RELATIONSHIP BETWEEN STILLBIRTH, CALVING DIFFICULTY AND AGE OF LITHUANIAN BLACK AND WHITE DAIRY COWS

Vida Juozaitienė, Arvydas Kardišauskas, Arūnas Juozaitis, Judita Žymantienė, Jonė Kantautaitė, Vytuolis Žilaitis, Ramūnas Antanaitis

Veterinary Academy, Lithuanian University of Health Sciences
Tilžės st. 18, LT - 47181 Kaunas, Lithuania

Corresponding author: Vida Juozaitienė; e–mail: vida.juozaitiene@lsmuni.lt

Abstract. The objective of the present study was to evaluate stillbirth and calving difficulty of Black and White cows in order to expand knowledge of dependence of these traits as a way to reduce mortality of calves. The research was carried out at the Laboratory of Establishment of Animal Breeding Value and Selection of Lithuanian University of Health Sciences. Records of stillbirth (SB) and calving ease (CE) were obtained from the Centre of State Rural Business Development. In the analysis, stillbirth was defined as a dead born calf or a calf that died within 24 hours after birth. Calving ease was measured on a scale from 0 (no difficulty) to 4 (difficult birth). The calving scores and stillbirths of Black and White cattle recorded since 1981 were used in the evaluation. The dataset had 872,565 records.

The SB was estimated to be 5.3% (first-lactation heifer stillbirth rates are higher $0.5-2\%$ than multiparous cows). Analysis of CE showed that 41.6% of cows calving were evaluated without difficulty and 0.3% of cows as difficult births. Difficult calvings are much more common in the first-calf heifers than in older cows. The data of the investigation highlight the dependence of SB on CE of cows, ($P<0.0001$): the majority (89.6%) of SB were observed in cows with evaluated CE score from 3 to 4.

Keywords: Black and White cattle, stillbirth, calving ease, lactation

Introduction. In recent years, the focus of dairy cattle breeders is shifting from traits that increase profit towards traits that reduce costs (De Maturana et al., 2007).

Several studies (Berry et al., 2003; Pryce et al., 2004; González-Recio et al., 2006) have shown that selection focused on milk production causes negative effects on reproductive performance.

Mortality of calves is an important economic component of farming systems since it reduces the number of animals available for sale, compromises animal well-being and reduces the number of animals available for selection as well as genetic progress (Hansen et al., 2003; Østerås et al., 2007, Fuerst-Waltl & Fuerst, 2010; Meyer et al., 2001).

Most studies on calf mortality have investigated stillbirth in dairy breeds (Bleul, 2011; Riley et al., 2004).

A stillborn calf is not just a calf born dead; it is a calf that is either born dead or dies within the first 24 to 48 hours after birth (Berry et al., 2003; Gundelach et al., 2009). Identification of the risk factors associated with stillbirth can aid in optimising herd reproductive efficiency (Atashi, 2011).

The calving difficulty is a leading cause of stillbirths. Manatrinon et al. (2009) found close positive genetic correlations between direct stillbirth and calving ease of Austrian Murboden breed. One of the best management practices to reduce stillbirth parturition may be utilising sire and daughter calving ease information when selecting sires to breed heifers (Atashi, 2011).

Eaglen et al. (2011) reported that a difficult calving could result in significant economic loss. Extra labour to assist the cow, a farm call to the herd veterinarian or death of the calf reduce profits for a dairy farm. Heifers and cows that go through a difficult calving tend to have impaired health, fertility, and production in the following lactation. Additional costs may occur due to increased likelihood of culling of the cow.

Easy calving and calf viability are economically important traits. Identification of problems and scheduling of solutions could improve calving performance, health and profitability of cows.

The objective of the present study was to evaluate stillbirth and calving difficulty of Black and White cows in order to expand knowledge of dependence of these traits as a way to reduce mortality of calves.

