Impact of growth and age at first calving on production and reproduction traits of Holstein cattle

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Objective of this study

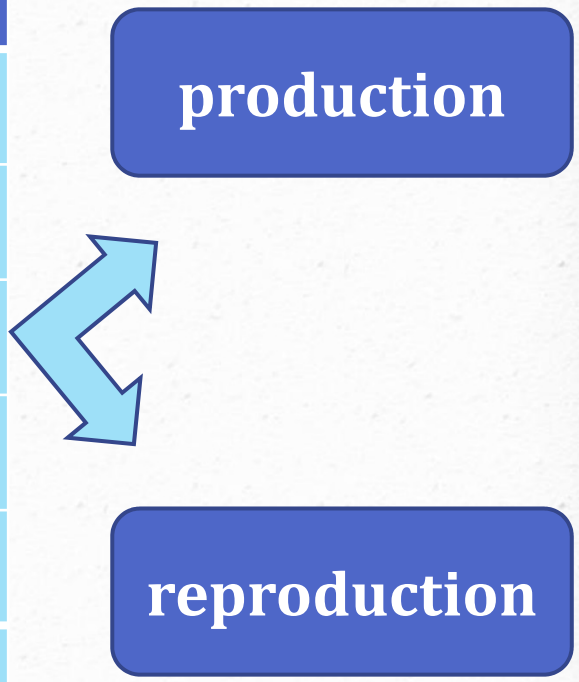
BCS, BW, ADG and **AFC**

Milk yield and **reproduction traits** in subsequent 3 lactations

Materials and methods

- **2 herds: ŠZP Lány Prague and Netluky Prague-Uhříněves**
- monitored during the year **2005 to 2011 - 780 Holstein heifers**

Item	Mean	SD
BCS, 14. mo of age (5 point scale)	3.37	0.33
BW, 14 mo of age (kg)	412.49	37.50
ADG, 5 to 10 mo of age (kg/d)	0.91	0.11
ADG, 11 to 14 mo of age (kg/d)	0.91	0.08
ADG, 5 to 14 mo of age (kg/d)	0.91	0.09
AFC, d	727	58



The MIXED Procedure (Tukey method) - SAS 9.2

$$y_{ijklmn} = \mu + A_i + S_j + H_k + B_l + BV_m + b(age_{ijklm} - age_{00000}) + e_{ijklmn}$$

where $\mathbf{y}_{ijklmn}$ = the value of the dependent variable (listed in Table 3), **μ** = the overall mean, $\mathbf{A}_i$ = effect of the i^{th} yr of calving (i = 2007, 2008, 2009, 2010, 2011), $\mathbf{S}_j$ = the effect of j^{th} season of calving (j = Spring, Summer, Autumn, Winter), $\mathbf{H}_k$ = the effect of k^{th} herd, $\mathbf{B}_l$ = the explanatory variables (effect of the l^{th} category of BCS or BW or ADG, listed in Table 2), $\mathbf{BV}_m$ = the effect of m^{th} estimated sire's breeding value for milk (kg) (m = ≥750, 749-300, ≤299), **b =** the vector of regression coefficients of AFC used for $\mathbf{B}_l$ and only for analysis of production and reproduction traits in the first three lactations, $\mathbf{Age}_{ijklm}$ = the AFC in d, $\mathbf{Age}_{00000}$ = the overall mean for the AFC, and $\mathbf{e}_{ijklmn}$ = random error

The MIXED Procedure (Tukey method) - SAS 9.2

$$y_{ijklm} = \mu + C_i + D_j + H_k + B_l + e_{ijklm}$$

where $\mathbf{y}_{ijklm}$ = the value of the dependent variable: i.e., BCS at 14 mo of age, BW at 14 mo of age, insemination index per heifer (number of inseminations per pregnant heifer) and AFC, **μ** = the overall mean, $\mathbf{C}_i$ = the i^{th} year of birth (i = 2005, 2006, 2007, 2008, 2009), $\mathbf{D}_j$ = the effect of j^{th} season of birth (j = Spring, Summer, Autumn, Winter), $\mathbf{H}_k$ = the effect of k^{th} herd, and $\mathbf{e}_{ijklm}$ = random error.

