

The effect of age at first calving and gestation length on calving difficulty in Holsteins

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Abstract

In the Czech Republic, calving difficulty (CD) is scored on three-point scale, i.e. normal calving, hard pull, complicated calving with veterinary assistance. Totally 2.5 million records have been collected in Holstein population since 1992. Classes 1, 2, and 3 represented 93.1, 6.0, and 0.9% of raw data, respectively. The objective of this study was to analyse the effect of age at first calving and gestation length on the course of calving. Age at first calving and gestation length were analysed separately. The first parity records (n=806 463) were detached from the basic data set and were divided by age at the calving into groups of one-month intervals; the average age at first calving was 841 ± 103 days (i.e. 27.6 months). When heifers calved at the extremely low age (less than 22 months) or extremely high age (more than 40 months), their CD fluctuated. When they calved between 22 and 27 months of age CD declined; from 27 to 40 months CD was balanced. Gestation length was 279.5 ± 7.2 days on average (n=1 757 364) and was categorized to one-day classes. The relationship between gestation length and CD was not linear. Cows with short or prolonged gestation tended to have more difficult delivery. Calving difficulty should be adjusted for both age at the first calving and gestation length in subsequent analyses including a genetic evaluation. An exclusion of records with the extreme age at first calving is recommended.

Introduction

Considering fitness related traits as cost reducing factors, an attention to calving difficulty and stillbirths is growing also in Holstein cattle, particularly in primiparous cows. The occurrence of difficult calvings in dairy herds can be reduced by use of sires which have been tested for calving ease. Several factors have an evident impact on calving performance with dam age or parity, gestation length, sex of calf and season of calving as the most important. Adjustments for such factors are made in genetic evaluation. Furthermore, knowledge about its influence might be useful for herd management.

This paper presents analysis of two of these factors: dam age at first calving and gestation length. The first one is a matter of herd management, whereas the second one is not. Gestation length used to be considered as a separate calving trait (Kemp et al., 1988, McGuirk et al., 1999, Hansen et al., 2004). Both of the above mentioned traits present a non-linear phenotypic relationship with calving performance (Meijering, 1984, Kemp et al., 1988), whereas genetic correlation was found to be weak (Hansen et al., 2004). Therefore we consider gestation length as well as age at first calving to be factors affecting calving performance.

The aim of this study was to determine the impact of dam age at first calving and gestation length on calving difficulty in the Czech Holstein population.

Material and methods

Since 1992 calving difficulty (CD) has been scored in Holsteins in the Czech Republic. In total, 2.5 million records have been collected. CD is assessed by farmers in three categories: 1=normal, 2=hard pull, 3=complicated with veterinary assistance. Classes 1, 2, and 3 represented 93.1, 6.0, and 0.9% of records, respectively. Two partial data sets have been separated from the basic data set, namely, (1) the first parity records ($n=806\,463$) and (2) records with available gestation length over all parities ($n=1\,757\,364$). Separate analyses were conducted for each of the factors. Age at first calving (AFC) and gestation length (GL) were categorized into one-month and one-day classes, respectively, and analysis of variance was performed. Regression analysis with linear and quadratic terms was applied to describe the relationship of AFC and GL to CD.

Results and discussion

Basic statistics of AFC and GL are given in Table 1. The mean value for AFC was 841 days, i.e. 27.6 months. This corresponds with an upper bound of the breeding goal (23-27 months) implicated in the Holstein breeding programme in the Czech Republic (2007). GL ranged from 260 to 303 days, which is an interval for the real last service; the other records considered as mistaken were omitted.