Materials and methods. The research was carried out at the Laboratory of Establishment of Animal Breeding Value and Selection of the Lithuanian University of Health Sciences. Records of stillbirth (SB) and calving ease (CE) were obtained from the Centre of State Rural Business Development.

In the analysis, stillbirth was defined as a dead born calf or a calf that died within 24 hours after birth.

Calving ease was measured on a scale from 0 (no difficulty) to 4 (difficult birth). Table 1 shows the scoring system for calving ease, which is also commonly referred to as dystocia.

Table 1. **The scoring system for calving ease**

Degree of difficulty	Calving ease score
No problem	0
Slight problem	1
Needed assistance	2
Considerable force	3
Extreme difficulty	4

The calving scores and stillbirths of Black and White cattle recorded since 1981 were used in the evaluation. The dataset had 872,565 records.

Statistical characteristics of the sample were calculated using statistical software SPSS (version 15, SPSS Inc., Chicago, IL).

Results. Analysis indicates that 94.7% of calves that were born during 1981−2015 were alive for 24 hours.

To investigate stillbirths, it is useful to separate out and to analyse the risk factors. Lactation of cows had a statistically reliable influence on Black and White calf mortality (P<0.0001). The highest number of deaths was observed in calves of cows in the first lactation (estimated to comprise 32.8% of all cows' SB). Figure 1 summarises the data of the dependence of SB on lactation of Black and White cows (according to polynomial regression model, R^2 =0.9787).
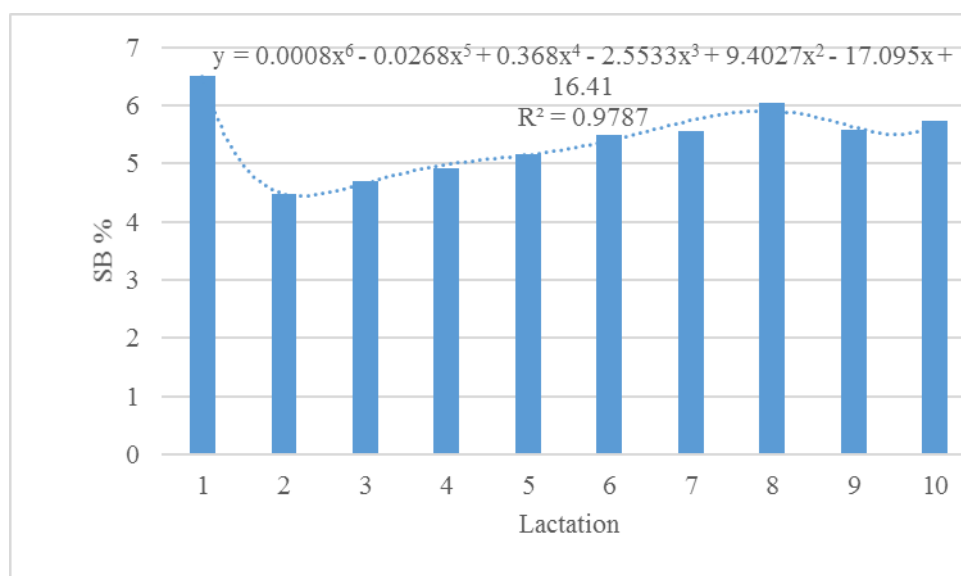

$$y = 0.0008x^6 - 0.0268x^5 + 0.368x^4 - 2.5533x^3 + 9.4027x^2 - 17.095x + 16.41$$
$$R^2 = 0.9787$$

Figure 1. **Dependence of SB on lactation of Black and White cows**

The stillbirth parturition rate was estimated to be 5.3% and shown to be a more important problem in the first lactation calving compared with the second or later calvings. SB in cows of the first lactation was 6.5%, in the second lactation 4.5%, and in the third lactation 4.7%. As

expected, the first-lactation heifer stillbirth rates were higher by 0.5−2% than those of multiparous cows.

