Season affects expression and heritability of automatically recorded estrus traits in Danish Holstein

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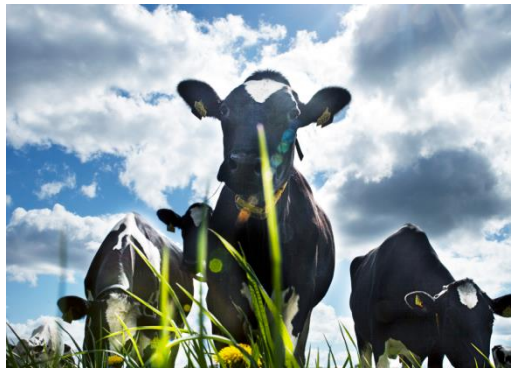



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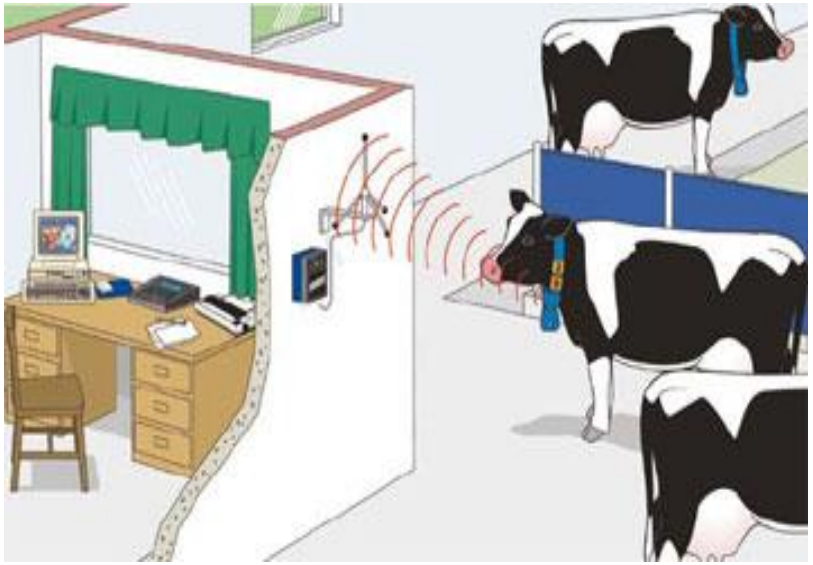
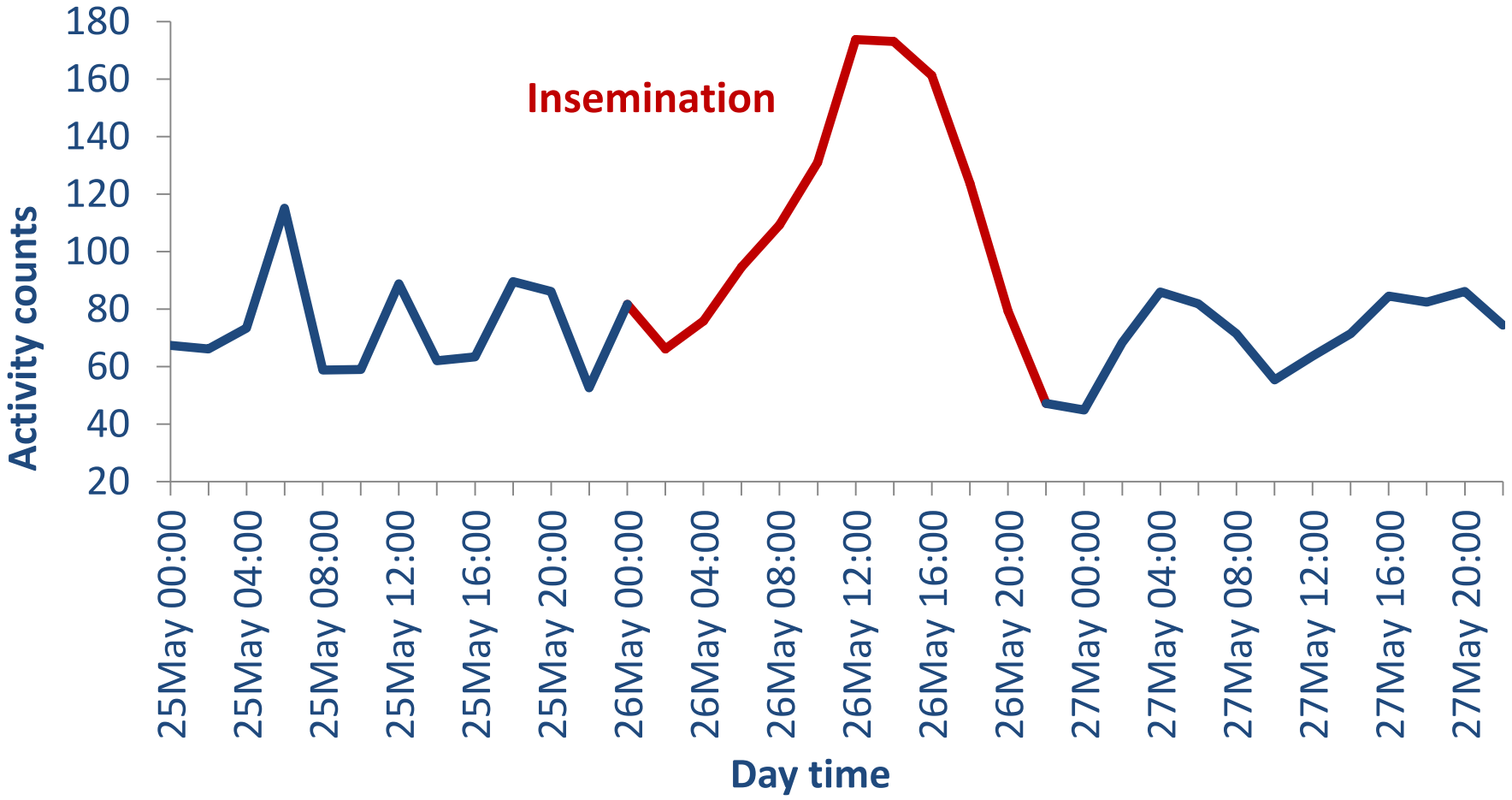
What is the automatically recorded estrus traits?

