GENETIC PARAMETERS FOR FITNESS TRAITS OF THE HUNGARIAN FLECKVIEH

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ABSTRACT

Genetic parameters were calculated and breeding value evaluation was introduced for heifer and cow fertility, calving ease and stillbirth. Regarding fertility traits, the number of inseminations to conception (NINS) and non-return rate until 56 days (NR56) of heifers, NINS, NR56 and days open of cows were evaluated by REML procedure. The h^2 of the heifers' two traits were 0.006 with a very strong genetic correlation (-0.95) between them. The h^2 for cow fertility traits varied between 0.018 and 0.041. Due to the low correlation between heifer and cow fertility (r=0.14), it is recommend that selection be based on both age groups. For calving ease and stillbirth variance components estimation and breeding value prediction threshold model. The heritability of heifer direct calving ease was 0.070, the maternal heritability was 0.226, the cow direct and maternal heritability was 0.034 and 0.135 respectively. An antagonism were observed between direct and maternal calving ease both for heifers (-0.635) and cows (-0.453). The correlation between heifer and cow calving ease was 0.2, which necessitates a separate breeding value evaluation, and different use of bulls for heifers and cows. For stillbirth, direct h^2 was 0.047, the maternal h^2 was 0.053 for heifers' stillbirth rate. The same parameters were 0.019 and 0.029 for cows. The genetic correlation between calving ease and stillbirth was 0.71 for heifers, and 0.43 for cows. Despite the decreasing tendency in stillbirth breeding value over the years, the inclusion of the trait in selection index is advisable for economic and animal welfare consideration.

Keywords: Hungarian Fleckvieh, fertility, calving ease, stillbirth

INTRODUCTION

Fertility is one of the most important economic traits independent of the type. In dairy herds the economic value follows milk yield and the tendency for mastitis (SUN et al., 2009). The selection index for the Austrian Fleckvieh includes fitness traits with 46% weight alongside the 38% and 16% weights for milk yield and beef yield, respectively (FUERST and GREDLER, 2009). Selection for high milk yield has resulted in the deterioration of fertility (STEFLER et al., 1995, BANOS et al., 2004), which is about 3% by generation – a tendency that cannot be maintained (THALER, 1998). VAN RADEN et al. (2004) showed a 0.35 negative genetic correlation between fertility and milk yield. It is impossible to maintain the same level of fertility, or improve it without selection.

Dystocia causes economic loss primarily during the first calving as a result of stillbirth, veterinary costs after calving, prolonged ovulation, or other health reasons. MATURANA et al. (2007) calculated a 10% rise in replacement costs as compared to easy calving, which appears in shorter functional life span. The majority of veterinary costs is related to dystocia, which MCGUIRKE et al. (2007) calculated as £110 for calving assistance, and £350-400 for operations.

Stillbirth is defined as either a calf born dead or calf death within 48 hours after calving (PHILLIPSSON et al., 1979). Half of the cases derive from dystocia, one third from growth disorders, and other yet unknown reasons (BERGLUND et al., 2003). Not only does stillbirth mean the loss of calves but the involution of cows is disorderly after stillbirth (STEVENSON and CALL, 1988), they ovulate and conceive later, have a higher risk for culling (+41%) or death (BICALHO et al., 2007). The milk yield of such cows is less during the first 60 days of lactation (BERRY et al., 2007*a*). In the USA, the occurrences of stillbirth increased from a 9.5% ratio in 1985 to 13.2% by 1996, which causes 125 million dollars loss in the dairy sector, therefore the replacement costs increased by 76 million dollars during the period mentioned (MEYER et al, 2001*a*).

MATERIAL AND METHOD

Reproduction data collected by the Hungarian Fleckieh Association between 2000 and 2009 were evaluated. Several aspects were observed for the validity and model harmonization of the data. Fertility measures analysed for heifers were NR56 and NINS, for cows were NR56, NINS and days open. If the female is recorded as reinseminated within 56 d of its first recorded insemination, then it is recorded as a failure (coded as 0). If the female does not have a second recorded insemination or its second insemination is greater than 56 d from its first recorded insemination, then it is recorded as a success (i.e., the female did not return to service, coded as 1). The genetic parameters for the fertility traits were estimated by the VCE6 software by REML procedure (GROENEVELD et al., 2008).
The breeder renders a score from 1 to 5 for the calving ease. Table 13 shows its definition and frequency. Calvings with codes 1 and 2 make up 85.56% and 93.3%, for heifers and cows respectively. In the course of our calculations codes 4 and 5 were combined due to their low occurrence. Data up to the 7^{th} calving were considered, which meant 97.7% of the data. The average number of calvings was 2.73. We considered calvings in which the gestation length was at least 260 days, but no more than 300 days. Cases of abortion were excluded. The calving ease and stillbirth traits were evaluated by threshold model using the TM software (LEGARRA et al, 2008).