Analysis of the calving scores (Figure 2) showed that 41.6% of cows calving were evaluated as no difficulty (score 0) and 0.3% of cows as difficult birth (score 4).
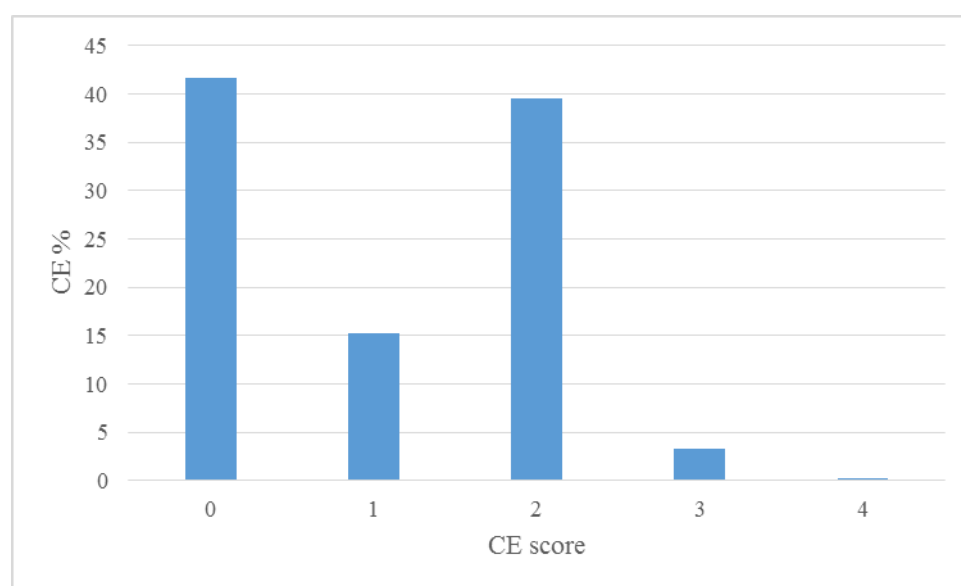

Figure 2. **Distribution of cows by CE score**

Table 2 shows the distribution of calving ease scores for first and later parity dams in the Black and White catlle herd.

The lactation had a statistically reliable influence on CE of cows (P<0.0001). CE in 60.5% of primiparous cows was evaluated by score 0−1, 35.3% of cows by score 2, and 4.1% of cows by score 3−4. As shown in Table 1, the majority of births received a score of 0−2, indicating that no assistance was needed.

Table 2. Evaluation of CE of Black and White cows by lactation

CE score	Lactation of cows									
	1	2	3	4	5	6	7	8	9	10
0	50.3	43.8	39.6	36.4	34.6	33.4	32.1	30.0	27.1	24.8
1	10.2	15.4	16.9	17.7	18.2	18.5	18.4	18.6	19.5	19.9
2	35.3	37.9	40.3	42.3	43.4	44.1	45.5	47.0	48.7	51.1
3	3.8	2.6	2.9	3.3	3.4	3.8	3.8	4.2	4.3	3.9
4	0.4	0.2	0.2	0.3	0.3	0.2	0.3	0.3	0.4	0.3

