

Calving difficulties and calf mortality in Finnish dairy cattle population

Seppo Niskanen and Jarmo Juga

*Finnish Animal Breeding Association
P.O.Box 40, 01301 Vantaa
Finland*

Abstract

Genetic parameters and breeding values for calving difficulties and calf mortality were estimated from Finnish dairy population. The data consisted of 1,160,833 Finnish Ayrshire (FAY) and 289,998 Finnish Holstein-Friesian (FHF) dairy cows first, second and third parity records. The data were analyzed using multiple-trait AI-REML methods with sire-grandsire model. Model included the effects of sex of calf, gestation length, calving month, parity of dam, herd-year, sire of calf and grandsire of calf.

The estimated heritabilities were low (0.01 - 0.04) for both calving difficulties and calf mortality. Both traits were estimated as an effect of sire and maternal grandsire of calf. Heritabilities were only a little greater in first than later parities. Genetic correlations between calving difficulties and calf mortality were high, 0.86 for FAY and 0.90 for FHF. More difficulties were observed when the calf was male, the gestation length was shorter or longer than normal, in winter and when the cow was a first calver.

1. Introduction

Calving difficulties and calf mortality have economic importance to dairy farmers (Groen et al. 1995). Costs consist of loss of calf or cow, veterinary fee, increased labor costs and fertility problems. Difficult calving or dead calf increases the probability of culling the dam. Because the herdsize is growing, it is important to try to have cows with easy calving. Before the breeding values of calf mortality have been estimated in Finland using selection index, breeding values of calving difficulties have not estimated before.

Calving difficulties and calf mortality have not been a big problem in Finnish dairy population. It has been noticed, however, that both of them have increased in last ten years. Many countries have reported that difficulties in calving and mortality have increased in black and white breed when the proportion of Holstein genes has increased in Friesian population (Pedersen 1995, McGuirk 1995). According to Finnish Milk Recording 4.4 % of calves died within 24 hours of birth and 2.7 % of dairy cows were culled because of difficult calving in 1996 (Association of Rural Advisory Center 1997). The true culling rate will be greater, because calving difficulties and calf mortality increase the risk of retained placenta which in turn increase the risk of metritis and

fertility problems and that way reduce production (Emanuelson et al. 1993). Thus another culling reason has most likely been reported in many cases than calving difficulties. Calving difficulties can be reduced by proper management procedures, like heifer rearing and feeding before and during gestation, but selection and breeding strategies are still important (Philipsson et al. 1979).

The objectives of this study were to describe the amount of calving difficulties and calf mortality in Finnish dairy cattle population and to estimate genetic parameters and the predicted transmitting abilities (PTA) for these traits.

2. Material and methods

Records of calving difficulty and calf mortality are scored by farmer and collected by Finnish Milk Recording System. The data for this research was sampled in 1997 by Agricultural Data Processing Centre and Finnish Animal Breeding Association. The edited data consisted of 1,160,833 Finnish Ayrshire (FAY) and 289,998 Finnish Holstein-Friesian (FHF) cows, first, second and third parity, that calved during January 1988 and February 1997. The cows were from overall of Finland. Twin calvings, abnormal and aborted calves were excluded. The number of sires (maternal grandsires) in FAY was 2,936 (3,822) and in FHF 868 (1,042).

Data of calving difficulties was coded in three categories: 1) normal, 2) little difficulties and 3) difficult. Information of calving difficulty was from 215,494 (FAY) and 66,160 (FHF) cows. Calf mortality was coded in two categories: 1) alive and 2) dead at birth or by 24 hours postpartum. This information was available from all cows with calvings.