RESULTS

The genetic parameters of fertility measures are shown in Table 10. The estimated h^2 of two heifers' reproductive measures was 0.006, the genetic correlation between them is very close to 1 (-0.96), which means the two traits describe identical phenomena and are exchangeable. The h^2 of fertility measures for Hungarian Fleckvieh heifers is higher than that of the Irish Holstein Friesian (0.000), and lower (0.014) for the Austrian Fleckvieh (GREDLER, 2008). Such low heifer heritability questions the inclusion of the fertility data for this age group into breeding value estimation and selection. All the h^2 measures for cows (0.018-0.041) are consistent with those of the Austrian Fleckvieh (GREDLER, 2008). Due to the very high correlation between the number of inseminations and non-return rate (0.94), it is sufficient to include one of the two measures. Since the non-return state is more easily available, on day 56 after the first insemination, it allows earlier selection than the total number of inseminations. The h^2 of days open is almost four times higher than the values calculated for the other two measures, therefore to apply it into selection is justified as it enhances reliability, and correlates with the other two measures on medium level.
KOMLÓSI and HÚTH (2010) evaluated the breed's genetic parameters of calving ease with a linear model in an earlier study. The direct h^2 value of calving ease was found 0.048, the maternal h^2 was 0.048. In the present study, the heritabilities for heifer calvings by

threshold model were 0.07 and 0.23 (*Table 1*). The higher values estimated by the threshold model are also supported by WELLER et al. (1988) and STEINBOCK et al. (2003). We calculated higher h^2 values for cows' calving ease with the threshold model (0.03 and 0.13) as well, which was lower than in the case of heifer calving in a way similar to the linear model (*Table 2*). The correlation is negative between the direct and maternal calving ease; it is 5% for heifers and cows alike, and differs from zero on the probability level of 0.05. The direct-maternal correlation is negative in the majority of cases reviewed, which indicates antagonism. MEIJERING (1984) claims that calves born with ease have smaller weight, more favorable frame morphology, in cow age, however, they calve with difficulty. The repeatability value of the calving ease is 0.22.

Table 1. Genetic parameters of calving ease and stillbirth calculated from heifers' calvings

Trait	**Parameter**	**Posterior mean**	**95% confidence interval of estimate**
calving ease	direct h^2	0.070	0.068- 0.071
	maternal h^2	0.226	0.224-0.229
	$r_{gdirect-maternal}$	-0.635	-0,649 - -0,621
stillbirth	direct h^2	0.047	0.045- 0.049
	maternal h^2	0.053	0.051-0.561
	$r_{gdirect-maternal}$	-0.363	-0.400 - -0.352
calving ease-stillbirth	$r_{gdirect-direct}$	0.711	0.654-0.783

Table 2. Genetic parameters of calving ease and stillbirth calculated from cows' calvings

Trait	Parameter	Posterior mean	95% confidence interval of estimate
calving ease	direct h^2	0.034	0.031- 0.038
	maternal h^2	0.135	0.106 -0.167
	$r_{gdirect-maternal}$	-0.453	-0.549 - -0.357
	repeatability	0.220	0.218-0.222
stillbirth	direct h^2	0.019	0.017- 0.021
	maternal h^2	0.029	0.028-0.030
	$r_{gdirect-maternal}$	-0.451	-0.483 - -0.419
	repeatability	0.024	0.023-0.025
calving ease-stillbirth	$r_{gdirect-direct}$	0.431	0.415 – 0.447

CONCLUSIONS

Low heifer heritability questions the inclusion of the fertility data for this age group into breeding value estimation and selection. All the h^2 measures for cows (0.018-0.041) are consistent with those of the Austrian Fleckvieh. Due to the very high correlation between the number of inseminations and non-return rate (0.94), it is sufficient to include one of the two measures. Since the non-return state is more easily available, on day 56 after the first insemination, it allows earlier selection than the total number of inseminations. The h^2 of days open is almost four times higher than the values calculated for the other two measures, therefore to apply it into selection is justified as it enhances reliability, and correlates with the other two measures on medium level.

Calving ease is in 3-7% of direct, in 13-23% of maternal genetic origin. The maternal effect on the trait is more considerable than that of the direct effect. Antagonism between the direct and maternal gene groups is of medium level. If we explain the negative correlation with birth-mature weight, and birth-mature frame morphology, then this phenomenon necessitates data collection and evaluation of birth and mature weight as well as shoulder and pelvic width. In the Australian beef breeding practice, selection for calving ease resulted in slim calves whose mature pelvic bone is narrow. It can be recommended for terminal breeds only. In the Hungarian Fleckvieh a compromise needs to be established (medium calf weight, medium pelvic size, medium cow weight), which requires data collection. In the absence of data, it is possible to observe the combined breeding values of direct and maternal calving ease.

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