$$y = -0.002x^5 + 0.0578x^4 - 0.6271x^3 + 3.1734x^2 - 7.1124x + 8.5867$$
$$R^2 = 0.9854$$
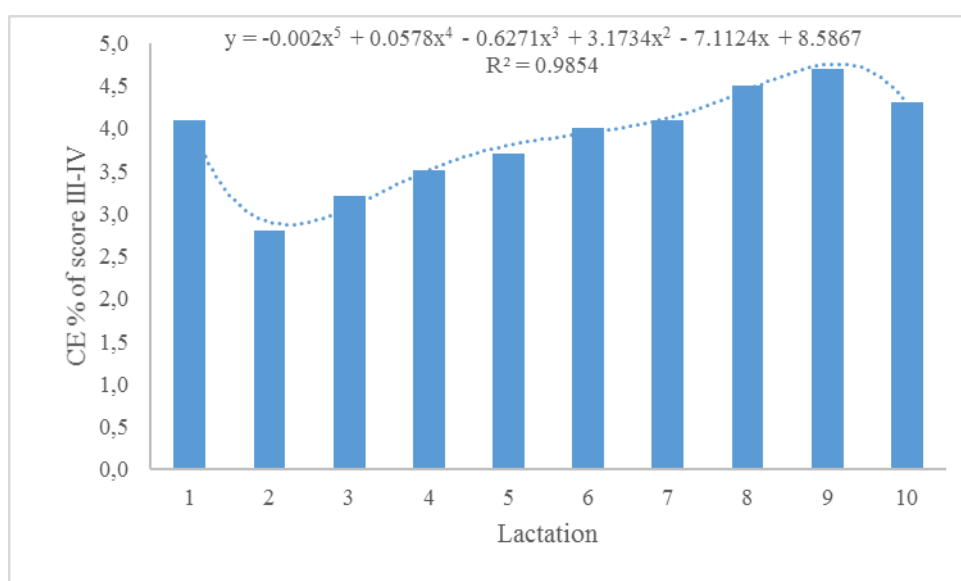
Figure 3. **Dependence of difficult calvings on lactation of cows**
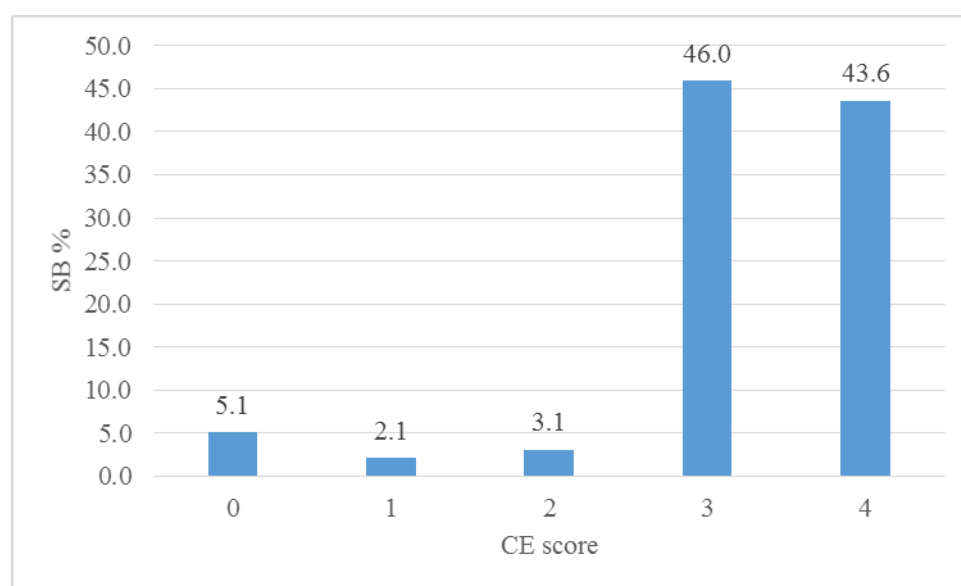
Figure 4. **Relationship between CE and SB of Black and White cows**

Difficult calvings (CE score 3-4) are much more common in first-calf heifers than in older cows and change from lactation 1 to 10 by a polynomial regression model (Figure 3), from lactation 2 to 9 according to the linear regression model: $y = 0.2595x + 2.6477$; $R^2 = 0.9811$.

Scores of 0, 1 and 2 indicate relatively easy births, and categories 3 and 4 indicate difficult births. The data in Figure 4 highlight the dependence of SB on CE of cows (P<0.0001). About 89.6% of SB were obtained in cows with evaluated CE score from 3 to 4 (Figure 4).

Discussion

Difficult calving and stillborn calves, as well as financial losses, are two of the biggest problems in a modern dairy farm. Currently, each year, about 5.3% of Black and White calves that are born in Lithuania die within 24 h of birth.