Figure 1 shows the relationship between CD and AFC. When heifers calved at an extremely low or high (less than 22 or more than 40 months) age CD fluctuated. When calving was between 22 and 27 months of the age CD declined, whereas it was balanced with the age between 27 and 40 months. Extreme low or high ages at first calving were found in only 0.5% of all records. First calving at the age of less than 22 months indicates mating age of less than 13 months, which is matter of mistakes more than a deliberate service at that age. Similarly, the first calving at the age of more than 40 months indicates problems with conception or an insufficient herd management. Due to a very low occurrence of the extreme age records, they should be excluded from analyses. According to the Description of National Genetic Evaluation Systems (available at <http://www-interbull.slu.se>, 2007), records with extreme AFC are excluded from the evaluation. For example in NL/BE, the records are omitted when $AFC < 640$ or > 1074 days, whereas in DE/AT, data are excluded when $AFC < 20$ or > 40 months. The expectation that calving is more difficult if heifers calve at very young or old age corresponds with the non-linear relationship between CD and AFC. Results of regression analysis are given in Table 2. The non-linear adjustment for AFC in genetic analysis of CD is required.

Gestation length is often analysed in addition to other calving traits. Hansen et al. (2004) presented a weak genetic correlation between GL and CD and thus, the benefit of using GL as a correlated trait in a genetic evaluation with CD seemed limited. However, in accordance to other studies (Meijering, 1984, Hansen et al., 2004), Figure 2 shows a phenotypic non-linear relationship between CD and GL. More difficulties are associated with short or long gestation periods. In shorter GL, delivery problems are probably related to the dam, whereas longer GL is associated with higher birth weight of the calf.

Conclusions

Calving difficulty should be adjusted for both age at the first calving and gestation length in subsequent analyses including a genetic evaluation. An exclusion of records with the extreme age at first calving is recommended.

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Description of National Genetic Evaluation Systems available at http://www.interbull.slu.se/national_ges_info2/framesida-ges.htm, 15 June 2007

Table 1: Basic statistics of age at first calving and gestation length

	No.	Mean	Min	Max	SD	No. of classes
Age at first calving	806 463	841.0	548	1459	103.39	30
Gestation length	1 757 364	279.5	260	303	7.20	44

Table 2: Regression of age at first calving and gestation length on calving difficulty

	Regression coefficients on calving difficulty		
	Intercept	Linear	Quadratic
Age at first calving	1.56 ++	-9.32*10 ⁻⁴ ++	4.66*10 ⁻⁷ ++
Gestation length	25.11 ++	-1.70*10 ⁻¹ ++	3.01*10 ⁻⁴ ++

