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Stillbirths in Holstein heifers – some results from Swedish research

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Background

There is a general agreement among scientists of a declining trend in conception and calving rates in high yielding dairy Holstein cows [1]. The gradual increase of stillbirth rates in Holstein heifers during the last 20 years however, has until recently received relatively little attention. One of the earliest reports on the problem of stillbirths was presented by Berglund & Philipsson at the EAAP-congress in Madrid 1992 [2]. These authors reported a large variation between bulls in stillbirth rates, defined as calves dead at birth or within 24 h after birth and after at least 260 days of gestation, and claimed the importance of testing foreign AI bulls and not accepting those with high stillbirth rates. However, the increasing stillbirth rates were at that time met with some scepticism and explained by different factors such as artefacts in the recording system or being caused by voluntary killing of calves by farmers due to low prices.

The difficulty of getting acceptance of the problem was also supported by the traditional view that stillbirths in general are a result of calving difficulties. Since rates of calving problems reported were rather stable it was difficult to get acceptance of the existence of a growing number of stillbirths not associated with dystocia. Recently however, several reports e.g. from USA, Denmark and Holland show stillbirth rates of 10–13% in Holstein heifers comparable with those reported in Sweden (e.g. [3-5]).

General causes of stillbirths

Calving difficulty is long regarded to be the most important reason for stillbirth. Stillbirth and calving difficulties are caused by genetic and/or environmental factors. Both the genotype of the calf (direct effect) and of the dam (maternal effect) affects the risk of calving difficulty and stillbirth. The direct effect is defined as the ability of the calf to be born without problems and the maternal effect as the ability of the dam to calve without problems.

Birth weight and sex of calf, parity and age of dam and season of calving are all factors associated with calving difficulties and stillbirths. Other causes of stillbirths not related to calving difficulties are, for example, infections (e.g. Bovine Virus Diarrhoea), insufficient placenta development, metabolic disorders of the cow, and congenital malformations of the calf. There is also a management part of the problem. Care of the pregnant cow before calving and supervision of the calving process are important factors. The latter can be illustrated by data from the Swedish AI and milk recording systems indicating that heifers and cows mated by a non-registered bull have around two percent higher stillbirth rates compared with females mated by an AI bull (Nils-Erik Larsson, Swedish Dairy Association, personal communication). There is a slightly increasing trend in Sweden to use a bull to mate heifers instead of AI, which makes it difficult to predict the time of calving and thereby increase the risk for unobserved calvings.

The nature of stillbirth in the Holstein heifer

In Sweden, stillbirth rates in Holstein heifers have increased from 6% to around 11% during the past 25 years. At the same time, reports of difficult calvings have increased from 6% to 7%. These trends indicate a growing problem with stillbirths not associated with calving difficulties. This is further supported by a study in which 67 stillborn calves from Holstein heifers in 41 farms were examined post mortem in order to find possible reasons for stillbirths [6]. Malformations were found in only approximately 5% of the calves while 46% had signs of calving difficulties (trauma). As many as one third (32%) were clinically normal and full-term and without any signs of calving difficulties. It was concluded that only half of the stillborn calves could be explained as caused by calving difficulties.

These results were also in agreement with another study based on an inquiry from 274 Holstein herds in which 3594 heifer calvings were supervised by the herdsman and data recorded according to a protocol [7]. A total of 10.5% of the calvings resulted in a stillborn calf and 55% of these were reported born at easy or normal calvings (unassisted or assisted by one person). At difficult calvings (assisted by more than one person or veterinary assistance) stillbirth rates were 4–8 times higher than at easy or normal calvings. All calves were weighed and it was concluded that the average birth weight of Holstein calves had not changed since the seventies and therefore could not be a part of the problem. Furthermore the study showed that the risk of stillbirth was enhanced at short and long gestation, at calvings during winter and spring and if the heifer was older than 29 months at calving.