The (co)variance components were estimated with DMU-package using multiple-trait AI-REML (Jensen et al. 1997). The (co)variance components were estimated from observations of three areas in Finland (Pohjois-Savo, Pohjois-Karjala and Kainuu). In the analyses of calving difficulties and mortality the following linear multiple-trait sire-grandsire model was assumed:

$$y_{ijklmnop} = \text{sex}_i + \text{glenth}_j + \text{month}_k + \text{parity}_l + \text{hy}_m + \text{sire}_n + \text{mgs}_o + e_{ijklmnop}$$

where

$y_{ijklmnop}$ = calving difficulty or calf mortality
 sex_i = sex of calf ($i=1,2$)
 glenth_j = gestation length ($j=1,\dots,6$)
 month_k = month of calving ($k=1,\dots,6$)
 parity_l = parity ($l=1,2,3$)
 hy_m = herd-year
 sire_n = sire of calf
 mgs_o = maternal grandsire of calf
 $e_{ijklmnop}$ = residual effects

The assumed (co)variance structure were

$$V(y) = Z_s G_s Z_s' + Z_{mgs} G_{mgs} Z_{mgs}' + R$$

$$V(\text{sire}) = G_s = A s_{\text{sire}}^2$$

$$V(\text{mgs}) = G_{mgs} = A s_{\text{mgs}}^2$$

$$V(e) = R = I s_e^2$$

$$\text{Cov}(\text{sire}, e) = \text{Cov}(\text{mgs}, e) = 0$$

Z_s and Z_{mgs} are the incidence matrices that link effects y ; A is the additive relationship matrix and I is an identity matrix.

Sex of calf (male and female), gestation length (six classes), month of calving (six classes, including two months per class) and parity (three classes) were fixed effects; herd-year, sire of calf, maternal grandsire of calf and residual were random effects. The effect of parity was replaced by the age of cow when analysing only first calvers data. The age of cow was then categorized in six classes. Calf mortality was collected for all calvings. In the repeatability model with three parities the cow was included as random effect in the model,

which accounted for the cows genetic effect and the random permanent environmental effect.

3. Results and discussion

The frequencies of different calving types and calf mortality by parity are presented in Tables 1 and 2. The frequency of calvings which were more or less difficult, was 6.0 % (FAY) and 10.8 % (FHF). Frequencies were a little greater with first calvers than second or third parity. Calf mortality is a problem of first calvers. The frequencies of mortality in the whole data were 3.7 to FAY and 3.9 to FHF, and with the first calvers 4.7 % and 6.6 for FAY and FHF, respectively. One reason to the difficulties in FHF is that a relative birth weight (birthweight of calf/weight of dam) is greater in FHF than in FAY (Kärki 1996).

Both calving difficulties and mortality were greater when the calf was male. Male calves are usually bigger at birth than female calves, and the gestation with male calves is about one day longer. Difficulties are more common if a gestation length is abnormal, too short or too long (Philipsson 1976c). After too short gestation calves are often small and weak, and if the gestation is too long, calves can grow too big which causes difficulties in calving. Calving first time at very young age increases calving difficulties and calf mortality. Calvings were most difficult at winter and easiest at summer and spring, but mortality were highest both in the middle of winter and summer.

Heritabilities were low for both traits. Direct (sire of calf) heritabilities were 0.02 for calving difficulties and 0.02 for mortality for FAY and 0.04 and 0.04 for FHF. Indirect (maternal grandsire of calf) heritabilities of calving difficulties and mortality were 0.01 and 0.01 for FAY and 0.04 and 0.02 for FHF. Heritabilities were practically the same when estimated only from first calvers. Estimated heritabilities are low but they agree with other studies using linear models (Hagger et al. 1990), but heritabilities from threshold models have found to be somewhat higher (Weller et al. 1989). Repeatabilities of calf mortality were 0.06 (FAY) and 0.05 (FHF). Genetic correlations between calving difficulties and mortality as a trait of sire were very high, 0.86 (FAY) and 0.90 (FHF), but as a trait of maternal grandsire they were a little bit lower, 0.41 for FAY and 0.69 for FHF.

Table 1. Calving difficulties (%) by parity

Breed		1. parity	2. & 3. parity	All parities
Finnish Ayrshire	normal	93.6	94.4	94.0
	little difficulties	3.8	3.4	3.6
	difficult	2.6	2.2	2.4
Finnish Holstein-Friesian	normal	89.0	90.2	89.7
	little difficulties	6.2	5.7	5.9
	difficult	4.8	4.1	4.4

Table 2. Mortality (%) by parity

Breed	1. parity	2. & 3. parity	All parities
Finnish Ayrshire	4.7	2.8	3.7
Finnish Holstein-Friesian	6.6	1.8	3.9

The predicted transmitting abilities (PTA) were calculated for these traits by DMU4-program. Variation between bulls was quite small. There are clearly some bulls, who cause more problems than others as a sire or maternal grandsire of calf, and the records of these bulls must be followed. Using calculated PTA's indexes the worst bulls can be excluded from breeding. Calf mortality indexes were compared to indexes, which has been calculated before by selection index. The correlations between indexes were 0.40 as a trait of sire of calf and 0.43 as a maternal grandsire of calf for FAY and for FHF these correlations were 0.39 as a trait of sire of calf and 0.55 as a maternal grandsire of the calf.