++ $P < 0.001$

Figure 1: Relationship between calving difficulty and age at first calving

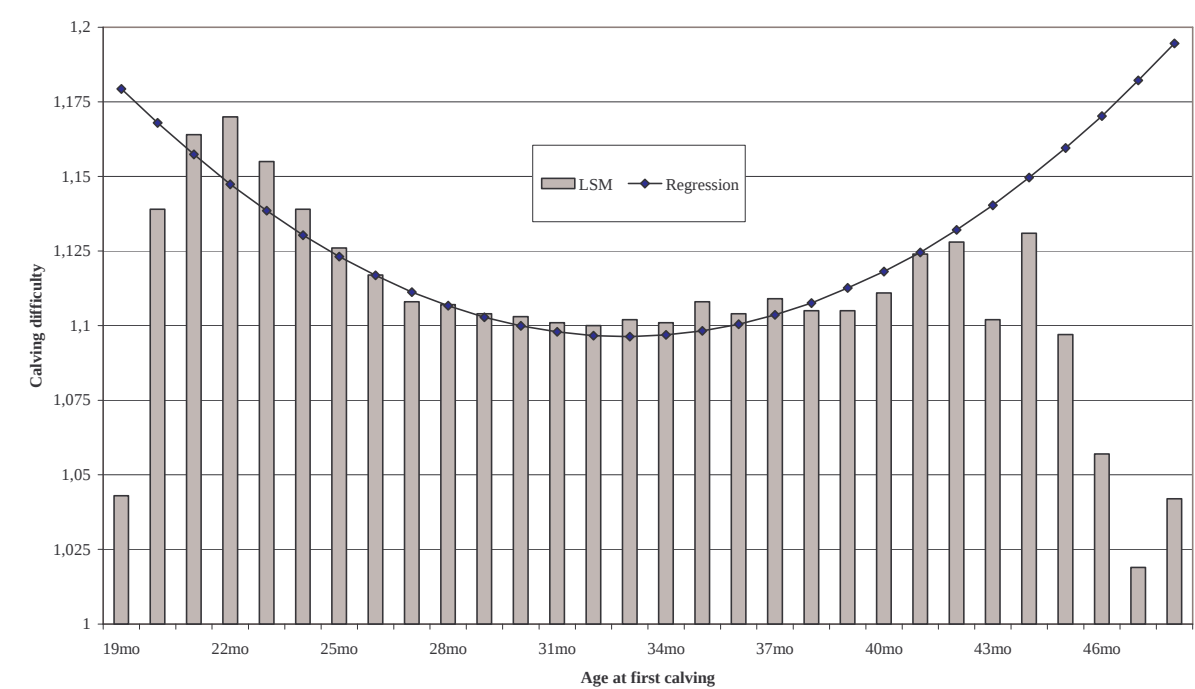
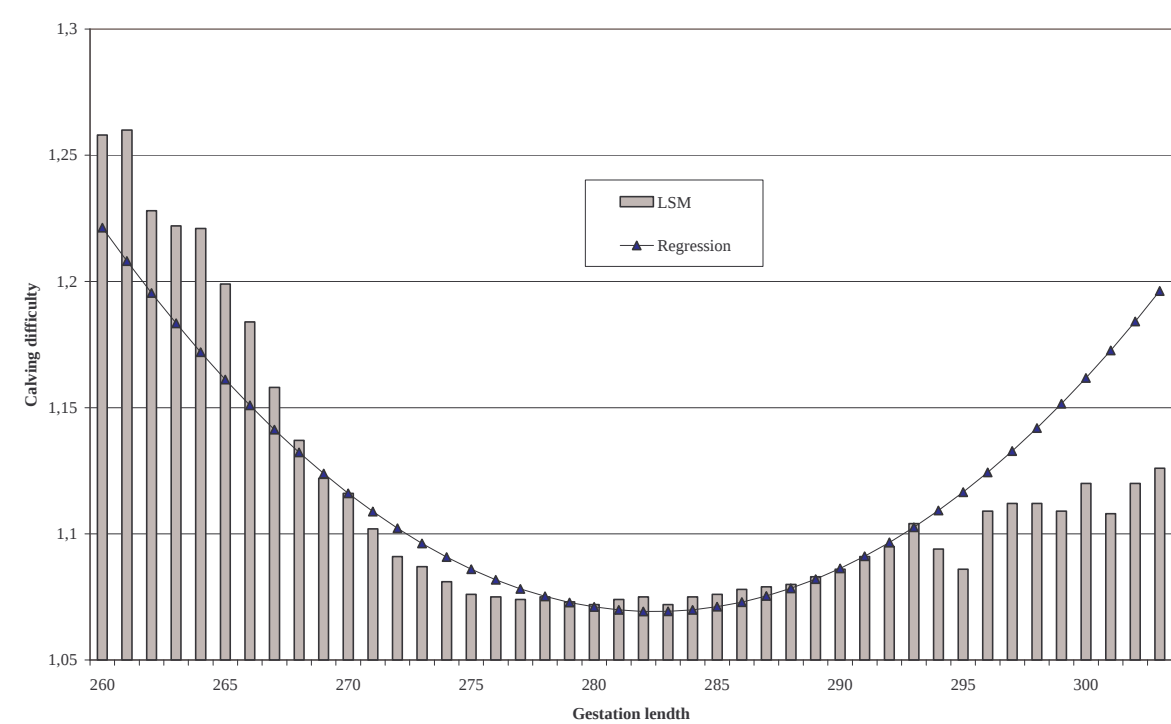


Figure 2: Relationship between calving difficulty and gestation length



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