Mee (2013) reported that high calf loss rates are an international welfare problem though it is often not recognised. Data recording, research, breeding, veterinary, extension and farmer organisations all have a role to play in improving bovine neonatal survival and hence improving animal welfare in the future.

More factors (parity, age at first calving, calving season and twinning) may contribute to a complex of reasons when the final outcome is a stillborn calf. Insufficient monitoring around the time of parturition in dairy cattle might prolong the birth process unnecessarily, thereby increasing the risk of stillbirth (Vasseur et al., 2010).

Kornmatitsuk et al. (2004) observed that the aetiology of stillbirths varies depending on the used sire and is associated with dystocia or low viability of calves. The authors described the increasing incidence of stillbirths in Swedish Holstein heifers to a current average of 11%. Eriksson et al. (2004) referred to an increase in stillbirth in Charolaise and Hereford cattle in Sweden (between 6% in the first and 1−2% in later parturitions).

The present study demonstrated that primiparous cows had significantly higher stillbirth rates compared with multiparous cows.

Atashi (2010) found a significant difference (P<0.05) in stillbirth rates between the first parity and the second or later parity cows.

The mortality rates observed (Figure 1) were coherent with those that were reported in the literature. Stillbirth rates ranged from 1.4% to 11%, and deaths from birth to weaning ranged from 3.2% to 10.8% (Bleul, 2011; Eriksson et al., 2004; Meyer et al., 2001; Riley et al., 2004).

The most important factor associated with stillbirths is calving assistance (Gundelach et al., 2009; Manatrinon et al., 2009).

Thompson et al. (1983) reported that greater mortality for large calves at first parity was partially due to the increased difficulty associated with larger calves. Calving difficulty resulted in impaired reproductive performance (more days open, more services, and more days to first breeding) and decreased 30-day milk production but had no effect on 90-day milk production and 305-day mature-equivalent milk production. Dystocia, milk fever, and retained placenta occurred as a complex.

Ghafariania et al. (2014) estimated that calving difficulty in primiparous cows was significantly different (P≤0.01) from each other. The estimated effect of parity 5 was at the highest, which means the highest frequency of difficult calvings, whereas the fewest difficulties were in parity 2, and after that calving difficulty rose until parity 5 significantly (P≤0.01).

The first-calf heifers are more likely to receive calving assistance than second- or greater lactation cows. The mortality rate is related to difficult birth of the calf (P<0.0001) and to the observed larger number of deaths in the primiparous cows.

Conclusions

Mortality of calves and difficult calving in Lithuanian Black and White cattle population depends on lactation of cows (P<0.0001) and are much more common in first-calf heifers than in older cows.

The investigation highlights the dependence of SB on CE of cows (P<0.0001): the majority (89.6%) of SB were observed in cows with evaluated CE score from 3 (considerable force) to 4 (extreme difficulty).

Stillbirth and difficult calving traits of Lithuanian Black and White cows should be analysed more closely and should be included as a selection criterion in breeding programmes aiming to reduce mortality of calves, and could improve health of cows.

References

1. Atashi, H. Factors affecting stillbirth and effects of stillbirth on subsequent lactation performance in a Holstein dairy herd in Isfahan. Iranian Journal of Veterinary Research. 2011. Vol. 12. No. 1. P. 24-30. Berry D. P., Buckley F., Dillon P., Evans R. D., Rathand M., Veerkamp R. F. Genetic parameters for body condition score, body weight, milk yield, and fertility estimated using random regression models. J. Dairy Sci. 2003. Vol. 86. P. 3704- 3717.

2. Bleul U. Risk factors and rates of perinatal and postnatal mortality in cattle in Switzerland. Livest. Sci. 2011. Vol.135. P.257-264.

3. De Maturana E., Legarra A, Varona L., Ugarte E. Analysis of fertility and dystocia using recursive models to handle censored and categorical data. J Dairy Sci. 2007. Vol. P. 90: 2012-2024.

