# Definition of Calving Traits – Results from Swedish Research

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## Introduction

Calving performance and stillbirth rate in dairy cattle were recognised already in the 60´s and 70´s in several European countries as traits showing considerable genetic variation and being of economic importance (eg. Van Dieten, 1963; Dreyer, 1965; Philipsson, 1976). Research and other activities to reduce the problems have been conducted in many countries, although seldom covering the full complexity of the traits to consider.

Despite the efforts made serious increases in stillbirth rate have been noted in the last two decades in a number of countries for holstein cattle. Swedish data show an increased stillbirth rate in holstein heifers from 5.4 to nearly 11% (fig. 1). Similarly Danish and Dutch data reveal average stillbirth rates of 11-12% at first parity of their holstein populations (Pedersen, 2000; Harbers et al., 2000). Studies of the North-American population show an increase in stillbirth rate at first parity from 9.5% in 1985 to 13.2% in 1996, while the increase in cows was moderate, from 5.3 to 6.6% (Meyer et al., 2001). Such levels of stillbirth rate at first calving are alarming, not least because of the presently on-going increase of dead born calves.

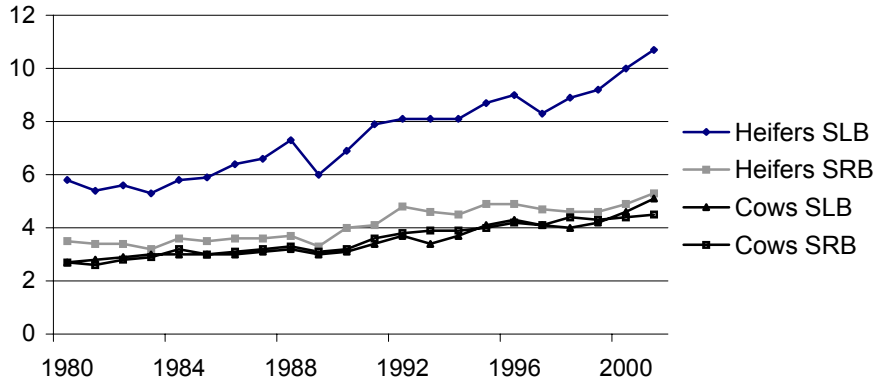


Figure 1. Trends in stillbirth rate of the Swedish Red and White (SRB) and Swedish Holstein (SLB) breeds according to the milk-recording statistics.

Although, calving results have been kept rather unchanged for the red breeds in Scandinavia, obviously the transition of the old friesians to holsteins has led to a radical increase in stillbirth rate at first parity. This is generally not accompanied by a similarly increased incidence of difficult calvings. Previously 60% of the stillborn calves were born at difficult calvings, now less than 50% belong to this group. Thus, the increased stillbirth rate seems at least partly to be a matter of declining vitality of calves at birth. Whereas large differences between parities exist for holsteins only marginal differences, and furthermore at a relatively low rate, are seen between parities in the SRB breed. In this breed less than 40% of stillborn calves at first parity are born at difficult calvings.

Obviously it is important to distinguish between different calving traits such as stillbirth and calving difficulty, and that these may have different expressions in heifers and cows as well as between breeds, and that each of these traits has a direct and a maternal component.

Biologically the causes for difficult calvings and stillbirths may vary between breeds and parities, which may be reflected in a number of genetic parameters, and consequently also in genetic evaluations and their role in the design of breeding programs. The purpose of this paper is to present some findings as regards genetic parameters from recent Swedish studies by Steinbock and co-workers and to discuss the choice of traits for genetic evaluations and possible implications for international evaluations.

## Definitions

The definition of calving traits was extensively discussed in an EEC working group report already in the 70's, and later as part of the GIFT project (Philipsson et al., 1979; Groen et al., 1998). Generally, calving performance is subjectively scored by herdsmen in 2-4 classes. Although it may be difficult to get exactly the same standards practised for classification of calvings, it is even more important to assure that all calvings, also the unattended, to be reported. Regarding stillbirth the general guideline is to consider calves stillborn if they are born dead or died within 24 hrs after birth. This measure has proven to be practical and easy to register and is an objective measure that allows populations to be regularly monitored for stillbirth rate. By nature calving traits depend on both the calf and the dam and their interactions. Thus, for genetic evaluation purposes one needs to distinguish between calf (direct) and dam (maternal) traits if these are not closely correlated.

## Genetic parameters

*Heritabilities*

In Table 1 the heritabilities on the visible scale, as well as on the underlying scale, are shown for both the Swedish Holsteins and the Swedish Red & White cattle at first and second parity. The levels of heritability, also after adjusting for the incidence levels, are generally of a much higher magnitude in Holstein heifers than in 2nd-calvers of the same breed. SRB-values are much lower than those of SLB in heifers, whereas no real difference between the breeds is seen among cows.