- Using activity monitor devices (pedometer/ activity tags) that use the behavioral changes to detect estrus in dairy cows.



The raw activity profile one day before and after the estrus day



Interval from calving to first high activity (CFHA)

- Reflects the ability of cow to return to cyclic after calving.
- Less biased compared to the Interval from calving to first insemination (CFI). (h^2= 0.16 vs 0.07) ☺
- Highly correlated with CFI (r_g=0.96).

Estrus duration (ED)

- The interval in hours between the episode started until the episode ended (h^2= 0.02).

Estrus strength (ES)

- The average of the highest 2 values. (h^2= 0.05)

(Løvendahl and Chagunda. 2009; Ismael et al., 2015)

Are fertility traits affected by seasons?

- **Days open:** Spring calvers remained open 27 days longer than summer calvers In US Holstein (Oseni et al. 2004).
- **Commencement of luteal activity:** Shortest for summer calvers compared with winter calvers by 8.0 and 10.5 days in UK and Sweden (Royal et al. 2002; Petersson et al. 2006).

Objectives

- **Investigate the effect of calving season on phenotypic expression and genetic parameters of estrus traits CFHA, first estrus duration (FED), and first estrus strength (FES) derived from activity tags.**

Data & Methods

20,794 cows from 1st to 3rd parity from 135 herds with single record per cow

Winter (Jan-Mar)	Spring (Apr-Jun)	Summer (Jul-Sep)	Fall (Oct-Dec)
4,895 records	5,178 records	5,687 records	5,034 records