4. Eaglen S/A., Coffey M.P., Woolliams J.A., Mrode R., Wall E. Phenotypic effects of calving ease on the subsequent fertility and milk production of dam and calf in UK Holstein-Friesian heifers. J Dairy Sci. 2011. Vol. 11P. 5413-5423.

5. Eriksson S., Näsholm A., Johansson K., Philipsson J. Genetic parameters for calving difficulty, stillbirth, and birth weight for Hereford and Charolais at first and later parities. J Animal Sci. 2004. Vol. 82. P. 375-383.

6. Fuerst-Waltl B., Fuerst C. Mortality in Austrian dual purpose Fleckvieh calves and heifers. Livest. Sci.

2010. Vol.132. P.80-86.

7.   Ghafariania Y., Babaiee M., Vatankhah M. Factors affecting calving difficulty on Holstein dairy cattle. Indian Journal of Fundamental and Applied Life Sciences. 2014. Vol. 4 (4). P. 1148-1155.

8.   González-Recio O., Alenda R., Chang Y. M., Weigel K. A., Gianola D. Selection for female fertility using censored fertility traits and investigation of the relationship with milk production. J. Dairy Sci. 2006. Vol.89. P. 4438-4444.

9.   Gundelach Y., Essmeyer K., Teltscher M. K. Hoedemaker M. Risk factors for perinatal mortality in dairy cattle: cow and foetal factors, calving process. Theriogenology. 2009. Vol.71. P. 901-909.

10.   Hansen M., Madsen P., Jensen J., Pedersen J., Christensen L. G. Genetic parameters of postnatal mortality in Danish Holstein calves. J Dairy Sci. 2003. Vol. 86. P.1807-1817.

11.   Kornmatitsuk B., Dahl E., Ropstad E., Beckers J.E., Gustafsson H., Kindahl H. Endocrine profiles, haematology and pregnancy outcomes of late pregnant Holstein dairy heifers sired by bulls giving a high or low incidence of stillbirth. Acta Veterinaria Scandinavica. 2004. Vol. 45. P. 47-68.

12.   Manatrinon S., Fürst-Waltl B., Baumung R. Genetic parameters for calving ease, gestation length and stillbirth in three endangered Austrian blond cattle breeds. Archiv Tierzucht. 2009. Vol.6. (52). P. 553-560.

13.   Mee J. F. Why do so many calves die on modern dairy farms and what can we do about calf welfare in the future? Animals. 2013. Vol.3.   P. 1036-1057; doi:10.3390/ani3041036.

14.   Meyer C.L., Berger P.J., Thompson J.R., Sattler C. G. Genetic evaluation of Holstein sires and maternal grandsires in the United States for perinatal survival. J Dairy Sci. 2001. Vol.84. P. 1246-1254.

15.   Østerås, O., Gjestvang M.S., Vatn S., Sølverød L.Perinatal death in production animals in the Nordic countries – incidence and costs.   Acta Veterinaria Scandinavica. 2007. Vol.49 (Suppl 1). P.14.

16.   Pryce J. E., Royal M. D., Garnsworthy P. C., Mao I. L. Fertility in the highproducing dairy cow. Livest. Prod. Sci. 2004. Vol. 86. P. 125-135.

17.   Riley D.G. Chase CC. Olson T.A., Coleman S. W., Hammond A. C. Genetic and nongenetic influences on vigor at birth and preweaning mortality of purebred and high percentage Brahman calves. J Animal Sci. 2004. Vol.82. P. 1581-1588.

18.   Thompson J.R., Pollak E.J., Pelissier C.L. Interrelationships of parturition problems, production of subsequent lactation, reproduction, and age at first calving. Dairy Sci. 1983. Vol. 66(5). P. 1119-1127.

19.   Vasseur E., Borderas F., Cue R.I., Lefebvre D., Pellerin D., Rushen J., Wade K.M., De Passillé A.M. A survey of dairy calf management practices in Canada that affect animal welfare. J Dairy Sci. 2010. Vol. 93. P.1307-1315.