Table 1. Heritabilities (%) on the visible scale (underlying scale) for calving difficulty (CD) and stillbirth (SB) at first and second parity calvings of Swedish Holstein (SLB) and Swedish Red & White (SRB) cattle (from Steinbock et al., 2003 and Steinbock, 2003).

| Trait | SLB | | SRB | |
|---|---|---|---|---|
| | parity 1 | parity 2 | parity 1 | parity 2 |
| CD | | | | |
| direct | 6.2 (19) | 0.4 (2) | 2.6 (13) | 0.6 (6) |
| maternal | 4.8 (15) | 0.2 (1) | 1.8 (9) | 0.3 (3) |
| SB | | | | |
| direct | 3.8 (14) | 0.7 (4) | 0.7 (3) | 0.7 (4) |
| maternal | 2.8 (11) | 0.3 (2) | 0.5 (2) | 0.2 (1) |

The genetic variation as expressed in ETAs among sires show a variation in stillbirths of 3-16% in holstein heifers and 1-4% in cows of the same breed.

*Genetic correlations*

The differences in heritabilities between parities raise the question whether calving traits could yet be considered the same traits in both heifers and cows. Similarly, should stillbirth and calving difficulty be seen as distinctly different expressions of the same trait as less than half of the stillborn calves are born at difficult calvings? Table 2 gives the genetic correlations estimated in the two breeds between parities as well as between calving difficulty and stillbirth within the same parity.

Table 2. Genetic correlations between CD and SB as direct and maternal traits within and between parities for SLB and SRB (from Steinbock et al., 2003 and Steinbock, 2003).

| Traits | | SLB | | SRB | |
|---|---|---|---|---|---|
| | | direct | maternal | direct | maternal |
| CD | (parity 1-2) | 0.61 | 0.71 | 0.85 | 0.76 |
| SB | (parity 1-2) | 0.45 | 0.48 | 0.83 | 0.85 |
| CD-SB | (parity 1) | 0.80 | 0.74 | 0.83 | 0.85 |
| CD-SB | (parity 2) | | | 0.75 | 0.71 |

The results indicate clearly that calving traits must be considered as different traits in heifers vs. cows in the holsteins, especially so for stillbirth ($r_G$ less than 0.5), whereas this difference is not as obvious in the SRB breed. In fact the correlations between parities are on average above 0.8 in this breed. The conclusion that the calving traits in heifers vs. cows should be considered as different in one breed (SLB), and less so in another (SRB), is supported by the fact that calving problems are obviously much more frequent in holstein heifers than in any of the other categories, and that they are to a much higher degree genetically determined in this group than in the others.

The genetic correlations between calving difficulty and stillbirth were all above 0.74 and slightly higher in SRB than in holsteins. With the rather low heritabilities experienced for these traits it would be advantageous to register both traits. Furthermore, as the genetic correlations between direct and maternal traits, for both calving difficulty and stillbirth of both breeds, are on average -0.1, one needs to have genetic evaluations of bulls as both sires and maternal grandsires of the calves.

## Monitoring and/or selection

It seems in all recording schemes wise to register at least all stillbirths, to have an opportunity to monitor the developments of a breed based on objective data. If the calving traits show a significant genetic variation genetic evaluations of AI sires seem unavoidable in a serious breeding program. If the problems in a breed are serious, as is the case in holstein heifers, selection to reduce the problems is important to apply. In a breed with limited problems, it may be enough to monitor the bulls, just to have an opportunity to avoid some of the worst bulls from being mated to heifers. If heritabilities as well are very low, as in the case of SRB, genetic evaluations may be rather unreliable, if not very large progeny groups are available. If correlations are high between heifer and cow results all data will be quite useful to improve the reliability of the proofs. In holsteins emphasis must be put on first-calvers, as they represent the group showing real problems and that exhibit the highest genetic variation.

## Implications for international evaluations

The results from the genetic analyses of both heifers and cows of the two main dairy breeds in Sweden the following conclusions may be drawn as regards possible implications for international evaluations:

- The increasing trend of stillbirths in holstein heifers indicates the need for international evaluations for this breed, and that both direct and maternal traits are considered. Emphasis should be put on first-calver data, as these represent the real calving problems of the breed.
- Results of the holstein breed are not automatically applicable for other breeds. Studies of incidence levels and genetic parameters must be conducted for each breed to assess the data and models for genetic evaluations, as well as the value of genetic selection vs. monitoring and some differential use of bulls on heifers vs. cows.
- Studies should include both stillbirth and calving difficulty in heifers and cows separately in order to determine the importance and causes of the problems in actual breeds and age categories.
- Incidence level and degree of genetic variation are important parameters when assessing the value of conducting MACE for international evaluations. Low levels indicate low reliability of proofs and less value of international evaluations.

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