APPLICATION OF THE GROUPED DATA MODEL TO THE STUDY OF CALVING DIFFICULTY OF BEEF COWS

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Objectives

To show that the grouped data model can be useful for the analysis and genetic evaluation of calving ease (CE) in beef cattle.

Material and Methods

1. Data

Data were recorded between 1990 and 2008 in four breeding herds. CE is scored by farmers of the **Bruna dels Pirineus** beef breed from 1 (no assistance) to 5 (caesarean).

After editing and excluding twin births and animals born in summer, our database included CE data of 8205 calves.

The pedigree file contained 9269 animals related to these calves, 147 being sires and 1892 being dams.

2. Grouped data model (GDM)

$$h(k) = \frac{P\{Y = k\}}{P\{Y \geq k\}} = 1 - \exp\{-\exp(\xi_k)\}$$

Where $\xi_k = \mu_k + \mathbf{X}\boldsymbol{\beta}(k) + s$

Fixed effects (β) are assumed CE-dependent

The sire effect $\mathbf{s} \sim \text{MVN}(\mathbf{0}, \mathbf{A}\sigma_s^2)$

The effective heritability was $h^2 = 4\sigma_s^2/(\sigma_s^2 + 1)$

Results

Table 1. Likelihood ratio tests for fixed effects in GDM, sire variance and heritability

		Likelihood ratio test	
Fixed effects	**DF**	**Sequential [a]**	**Last [b]**
Year	18	154.9 ***	84.0 ***
Herd	3	162.5 ***	132.1 ***
Parity	4	347.3 ***	307.3 ***
Sex	1	160.0 ***	NS
Month of calving	8	21.0 **	NS
Birth weight	5	423.8 ***	223.1 ***
Tim_unit	4	290.0 ***	290.0 ***
Herd(CE)	19	434.0 ***	
Parity(CE)	24	57.5 ***	
Random effects		**Variance**	**Heritability**
Sire		0.046	0.165

Table 2. Frequencies of CE values by each factor

		Calving ease				
	n	**1**	**2**	**3**	**4**	**5**
Herd						
BK	1844	80.0	5.3	12.0	1.6	1.0
BL	1459	90.0	7.8	0.8	0.7	0.7
FA	1847	74.9	19.5	3.7	0.8	1.1
ZG	1563	86.3	9.7	2.1	0.2	1.7
Parity						
First	1007	64.6	22.5	11.1	1.4	2.9
Second	1145	82.9	10.9	4.1	0.9	1.1
Third	1014	85.4	9.4	3.7	0.7	0.8
Fourth	841	85.2	9.1	4.5	0.5	0.7
Fifth or more	2706	87.6	7.3	3.7	0.7	0.6
Sex						
Males	4162	77.6	12.8	6.6	1.1	1.8
Females	4043	86.1	9.2	3.6	0.7	0.5
Birth weight (kg)						
< 40 kg	698	84.5	11.8	2.6	0.5	0.6
40-44	1474	86.6	10.3	2.3	0.2	0.6
44-48	1719	87.2	8.2	3.7	0.5	0.4
48-52	1661	82.7	11.0	4.8	0.9	0.6
> 52 kg	1213	65.4	15.2	13.9	2.4	3.0
Missing	1440	84.9	5.7	7.3	0.7	1.3

Table 3. Frequencies of CE stratifying by sire EBV estimated using GDM

		Calving ease				
	EBV	**1**	**2**	**3**	**4**	**5**
Very difficult	$< -\sigma_s$	69.3	18.5	8.4	1.5	2.3
Difficult	$-\sigma_s - 0$	79.8	11.6	6.3	0.9	1.4
Ease	$0 - \sigma_s$	86.4	8.7	3.5	0.8	0.6
Very ease	$> \sigma_s$	89.8	7.5	2.4	0.2	0.1

Conclusions

1. **The inclusion of CE-dependent effects gave a great flexibility to this model which can be used for genetic evaluation.**
2. **Huge differences in CE were detected among herds and parities, especially primiparous cows.**
3. **Male calves and calves born in autumn (October to December) had higher calving difficulty due to their higher birth weight.**
4. **The heritability found for CE in our data set was low to moderate (0.165) and CE inclusion in the breeding objective would be justified.**
5. **The grouped data model can be a powerful tool to analyse and assess CE in beef calves.**

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