4. Conclusions

Calving difficulties and calf mortality have been increased in Finnish dairy population in last ten years. The increase has not been very fast however. Difficulties are more common for Finnish Holstein-Friesian than Finnish Ayrshire. There are also more difficulties with the first calvers, when the calf is male, in the middle of winter or summer or when the gestation length is abnormal. There are more difficulties, if a cow is very young at first calving. The heritabilities were low both for calving difficulties and calf mortality. Also repeatability of mortality was low, so the next calving is difficult to estimate on the ground of previous calving. Genetic correlations between calving difficulties and mortality were high both as a trait of sire and as a trait of maternal grandsire.

Correlations of calf mortality between now calculated PTA and before by selection index calculated PTA were between 0.39 - 0.55.

References

- Association of Rural Advisory Center, 1997. Milk recording results 1996 in Finland. Publ. 915. Assoc. Rural Advisory Crr., Helsinki, Finland.
- Emanuelson, U., Oltenacu, P.A. and Gröhn, Y.T. 1993. Nonlinear mixed model analyses of five production disorders of dairy cattle. J. Dairy Sci 76:2765-2772.
- Groen, A.F., Brandts, A.G.B.M., Jansen, H.H. ja Kanis, E. 1995. Economics value and genetic parameters for calving performance in Dutch dairy cattle breeding. Proceedings of the open session of the Interbull annual meeting. Prague, Czech Republic, 7 - 8 September 1995.
- Hagger, C and Hofer, A. 1990. Genetic analyses of calving traits in the Swiss Black and White, Braunvieh and Simmental breeds by REML and MAPP procedures. Livestock Prod. Sci. 24:93-107
- Jensen, J., Mäntysaari, E.A., Madsen, P. and Thompson, R. 1997. Residual maximum likelihood estimation of (co)variance components in multivariate mixed models using average information. J. The Indian Society Agr. Statistic 49: 215 - 236.
- Kärki, S. 1996. Lypsyrotuisten vasikoiden syntymäpainon perinnölliset tunnusluvut ja yhteydet muihin ominaisuuksiin. Publ.16 of

- Depart. of Anim. Sci Helsinki University.
Finland.
- Manfredi, E., Ducrocq, V. and Foulley, J.L.
1991. Genetic analysis of dystocia in dairy
cattle. *J. Dairy Sci.* 74:1715-1723.
- McGuirk, B.J., Going, I. and Gilmour, A.R.
1995. The evaluation of Holstein Friesian
sires for calving ease in the UK. Proceedings
of the open session of the Interbull annual
meeting. Prague, Czech Republic, 7 - 8
September 1995.
- Meijering, A. 1984. Dystocia and stillbirth in
cattle - a review of causes, relations and
implications. *Livest. Prod. Sci.* 11:143 - 177.
- Pedersen, J. 1995. Evaluation of calving
performance of Danish dairy sires.
Proceedings of the open session of the
Interbull annual meeting. Prague, Czech
Republic, 7 - 8 September 1995.
- Philipsson, J. 1976c. Studies on calving
difficulty, stillbirth and associated factors in
Swedish cattle breeds. III. Genetic
parameters. *Acta Agr. Scand.* 26:244 - 220.
- Philipsson, J., Foulley, J.L., Lederer, J.,
Liboriussen, T. and Osinga, A. 1979. Sire
evaluation standards and breeding strategies
for limiting dystocia and stillbirth. *Livestock
Prod. Sci.* 6: 111 - 127.
- Weller, J.I. and Gianola, D. 1989. Models for
genetic analysis of dystocia and calf
mortality. *J. Dairy Sci.* 72:2633-2643.