

Ongoing research on the causes of variation in calving performance and stillbirths in Swedish dairy cattle

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Introduction

Stillbirth rates have been increasing for all dairy breeds in Sweden during the latest years (Fig. 1; SHS, 1995). Stillbirth is defined as calf mortality before, during and within 24 hours after parturition. The increasing trend has been especially noticeable for first calving Swedish Friesians (SLB) that traditionally compared to e.g. the Swedish Red and White breed has been on a higher level of problems related to calving (Fig.1). Average stillbirth rate for first calving SLB is now 9.0% (Bratt, 1996).

An extensive use of semen from the superior milk producing American Holstein Friesian (HF) has occurred during the same period. A pilot study (calving survey) was performed 1991/92 in order to further investigate reasons behind the increasing stillbirths (Berglund and Philipsson, 1992). The study indicated larger problems with an increased proportion of HF in SLB, and a larger proportion of stillbirths at normal calvings. This study formed a basis for a larger investigation that started 1994 and will go on during three years in which reasons behind the increasing stillbirths will be studied more in detail. The objective with this paper is to describe ongoing research on the causes of variation in stillbirths and calving performance traits in Sweden.

Factors influencing stillbirth rates

Difficult calving is a main factor connected with stillbirths. The genetic correlation between calving performance and stillbirth is around 0.6, and around 40-60% of the dead calves were born at difficult calvings (Philipsson, 1976; Meijering, 1984). Thus although calving performance and stillbirths are clearly related, they remain two different traits.

Increasing stillbirth rates have multifactorial causes. Trends are similar for all breeds in Sweden. Managerial factors may therefore have a large impact on results. In Sweden as in most industrial countries, average herd size is increasing. This most likely causes less time for supervision of calvings. A larger proportion of nonsupervised calvings increases problems at calving and most probably also results in a larger proportion of difficult calvings that become recorded as just stillbirths.

Changes in the infectional status of the herd e.g. presence of Bovine Virus Diarrhoea Virus (BVDV) and Neospora Caninum might also influence results. Neospora Caninum is a pathogen that can cause abortion or early deaths of calves. The calves born alive are often very weak, and dies in a couple of weeks (Anderson et al., 1991). As stillbirths mainly are a first calving problem one may speculate in that the immunosystem is not fully developed and thus that first-calvers generally are more affected.

Changes in calving age is another factor that can influence stillbirth rates as well as numbers of difficult calvings. Calving age for SLB should for example

according to an investigation by Eriksson (1994), not be less than 25 months.

Feeding regimes are also important. Fetopelvic incompatibility (FPI), abnormal presentation of calf and weak labour are considered to be the most important factors behind calving problems. Fat heifers as well as underdeveloped heifers has since long been known to be a risk factor at calving. Thus, a change in feeding intensity or even in feeding composition as for example in selenium amount in concentrates might have an influence on calving performance and stillbirths. However, no such investigations, at least under Swedish conditions, have been performed lately.

Although low heritabilities (0.01-0.10) are found for calving traits a number of investigations have shown a large genetic variation in these traits (e.g. Berglund and Philipsson, 1992). Thus a genetic background is also evident. Genetic defects, e.g. a larger number of sublethal genes lowers the viability at birth, could be one of the reasons behind the large differences in the daughter groups of bulls. Some genetic defects have been identified, but there are probably several others that we do not know about yet.

Genetic defects

A number of point mutations has rather recently been identified within the Holstein breed which causes lethal defects at a low age for carriers. Some of the defects e.g. DUMPS are expressed during the foetal period and due to a disturbed RNA- and DNA synthesis causes early abortions of homozygous fetuses which are expressed as impaired fertility (Shanks et al., 1987)

Other defects are expressed in the newborn period and could thereby influence on stillbirth statistics. One example is citrullinemia. This defect is due to the lack of an enzyme in the urea cycle (Healy et al., 1990), causing an

accumulation of ammonium which leads to lethal disturbances in the central nervous system of the newborn calf.

Some other defects, those of the kind that cause insufficient function of the immunosystem, can under favourable environmental conditions be expressed relatively late, however during the first year of life. An example of this is BLAD, where a deficiency of a specific glycoprotein on the cell surface of the leukocytes (Kehrli et al., 1990), causes an impaired function of the neutrophils. This leads to an increased susceptibility for infections. Calves homozygous for BLAD are generally dying before one year of age or earlier.

Pilot study (calving survey)

In order to further investigate reasons behind the increasing stillbirth rates, and especially in SLB, a pilot study based on calving reports was run during the calving season 1991/92 (Berglund and Philipsson, 1992). The study consisted of reports from 645 first calvers from 73 randomly chosen SLB herds. It was confirmed that stillbirth rate clearly had increased while it was uncertain if calving difficulties at all had increased. The proportion of stillbirths not caused by calving difficulties thus seemed to have increased which might indicate problems with the viability of calves.

Furthermore a clear effect of more difficult calvings and a higher stillbirth rate was found with an increased proportion of HF genes in the sire of calf. In United Kingdom McGuirk et al., (1995) have shown similar results, while it was more uncertain in Dutch (Boer, 1995) and in Danish studies (Pedersen, et al., 1995) if HF importations has had any effect on calving traits.

Stillbirth data from the Swedish milk recording scheme for first-calving SLB, was summarized at the same time as the pilot study was performed (Table 1). Among the latest (at that time) 200

proven bulls for stillbirth rate with at least 150 calvings the best bull had as sire of calf an average stillbirth rate of 1.3% and the worst had 18.7% stillbirths. Figures were very similar when looking at the bulls as maternal grandsires. Thus a very large variation in stillbirths is obvious and the variation is even larger today.