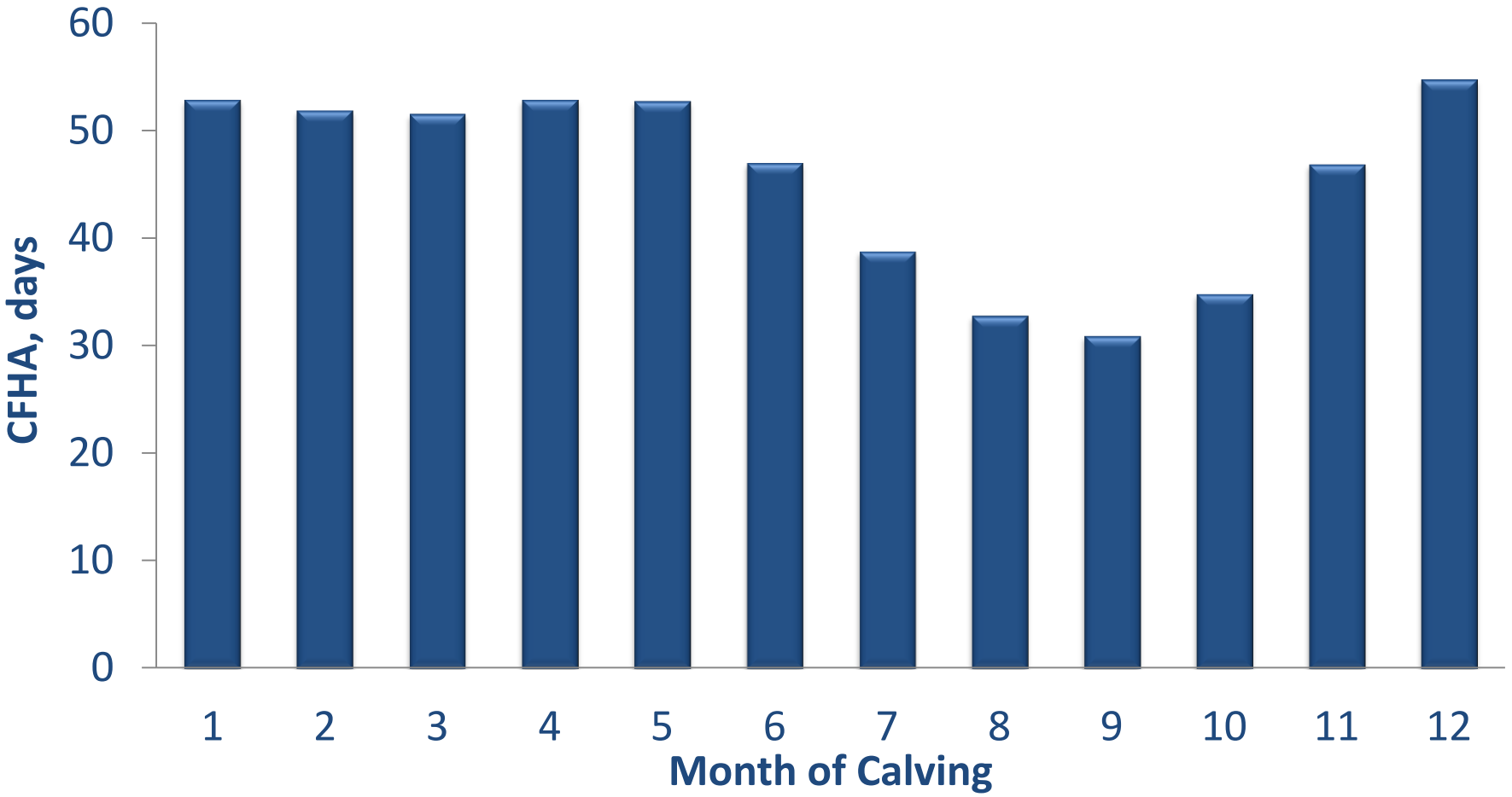
Genetic analysis

- Bivariate animal model (DMU Package). The pedigree file included 134,532 animals.