Genetic studies

In the pilot study by Berglund & Philipsson [2] based on reports from 645 first calvers from 73 randomly chosen SLB herds in Sweden, there was a clear effect of more difficult calvings and higher stillbirth rates with an increased proportion of Holstein genes in the sire. There was a large variation in stillbirth rates among bulls both as fathers and grand-fathers ranging from 1.3% to 19%.

Genetic effects of stillbirths were later investigated in more detail and presented in a paper by Steinbock et al. [8]. It was found that the heritability of stillbirth was 4% for the direct effect and 3% for the maternal effect at first calving, while it dropped to below 1% in the second calving. This means that the heritability for stillbirths in Holstein heifers have increased almost 2-fold during the last 30 years reflecting the increased phenotypic stillbirth rates. It is likely that the increasing rates are to a certain degree due to the influx of North American Holstein genes through the import of semen and embryos that started in the 1980s and continued during the study period. Heritability for stillbirth was halved when adjustment was made for calving difficulties. Thus this again confirms that considerable genetic variation in stillbirth rates and the vitality of calves at birth remains independent of calving performance. At second calving there has only been a moderate increase in stillbirth rates over the years and no increase in heritibility. The reason behind this difference between first and second calvers is unknown but it could be speculated that heifers have gradually changed phenotypically and may have been less mature at the common calving age resulting in a lower capacity to support and nourish a growing foetus. Another hypothesis is the increasing level of inbreeding in the Holstein breed causing more pronounced effects on the vitality of calves from first calvers as found by Adamec et al. [9].

Patho-physiological studies

When do the calves die: during late gestation, during parturition or shortly thereafter? Is placenta insufficiency a possible cause? These questions were addressed in another Swedish study by Kornmatitsuk et al. [10].

Twenty Swedish Holstein dairy heifers sired by bulls with breeding values indicating a high risk of stillbirth (3.5–9% higher than the average, experimental group) and a low risk of stillbirth (0–6% lower than the average, control group) were selected based on information in the Swedish AI data base. The heifers were kept at the SLU clinic in Uppsala and supervised continuously from 6–7 months of pregnancy up to birth. The pregnancies and parturitions were compared between groups regarding e.g. clinical findings, hormonal levels, placental characteristics and calf viability. In the experimental group (n = 12), 3 stillborn calves, one associated with calving difficulties, were born while all calves (n = 8), in the control group were born alive without assistance. Based on clinical recordings performed, all stillborn calves were alive until the start of the parturition process. The results also show that, in this very limited sample, there was a clear difference between bulls in relation to breeding values for stillbirths.

No significant difference regarding gross morphology of the placenta was seen between the groups or individuals. Deviating profiles of oestrone sulphate (E1SO4) and pregnancy associated glycoproteins (PAGs) were observed from 6 weeks before parturition in the two heifers delivering a stillborn calf not associated to dystocia compared with all other animals in both experimental and control groups. This supports the earlier indications that two types of stillbirths occur with different aetiology: one with and one without associations with dystocia.

Since both hormones are associated with the placenta function, placental dysfunction was suggested as a possi-

ble factor behind stillbirths with no calving difficulty. The findings also suggest that the analyses of E1SO4 and PAGs could be used to monitor foetal well-being in animals with a high risk of stillbirth at term.

The future

Today the bull centres and AI organisations are aware of the stillbirth problem associated with the Holstein breed and cull bulls with poor breeding values for stillbirths. Due to a growing concern of animal health and welfare issues among consumers, the problem has become of more interest for the dairy industry. There is also an increasing awareness that stillbirths cost money for the dairy producer. Based on Danish production systems the marginal cost of stillbirth was 210 to 280 EUR per cow (cit. [3]).

However the problem will probably exist for a long time and may be seen as a part of the increased reproductive loss from fertilization up to birth observed in high yielding Holstein female animals. An informal European stillbirth working group, consisting of researchers from several European countries, has pointed out the emergence of idiopathic stillbirth as a challenge for research to geneticists, pathologists and physiologists.

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