GENETIC AND NON GENETIC ANALYSIS OF NEONATAL MORTALITY IN BELGIAN BLUE BREED

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Abstract

Calving records of 40,125 Belgian Blue breed cows of the doubled-muscled type from 1985 to 1994 were analyzed for calf neonatal mortality (death within 48 hours of birth). The mortality was scored as a dichotomous trait. The model used for analysis included region, year and month of birth, sex of calf, parity of cow (1 to = > 4), birth weight (8 categories) and dystocia as fixed effects. Dystocia was described into four classes Caesarian section or not and could be considered as a fixed effect because caesarean section became a "breeding technique" in the breed and its incidence in the data was 91.5%. Sire of calf and residuals were random with diagonal covariance matrices. Analysis was performed with threshold model and variance components were estimated by REML using the program CMMAT2 by Misztal. Heritability was estimated at 0.025.

Solutions for fixed effects are presented. The incidence of mortality was higher in male calves, decreased with age of cows, was higher in oversized calves and was lower for calvings by caesarean sections.

Introduction

Several studies have analyzed both calving mortality and calving mode with single traits of multiple trait procedure. Both traits have low heritabilty and high genetic correlation (Bar-Anam et al., 1976; Tompson and Rege, 1984; Van Vleck and Edlin, 1984; Weller and Gianola, 1989) and the direct genetic effect is larger than the maternal effect (Ron et al, 1986; Weller et al., 1988).

In the Belgian Blue Breed, the majority of the animals are double muscled. This phenotype is due to the homozygous "mh/mh" condition at the locus mh (Hanset and Michaux, 1985 a and b). This muscular hypertrophied phenotype caused calving difficulties and caesarean section became a necessary "breeding technique". Practically no pulling of the calf is attempted

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and the incidence of the caesaran section in the breed is about 90%, therefore actually, when analyzing stillbirth, the calving mode is not be considered as a trait, but rather as an enviromental effect.

Very low mortality and morbidity have been observed in calf and cow experienced caesarean section (Michaux and Hanset, 1986).

From a review of the litterature, Meijering (1984) concluded that 40-60% of calf neonatal mortality are associated with dystocia, caesaren being considered as the highest degree of dystocia.

Calf mortality is scored categorically and genetic analyses have been performed with linear model (Review by Meijering, 1984), logistic linear model (Azzam et al, 1993). The threshold model has been proposed as the most theoretically appropriate for categorical traits. It assumes an underlyng normal variable, is a non linear model and it involves probability funcions (Gianola and Foulley, 1983; Meijering and Gianola, 1985). It has been used to analysed mortality field data (Meijering, 1985; Weller et al., 1988; Weller and Gianola, 1989; Hagger and Hofer, 1990; Manfredi, 1990).

The purposes of this study is (1) to investigate enviromental effects including calving mode and the phenotypic effect of calf birth weight on neonatal calf mortality and (2) to estimate the heritability calf mortality.

Material and methods

After editing, the data were 40.125 birth records of Belgian Blue double-muscled calves born from double-muscled cows between 1985 and 1994. The data came from the field progeny test program of AI bulls. Records of multiple births or abortions, with gestation length less than 264 days or longer than 300 days, with undefined or with erroneous information are deleted. Calf neonatal mortality was scored as 1 for a live calf or as 2 for a dead calf within 48 hours of birth.

The following model was used for analysis:

$$Y_{ijklmnop} = R_i + Y_j + M_k + P_l + S_m + BW_n + CM_o + SIRE_p + e_{jklmnop}$$

where:
$Y_{ijklmnop}$ = neonatal mortality of calf ijklmnop;
R_i = fixed effect of the region i;
Y_j = fixed effect of calving year j;
M_k = fixed effect of calving month k;
P_l = fixed effect of dam parity l;
S_m = fixed effect of calf sexe m;
BW_n = fixed effect of the class birth weight n;
CM_o = fixed effect of calving mode o;
$SIRE_p$ = random effect of calf sire p;
$e_{ijklmnop}$ = random residual.