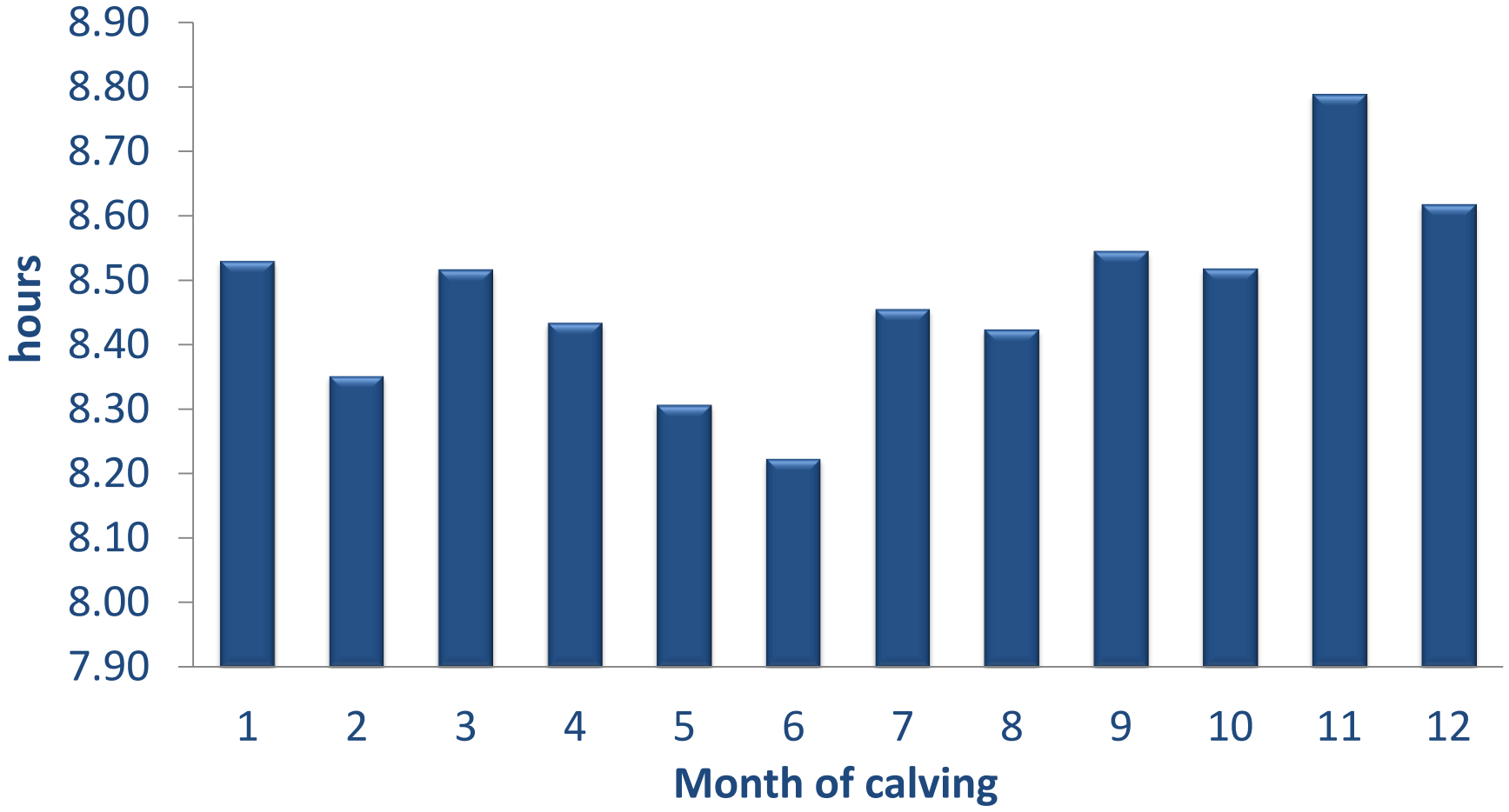
$$y_{ijkl} = ym_i + p_j + h_k + a_l + e_{ijkl}$$

  - Year month of episode (Fixed)
  - Parity (Fixed)
  - Herd (Fixed)
  - Animal genetic effect (Random)
  - Residual (Random)