Inquiry study/calving reports

The pilot study formed a basis for a larger study that started 1994 and will go on during three years. Reasons behind stillbirths will be studied more in detail by an extended inquiry study combined with post-mortem examinations of certain calves. Furthermore, statistics from the milk recording scheme will be used to analyse genetic parameters and to improve breeding evaluation methods for calving traits.

To be able to compare results of different time periods calving reports are largely the same in the presently running project as those used in the pilot project, which in turn were based on the large investigations on calving performance in Swedish dairy cattle by Philipsson, (1976).

Reports contains information about age and pedigree of heifer, insemination date and pedigree of bull, calving date, single or twinbirth, calving ease (1=easy, 2=normal, 3=difficult), attitude of calf, status of cow after calving and retained placenta. Concerning the calf there was information on sex of calf, birth weight, viability (born alive or dead/died within 24h) and any congenital defects.

A preliminary analysis of the first year of calvings (94/95) has been performed. After edition of the material 2268 first calving SLB reports from 260 herds were analysed. Herds in all regions in Sweden were represented, but participating herds should have inseminated with at least one of some selected bulls suspected to have a high risk of giving problems at calving.

However, as reports are sent in for all first calvers (of SLB) in the herds several other bulls were also represented in the material, (in total 299 bulls).

Stillbirth rate was as high as 11.4%. The selected bulls had in total few daughters in the material and did not, as initially expected, have a higher stillbirth rate compared to the other bulls. The frequency of difficult calving was 12.9%. Compared to studies in the beginning of the seventies (Philipsson, 1976), stillbirth rate has dramatically increased and especially in relation to the level of difficult calvings. Out of all stillbirths, 43.8% occurred at difficult calvings. Consequently, there is a rather large proportion of stillbirths occurring at normal calvings. And this proportion seems to have increased. In the investigations by Philipsson (1976), corresponding figures for SLB heifers in two areas in the south of Sweden were 51.8 and 68.5%, respectively. The average birth weight was slightly higher for stillborn calves (41.3 kg) compared to calves born alive (40.0 kg).

Nine bulls had at least 50 calving daughters. Average number of stillborn calves in their daughter groups varied from 3 to 20%, number of difficult calvings between 2 and 23%.

Post-mortem examinations

Two hundred out of the herds were also asked to let their stillborn calves be post-mortem examined. Stillborn calves were defined as dead or died within 24h of birth. Only stillborn calves with at least 240 days of pregnancy were considered. The post-mortem examinations were performed in three different regions in south of Sweden where there were laboratories with required competence and facilities.

A protocol was developed for this purpose. In addition to the information on the inquiries, there were information, e.g.

of length of foetus, judgement if the foetus was alive in the uterus and in that case for how long the foetus had been alive, if it had breathed, any infections, congenital defects and macroscopic investigation of the most important organs.

Preparates are also frozen from each stillborn calf for later analysis of defects on a DNA level. Blood samples are collected for analysis of antibodies against BVDV and for the presence of Neospora Caninum.

During the first year of calving (94/95), 62 calves were post-mortem examined. Average weight of these were 43.3 kg with a variation between 23 and 62 kg. Sixteen calves (26%) was considered to have breathed. Four calves (6.5%) were clearly malformed, which is a rather normal figure (Elvander, 1995). Malformations found were; enlarged thymus, heart defect (chamberseptum def.), urine bladder adherence to navel region and underbite.

These types of investigations are often very complex to perform. The material will be analysed more in detail when the second year (95/96) of post-mortem examinations have been collected.

Genetic evaluation for calving performance of Swedish dairy bulls

In Sweden the evaluation of bulls for calving performance was since 1974 based on numbers of stillborn calves at first calving both as sire of the calf (direct effect) and as sire of the dam (maternal effect). Breeding values (BV's) were calculated based on average stillbirth rate (per cent) by the bulls as sires and as maternal grandsires of the calves. Breeding values were corrected for breed and number of calvings. Thus, this was a very simple method that worked satisfactorily, however, during many years (Eriksson, 1994).

Since the autumn 1994 BV's for stillbirths and calving difficulties are

calculated using a linear model (BLUP sire maternal grandsire) including a relationship matrix. The model includes effects of herd, calving season, calving age and sex of calf (Eriksson, 1994).

In a third part of the ongoing study, the genetic evaluation of calving performance traits is going to be further developed. Data collected in the Swedish milk recording scheme since 1982 and onwards will be used.

Estimates of genetic parameters from a linear model will be compared by a threshold model. The size and correlation between direct and maternal effects in heifers and cows (with at least two calvings) will be estimated. The significance of non additive genetic effects (heterosis, recombination loss) and other environmental effects will be investigated as well as the value of using more than first calving records (second and third calvings).

Following estimation of BV's for calving performance at the national level additional studies will be undertaken to compare BV's of bulls estimated in Sweden to BV's of the same or genetically related bulls used in other countries. This will provide a possibility for simultaneous bull rankings for calving performance at the international level. Resources from the International Bull Evaluation Service (Interbull), that is located in Uppsala, will be utilized for this step.

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Table 1.

Variation among progeny groups of Swedish Friesian bulls in stillbirth rate (%). First-calvers recorded in the Swedish milk-recording scheme (Berglund & Philipsson, 1992)

	Number bulls*	% stillbirth rate best bull	% stillbirth rate worst bull	Proportion of bulls (%) with >10% stillbirths
Sire of calf	200	1.3	18.7	20
Maternal grandsire of calf	200	0.5	18.3	19

* the latest 200 proven bulls for stillbirth with at least 150 calvings