Results

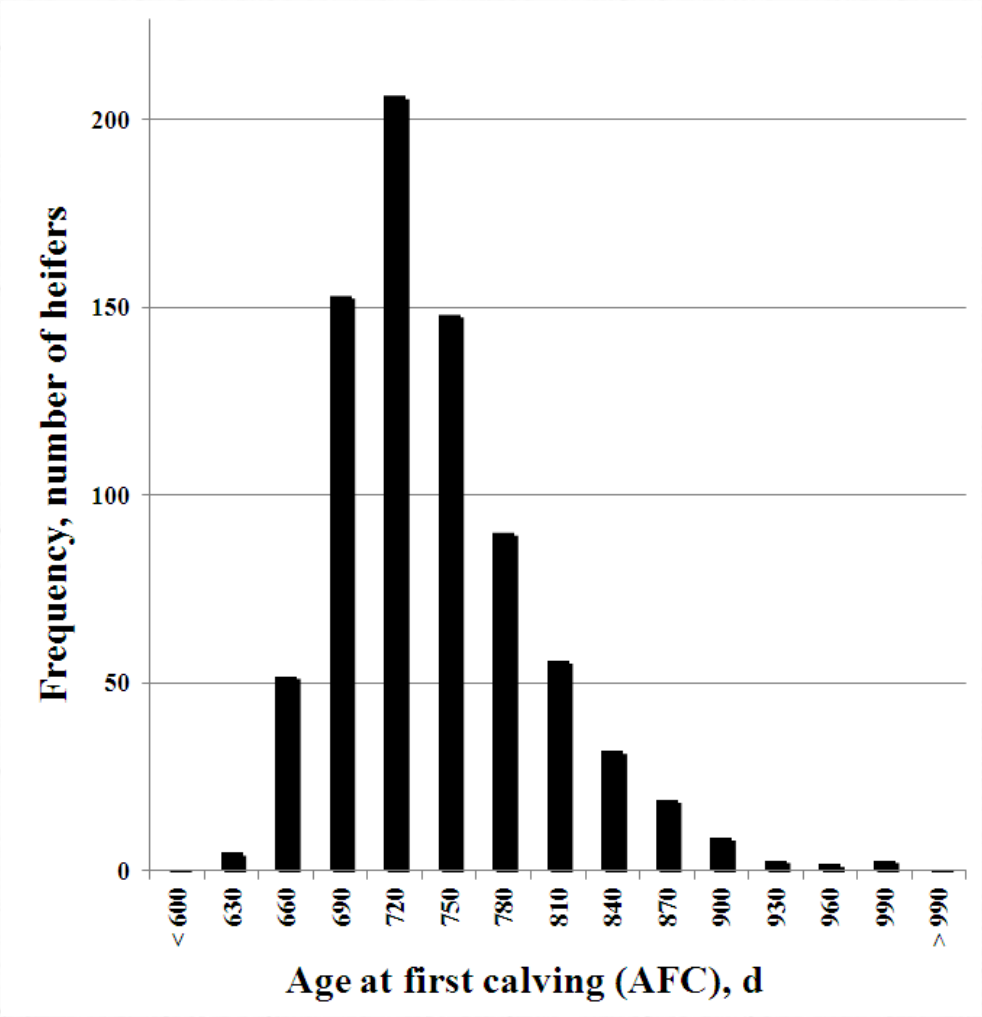
Table 1. Effects of herifers' average daily weight gain (ADG, g – 5. to 14. mo of age) and subsequent performance in dairy herd

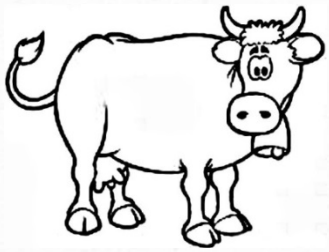
Item	Statistical value	ADG (≥950) (1)	ADG (949–850) (2)	ADG (≤849) (3)	Signif. differ. p<0,05
n (heifers)		119	156	95	
AFC, d	μ + ai	**713**	**719**	**734**	1:3
	sμ + ai	4,22	3,67	4,82	2:3
Milk yield, kg (1st; 305 d)	μ + ai	**9 275**	**9 289**	**8 811**	1:3
	sμ + ai	224	221	251	2:3
Calving interval, d	μ + ai	**404**	**384**	**391**	1:2
	sμ + ai	9,19	7,02	9,54	