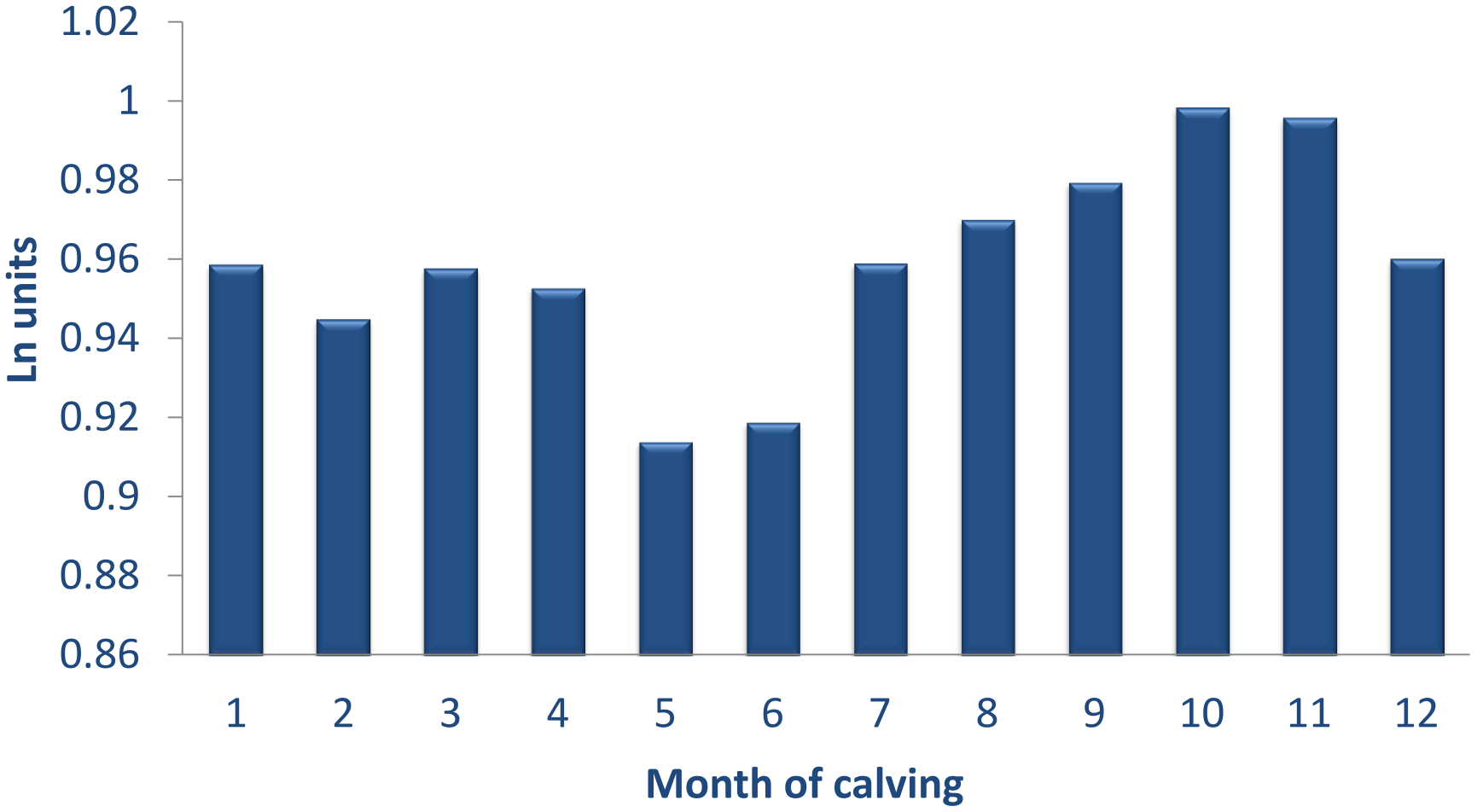
Effect of calving month on CFHA



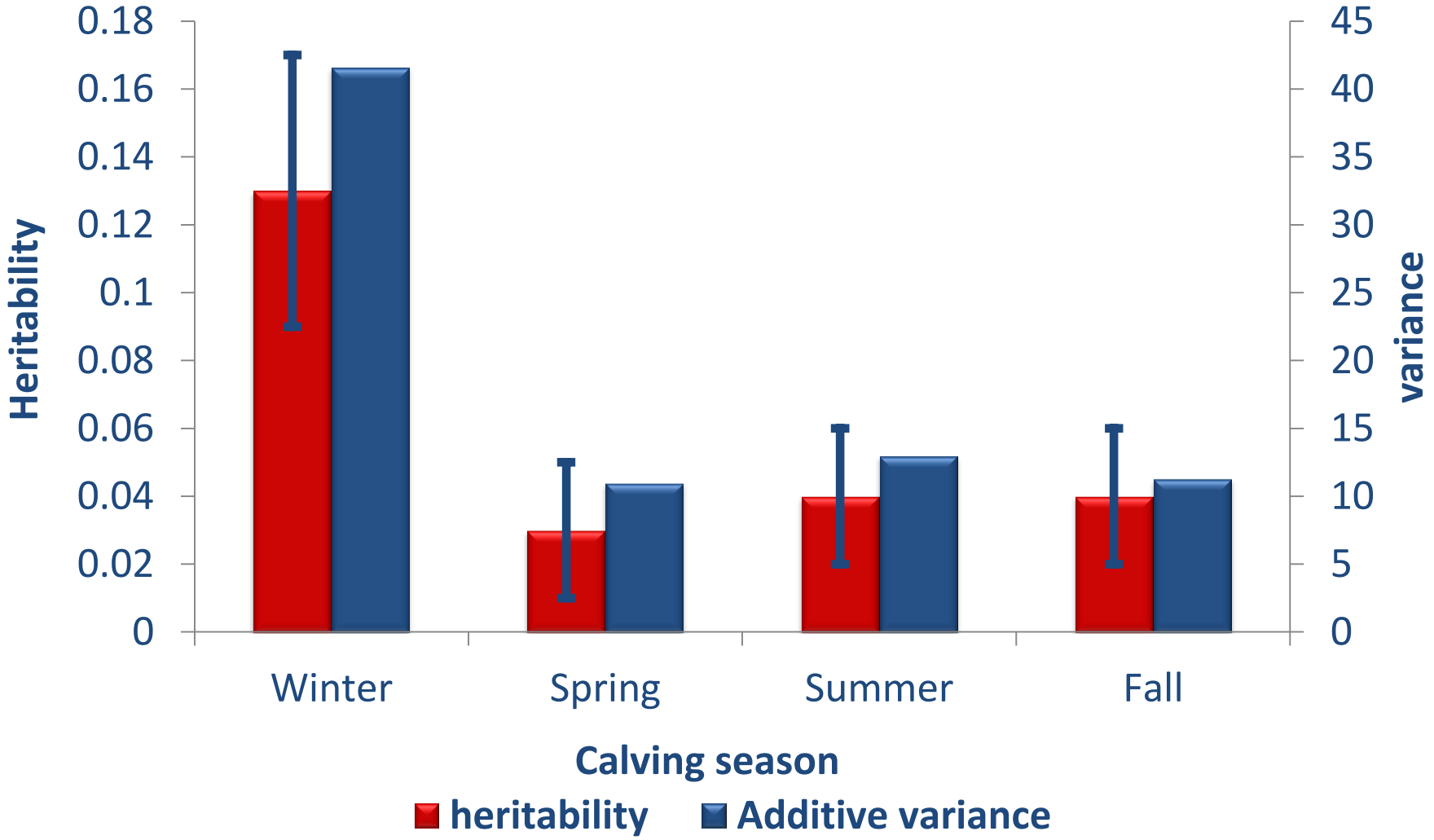
Effect of calving month on first estrus duration



