

# Risk factors for perinatal mortality in dairy cattle: Cow and foetal factors, calving process

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## Abstract

It was the aim of this study to identify risk factors of perinatal mortality (PM) on a large dairy farm in Germany. Four hundred and sixty-three cows were observed continuously around calving. Data such as the lactation number, body condition score, pelvic measurements, duration of second stage of labour (SSL), degree of abdominal press (AP), presentation/position/posture of the calf, calving classification, various measurements of the calves and every action of the barn staff were documented. Calves born dead and those that died within 24 h were classified as cases of PM. Logistic regression was performed to identify risk factors for the dependent variables PM, SSL and AP. 9.7% of all calves born ( $n = 483$ ) were classified as PM. In the logistic regression model, only SSL and presentation/position/posture of the foetus remained as significant effects for PM. The odds ratio for PM was 0.20, when SSL was  $\leq 120$  min, and 0.33, when the calves were born in anterior presentation, upper position and normal posture. With regard to SSL, primipara, insufficient AP, assisted calvings and as a trend, work shift changeover, these were risk factors for a prolonged SSL beyond 120 min. The risk for insufficient AP was lower when the calves were born spontaneously, in anterior presentation and as single calves. In conclusion, the duration of SSL and presentation/position/posture of the calf seemed to be key risk factors for PM. Interventions should be considered when SSL lasts longer than 2 h. Insufficient monitoring around parturition had a negative effect on the duration of SSL and thereby, indirectly on PM.

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## 1. Introduction

Several studies reported a continuous increase in the frequency of stillbirth throughout the last decades in many countries [1–3]. In the USA, stillborn calves cause economic damage of about 125 million US\$ annually due to loss of calves [1]. Additional economic losses result from a decreased milk yield [4,5] and a higher risk

of endometritis and retained placental foetal membranes [6,7] in the affected dams. Therefore, the clarification of causes and risk factors of an increased rate of stillbirth is of special interest. The term stillbirth often includes calf mortality shortly before, during and within 24 or 48 h after parturition [8]. For this reason, the term perinatal mortality (PM) will be used throughout the following text.

Perinatal mortality has been associated with genetic [3,9] and a variety of nongenetic factors [8]. Among these factors are the lactation number with primipara being at a higher risk of PM [1,3,10,11] and dystocia [1–3,8,12,13]. Weak or lack of myometrial contractions and incomplete widening of the cervix uteri or vulva

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have been suggested as other risk factors [8,14]. In addition, the management, especially the monitoring around parturition plays a major role [13].

Many studies that deal with causes of increased PM are retrospective and/or used data derived from dairy farmers. There is a lack of prospective investigations with a detailed documentation of the birth process, recording parameters such a quality of abdominal contractions, length of the birth process (especially the second stage of labour (SSL) as defined by the interval from rupture of the allantoic/amniotic sac to the passage of the foetal front head (anterior presentation) or the pelvis (posterior presentation) through the vulva [15]), exact measurements of the foetus and the dam as well as the management of calving cows.

It was the aim of this study to identify risk factors of increased PM in a large dairy herd in Saxony, Germany, by continuously monitoring the birth process and thereby, obtaining detailed data about the course of labour and related activities of the farm staff. In addition, measurements of the dams (e.g. size of the pelvis, body condition score) and the foetus (e.g. weight, diameter of the fetlock, etc.) were collected.

## 2. Materials and methods

### 2.1. Animals

The study was performed on a dairy farm in Saxony, Germany, from 24.04.2004 until 03.08.2004. During this time period, there were 1542 lactating and approximately 269 dry cows. In addition, the farm housed 1479 heifers (aged 6 months and older) and 425 calves (up to 6 months). The average herd milk yield was 8168 kg. The breed was primarily German Holstein (Black Pied) and some crossbreedings of German Holstein with Black Pied Dairy Cow.

Lactating cows, dry cows and heifers (9 months and older) were housed in free stalls in groups of approximately 100 animals. Animals were fed a Total Mixed Ration (TMR) consisting of grass silage, corn silage, straw, corn meal, barley, soybean meal, rape meal, sugar beat chips, minerals, molasses, non-degradable protein and propylene glycol according to age, stage of lactation or milk yield performance. Starting in June, fresh alfalfa and clover were added to the TMR.

Approximately 1 week before the calculated calving date, animals were transferred to the calving area, which consisted of a stanchion barn with rubber mats bedded with wood shavings (short standing (120 cm

wide × 185 cm long) with metal gratings (70 cm wide) covering the dung channel). The metal gratings were covered with rubber mats when a cow was seen to be in labour.

### 2.2. Experimental protocol

Cows were continuously observed by two skilled investigators once they had entered the calving area until completion of parturition. All observations, especially the more subjective measurements, were tuned between the investigators in order to minimise interobserver variation.

The following data were collected from the dams: number of lactations, age, date of last insemination. The body condition score was determined according to Edmonson et al. [16] on a five-point scale with 0.25 increments. The distance between the ischial or the hip bones and the length of the pelvis were measured with a calliper-like measuring device. The inner width of the pelvis was determined with a pelvic circle according to Bouloire, Menissier and Vissac by rectal palpation [17]. The degree of pelvic adipose tissue was estimated semiquantitatively during rectal palpation. Furthermore, the height at the sacrum and the position of the pelvis were recorded. Definitions of the various measurements are shown in Table 1. Upon the first signs of the forthcoming labour (uneasiness, vaginal discharge, abdominal contractions), all actions of the animals and the farm staff assigned to the calving area were documented. Also a work shift changeover, meaning that a calving started during one shift and ended during another, was documented. The investigators did not intervene in the birth process or have any contact with the staff that could have had any influence on the performance of the staff. The following parameters were recorded: degree of abdominal contractions, duration of the second stage of labour, presentation, position and posture of the foetus, classification of the birth process (for definitions see Table 2).

After parturition, measurements of the calf were taken with a calliper: neck-rump length, vertex distance, width and height of the fetlock joint, cannon bone diameter (for definitions see Table 3). In addition, sex and weight were recorded.

Calves that were born dead or died within 24 h after parturition were classified as stillborn calves (perinatal mortality) and sent to the Institute of Veterinary Pathology, Veterinary Faculty of the University of Leipzig for pathological, anatomical and histological examination.

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