Table 2. Effects of herifers' age at first calving (AFC,d) and subsequent performance in dairy herd

Item	Statistical value	AFC (≥751) (1)	AFC (750–700) (2)	AFC (≤699) (3)	Signif. differ. p<0,05
n (heifers)		119	156	95	
Milk yield, kg (first 100 d)	μ + ai	**3 046**	**2 961**	**2 917**	1:2
	sμ + ai	32,29	27,36	32,04	1:3
Days open, d	μ + ai	**146**	**139**	**132**	1:2
	sμ + ai	7,24	6,29	6,96	1:3
Milk yield, kg (3rd; 305 d)	μ + ai	**9 903**	**10 578**	**10 922**	1:2
	sμ + ai	282	237	266	1:3

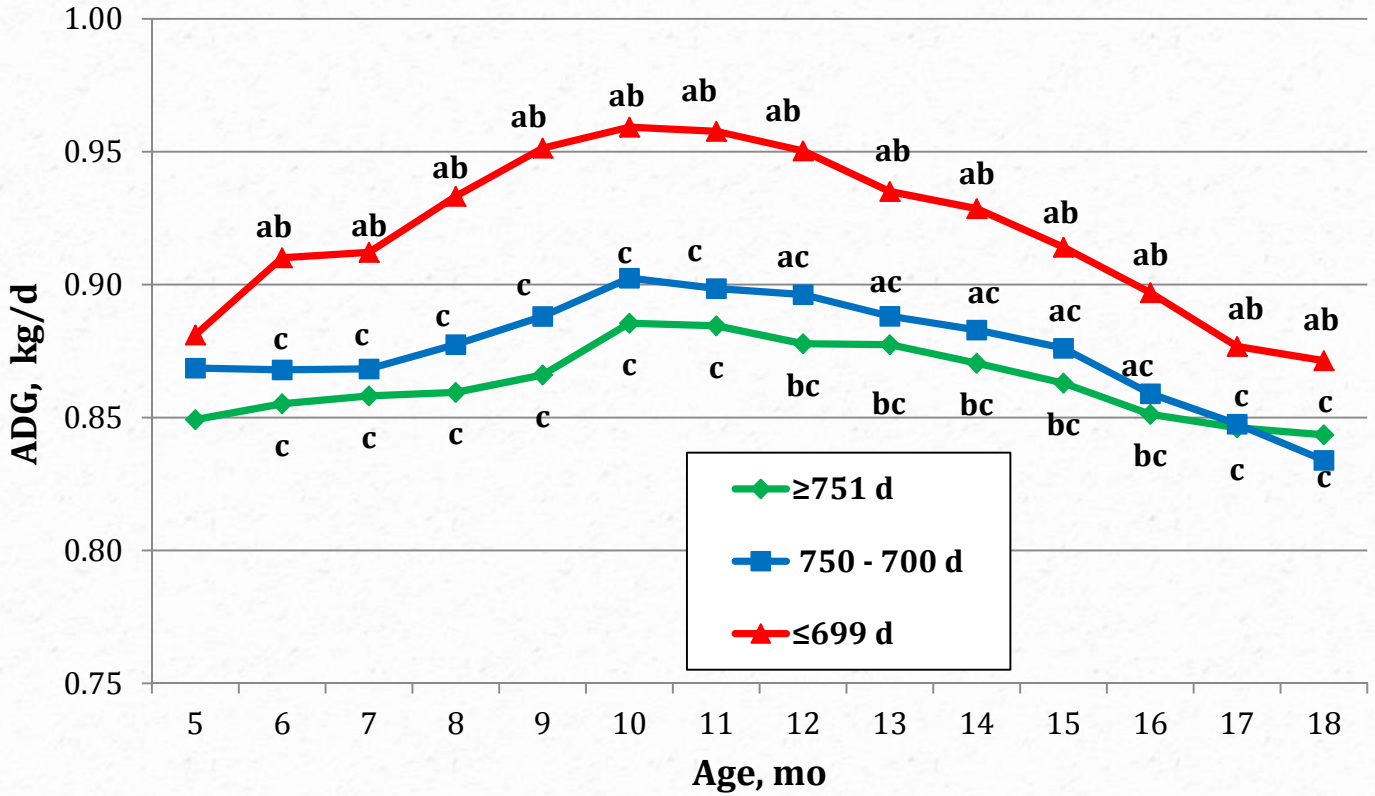
Figure 1. Histogram of age at first calving (AFC, d) for all 780 heifers in the study.