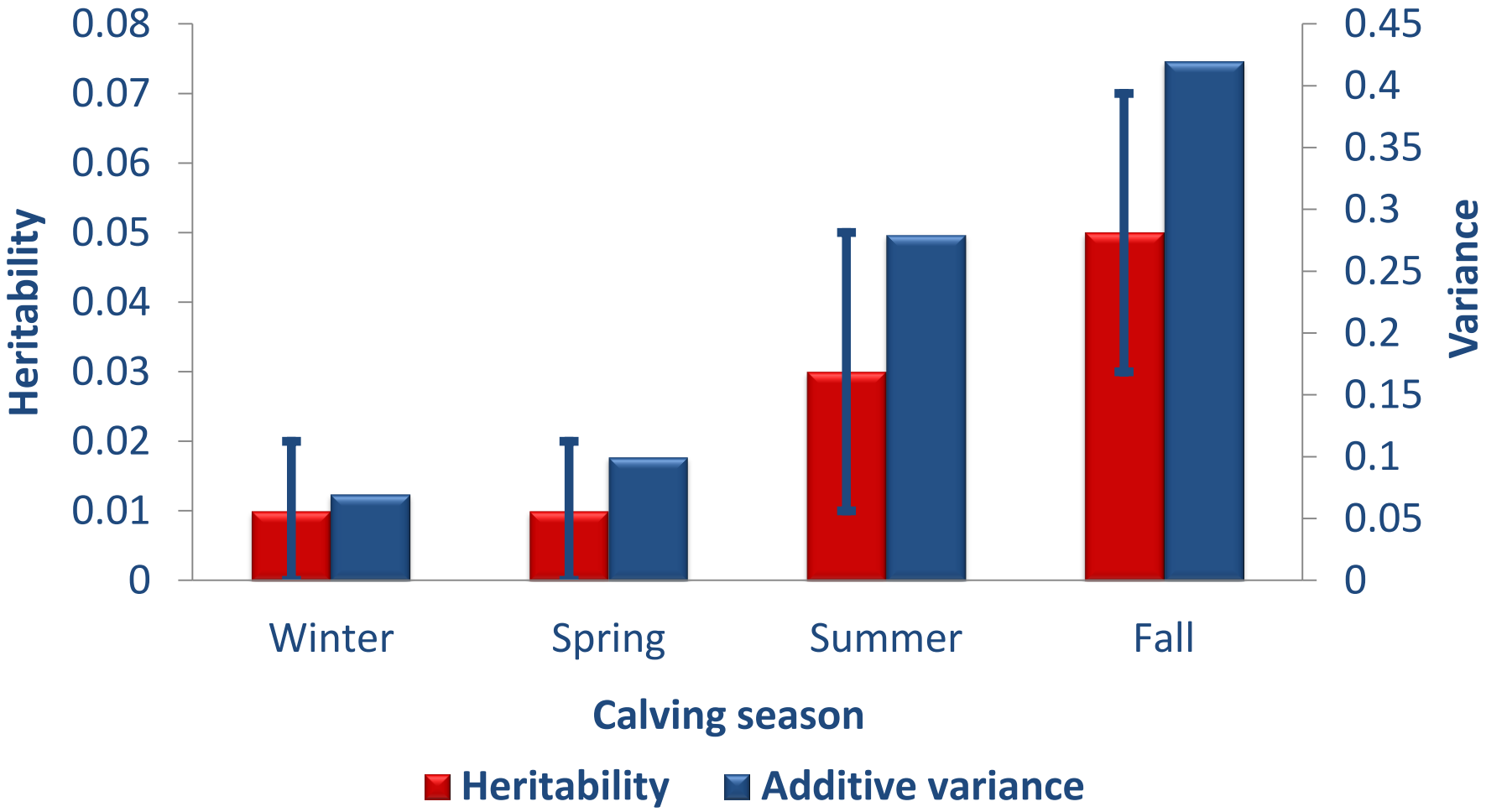
Effect of calving month on first estrus strength



