

Estimated heritability (h^2) of endocrine and classical fertility traits

Trait	C-LA	LPL	IOI	CLAFS	LA60	PLA	CI	CFI	CLI	FLI
h^2	0.25	0.05	0.06	0.12	0.15	0.14	0.11	0.01	0.01	0.01

Conclusions

- ☞ SR had better fertility than SH in both endocrine and classical fertility traits.
- ☞ Fertility of the dairy cows decreases along parity up to the 4th parity which could be linked to the increased milk yield
- ☞ Few endocrine traits (e.g. C-LA) could be good indicators for fertility and may help to define breeding goals.

Acknowledgments

- Dairy Herd owners

Thank you