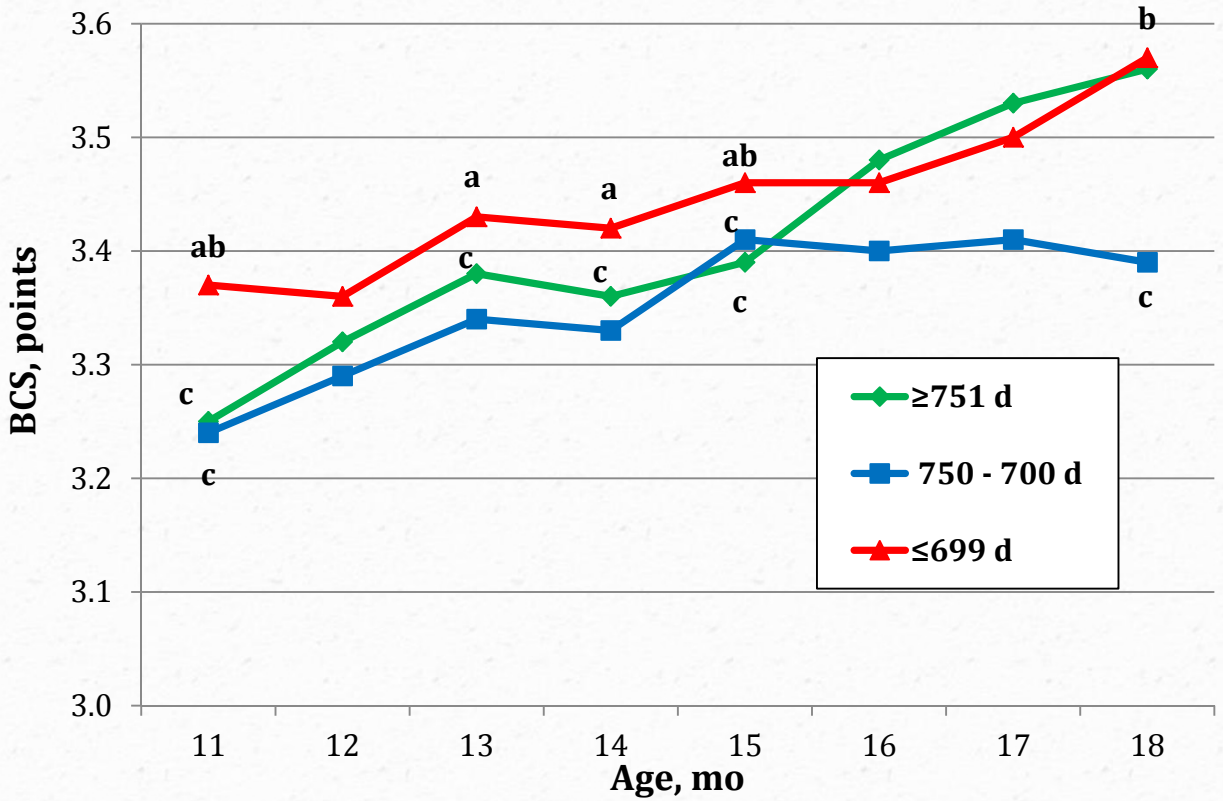
Ages at first calving were grouped as: low = ≤699 d, n = 269, mean ± SD = 674.57±19.09 d; medium = 750 to 700 d, n = 296, mean ± SD = 722.88±14.26 d; and high = ≥ 751 d, n = 215, mean ± SD = 801.35±48.62 d.

Figure 2. Growth of heifers (average daily weight gain in kg/d - ADG) according to age at first calving (AFC).