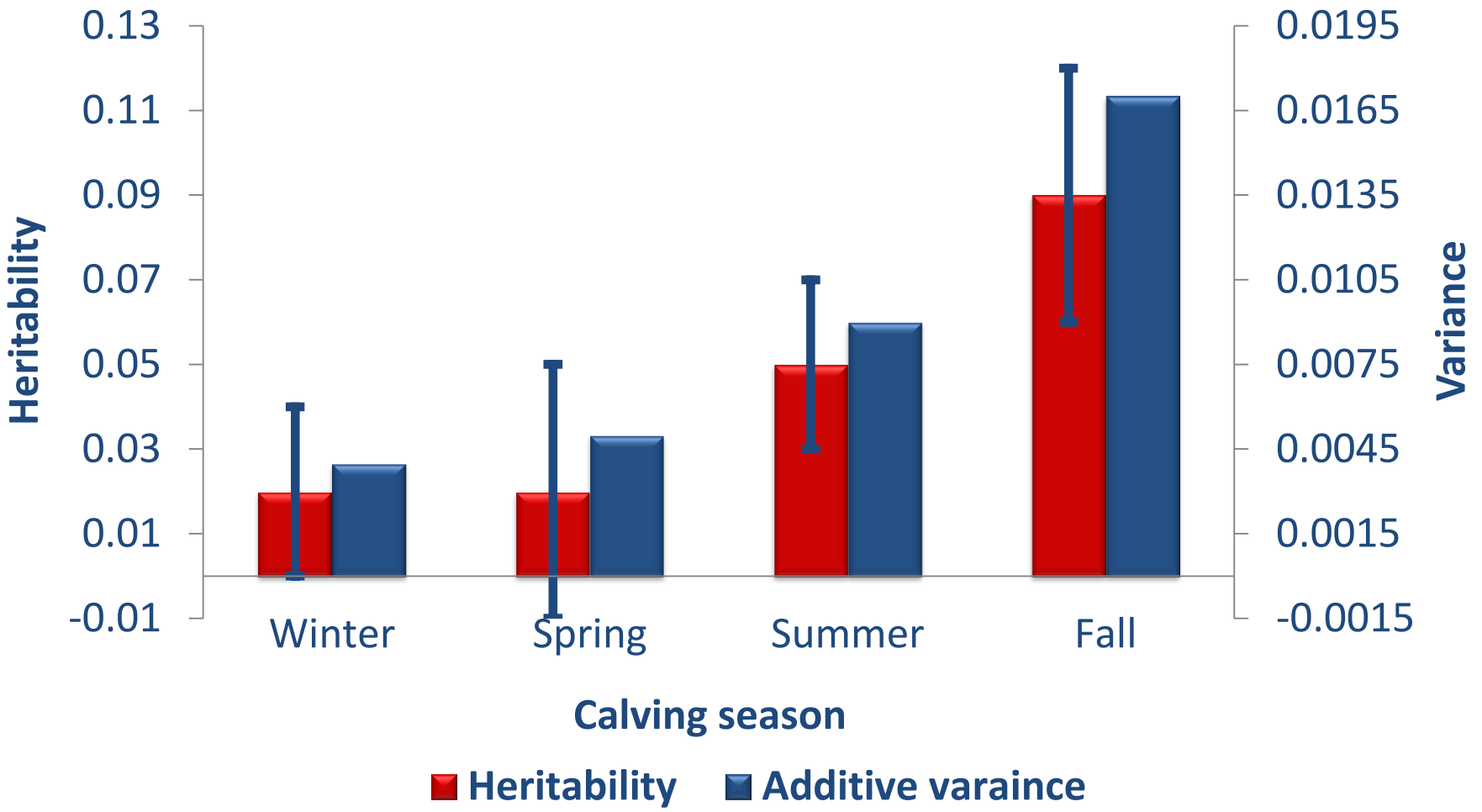
Heritability of CFHA



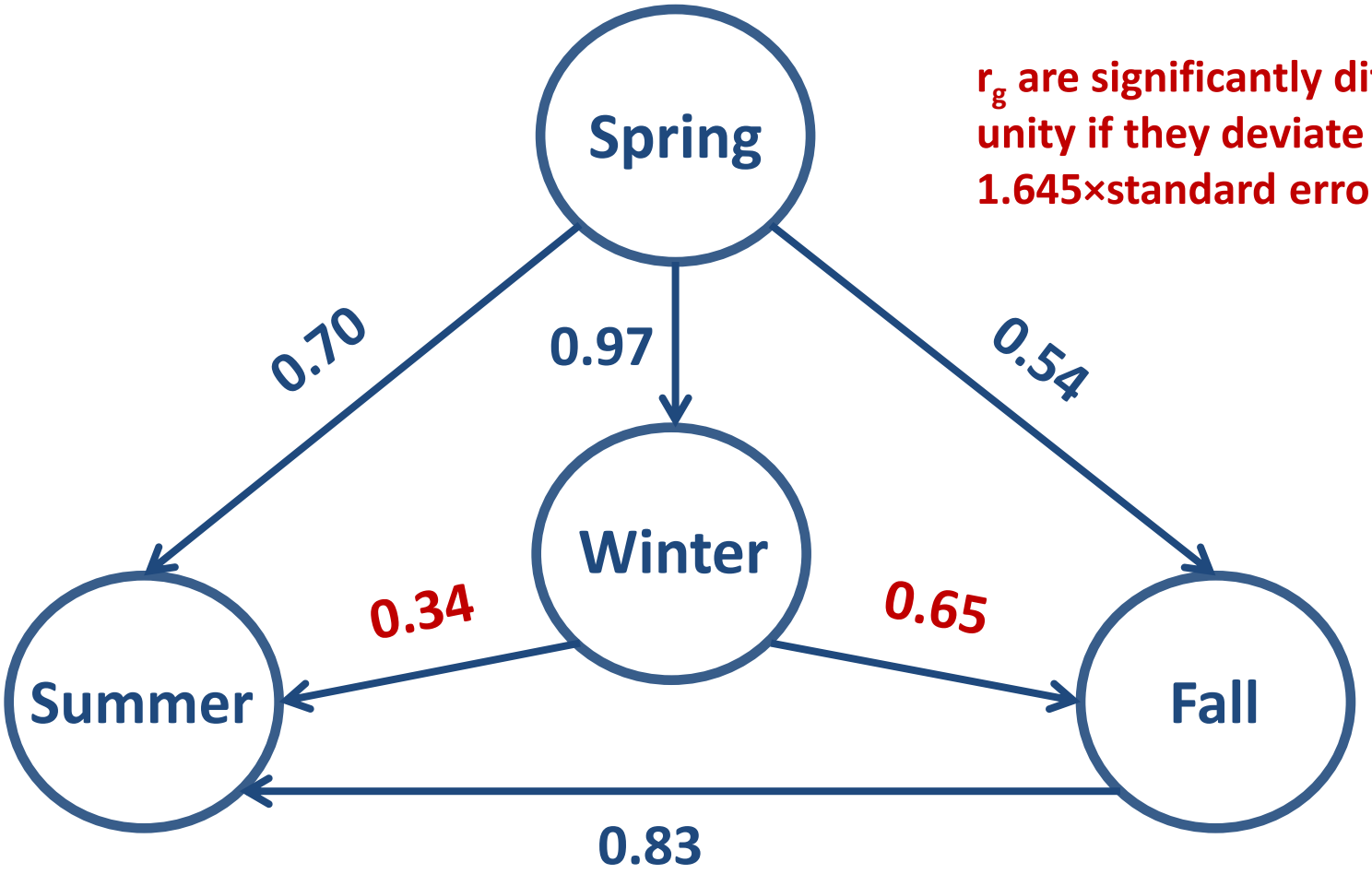
Heritability of FED



Heritability of FES



Genetic correlations of CFHA between calving seasons



r_g are significantly different from unity if they deviate by more than 1.645×standard error from one

Conclusions

- On the phenotypic level, CFHA is heavily influenced by seasonal variation compared to FED and FES.
- There is a re-ranking of animals between winter and summer or fall calving.
- There might be a scaling effect due to heterogeneity of genetic variance and heritability estimates for the traits between calving seasons.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