Month of calving was January, February, March, April to August, September to October, November and December, Parity 4 and more were grouped. Calving mode was defined as unassisted, slight assistance, forced traction or caesaren. Eight birth weight categories were defined as_<34, 35 to 39, 40 to 44, 45 to 49, 50 to 54, 55 to 59, 60 to 64 and or >64 kgs.

Analysis was performed with a threshold model and variance components were estimated by REML using the program writtten by Misztal (CMMAT) and described by Misztal et al. (1989).

Results and discussion

Table 1. - CHARACTERISTICS OF THE DATA SET AND DESCRIPTIVE STATISTICS.

Number of records	40,125	
Number of sires	169	
Neonatal calf mortality	2.3%	
Calving mode	Frequency of calving mode (%)	Frequency of mortality by calving mode (%)
Unassisted	1.2	5.6
Slight assistance	4.9	3.6
Forced traction	2.4	7.9
Caesarean	91.5	2.0

Characteristics of the data set, and overall and by calving mode observed percentages are im Table 1. From survey of the litterature, stillbirth varies in case of normal or difficult calving from 2.6% to 28.9% (Laster and Gregory, 1973; Philipsson, 1979; Menissier and Foulley, 1979) and in case of caesarean, from 16,8% to 22.9% (Laster and Gregory, 1973; Menissier and Foulley, 1979). The neonatal mortality in Belgian Blue breed was 2.3% across all calving mode classes.

The distribution of records by classes of fixed effects and solutions in the underlying scale for fixed effects are given in Table 2. Calving mortality was lowest in April to August and highest in September - October and January. The seasonal influence has been observed but no general pattern and causes arised (review by Meijering, 1984; Weller et al., 1988). Azzam et al. (1993) reported an effect of weather conditions of day of birth.

Calving mortality decreased with increasing parity. Higher stillbirth incidence in heifers has been reported, associated with higher dystocia frequency (review by Meijering, 1984) but also when calving was normal (Cummers et al 1965; Laster and Gregory, 1973). Azzam et al. (1993) observed decreasing calf mortality with age of cows not experiencing dystocia.

Stillbirth rate was highest for male calves. It has been observed mainly in heifers and in case of dystocia and was related to the higher birth weight (review by Meijering, 1984).

Calves born by forced traction or unassisted calving had more mortality, calves born with slight assistance less mortality and calves experiencing caesarean had the lowest mortality rate.

GENETIČKA I NEGENETIČKA ANALIZA SMRTNOSTI NOVOROĐENČADI PASMINE BELGIAN BLUE / BELGIJSKA PLAVA

Sažetak

U vezi sa smrtnošću novorođene teladi (smrt u 48 sati nakon porođaja) analizirane su bilješke o telenju 40.125 krava pasmine Belgian Blue dvostruko-mišićavog tipa od 1985. do 1994. Smrtnost je zabilježena kao dihotomna značajka. Model upotrijebljen za analizu uključio je područje, godinu i mjesec rođenja, spol teleta, paritet krave (1 do = 4), težinu kod porođaja (8 kategorija) i distociju kao stalno djelovanje. Dostocija je opisana u četiri razreda, sa ili bez carskog reza, te se može smatrati stalnim djelovanjem jer je carski rez postao "uzgojnom tehnikom" u pasmini, a njegova učestalost u podacima iznosila je 91.5%. Otac teleta i ostali bili su slučajni s dijagonalnim matricama kovarijance. Analiza je provedena s početnim modelom a komponente varijance procijenjene pomoću REML-a primjenom programa CMMAT2 Misztal-a. Heritabilnost je procijenjena na 0.025.

Iznesena su rješenja za stalno djelovanje. Smrtnost je bila veća kod muške teladi, padala je s dobi krava, bila je veća kod teladi iznad ili ispod normalne težine, te manja kod porođaja carskim rezom.