Ages at calving were grouped as: high (a) = ≥ 751 d, n = 215, mean ± SD = 801.35±48.62 d; medium (b) = 750 to 700 d n = 296, mean ± SD = 722.88±14.26 d d; and low (c) =≤699 d, n = 269, mean ± SD = 674.57±19.09 d. Differences between groups (P <0.001) are denoted with different letters vertically.

Figure 3. Body condition score (BCS) in the postpubertal period of growth according to age at first calving (AFC).



Ages at calving were grouped as: high (a) = ≥ 751 d, n = 215, mean ± SD = 801.35±48.62 d; medium (b) = 750 to 700 d n = 296, mean ± SD = 722.88±14.26 d d; and low (c) =≤699 d, n = 269, mean ± SD = 674.57±19.09 d. Differences between groups (P <0.05) are denoted with different letters vertically.

Conclusion

- ADG **higher than** 850 g/d in all evaluated groups → AFC **lower than** 23,5 mo of age.
- **Low AFC** (less than 23 mo of age) → **lower** milk yield only during the first 100 d on first parity.
- **AFC higher than** 24,5 mo of age → **worse** level of reproduction parameters and production parameters on second and third lactation.
- **AFC higher than** 24,5 mo of age → **the lowest** average milk yield (3rd lactation)

References

- Bach, A.; Kertz, A. F. (2010): Raising Dairy Replacements Objectively: The Value of Data-Based On-Farm Decisions. Proceedings of the 19th Annual Tri-State Dairy Nutrition Conference. 77-90.
- Bicalho, R. C.; Galva˜o, K. N.; Cheong, S. H.; Gilbert, R. O.; Warnick, L. D.; Guard, C. L. (2007): Effect of stillbirth on dam's survival and reproduction performance in Holstein dairy cows. Journal of Dairy Science. 90: 2797–2803.
- De Vries, A.; Risco, C. A. (2005): Trends and seasonality of reproductive performance in Florida and Georgia dairy herds from 1976 to 2002. Journal of Dairy Science. 88 (9):3155 -3165.
- Hansen, M.; Misztal, I.; Lund, M. S.; Pedersen, J.; Christensen, L. G. (2004): Undesired phenotypic and genetic trend for stillbirth in Danish Holsteins. Journal of Dairy Science. 87:1477–1486.
- Heikkila, A. M.; Nousiainen, J. I.; Jauhiainen, L. (2008): Title Optimal replacement policy and economic value of dairy cows with diverse health status and production capacity. Journal of Dairy Science. 91 (6):2342-2352.
- Kadokawa, H.; Martin G. B. (2006): A New Perspective on Management of Reproduction in Dairy Cows: the Need for Detailed Metabolic Information, an Improved Selection Index and Extended Lactation. Journal of Reproductive Development. 52:161-168.
- Kvapilík, J.; Hanuš, O. (2001): Modelové schéma konstrukce odhadu vlivu některých komerčních a chovatelských ukazatelů chovu dojnic na rentabilitu prvovýroby mléka. VÚSCH Rapotín.1-4.
- Le Cozler, Y.; Peccatte, J. R.; Porhiel, J. Y.; Brunschwig, P.; Disenhaus, C. (2009a): Rearing dairy heifers. Productions Animale. 22:303-316.
- Le Cozler, Y.; Peyraud, J. L.; Troccon, J. L. (2009b): Effect of feeding regime, growth intensity and age at first insemination on performances and longevity of Holstein heifers born during autumn. Livestock Science. 124:72-81.
- Lee, J. I.; Kim, I. H. (2007): Pregnancy loss in dairy cows: the contributing factors, the effects on reproductive performance and the economic impact. Journal of Veterinary Science. 8 (3):283-288.
- Leroy, J. L. M. R.; De Kruif, A. (2006): Reduced reproductive performance in high producing dairy cows: is there actually a problem?.Vlaams Diergeneeskundig Tijdschrift. 75 (2A):55 -60.
- Mourits, M. C. M.; Galligan, D. T.; Dijkhuizen, A. A.; Huirne, R. B. M. (2000): Optimization of dairy heifer management decisions based on production conditions of Pennsylvania. Journal of Dairy Science. 83:1989-1997.

Thank you for your attention!