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Calving Ease and Perinatal Mortality – Causes and Implications

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Calving ease and perinatal mortality are functional characteristics of high economic significance. The percentage of difficult calvings in Holstein-Friesian cattle populations varies and ranges from 2 to 13.7% (Mee, 2008). Calf mortality ranges from 3.5 to 10% (Mee et al., 2008). In Poland, the most recent population-based studies on the frequency of difficult calvings were carried out in 2010 (Pogorzelska and Nogalski, 2010). Then, the frequency of difficult births in cows was estimated at the level of 3.86% while perinatal mortality of calves was equal to 5.62% (Pogorzelska and Nogalski, 2010). In other studies, the authors found that the percentage of difficult calvings amounted to 15.16% for heifers, and 4.50% for cows (Sawa, 1994). In turn, Fenlon et al. (2017) estimated the percentage of calvings requiring veterinary assistance at the level of 5.9%.

Difficult calving and perinatal mortality of calves can reduce the profitability of dairy farms in a significant way. The main consequence of difficult calvings is the increase in perinatal mortality of the offspring (Meyer et al., 2001, Berglund et al., 2003), which occurs most frequently during the first hour after the birth (Mee, 2004). In addition to increasing the number of stillbirths, the course of delivery has a decisive impact on the health of the offspring. In calves that have survived prolonged and complicated calving there may occur hypoxia (Lombard et al., 2007), metabolic and respiratory acidosis (Lombard et al., 2007), internal injuries (Berglund et al., 2003; Gundelach et al., 2009) leading to a reduction in neonatal viability and, thus, a reduced caloric ability of thermoregulation. The absorption of immunoglobulins from colostrum is also reduced which, in turn, leads to a decrease in passive immunity (Bellows and Lammoglia, 2000). This means that health and survival of calves in the postpartum period are deteriorating (Lombard et al., 2007). There is also a reduction in survival and milk yield of mature heifers derived from difficult calvings (Barrier et al., 2013, Henderson et al., 2011, Heinrichs and Heinrichs, 2011).

Difficult calvings and perinatal mortality of calves cause a number of health consequences for the cow. In cows that have experienced difficult calvings and have given birth to dead calves, injuries, diseases related to the postnatal period and metabolic diseases, such as foetal membrane retention, uterus inflammation, ovarian cysts, genital tract infections, postpartum paralysis, abomasum dislocation or prolapse of the uterus are diagnosed much more often (Correa et al., 1993, Emanuelson et al., 1993; LeBlanc, 2008, Benzaquen et al., 2007, Stevenson and Call, 1988). The development of these diseases is favoured by bacterial infections which can develop in two ways, namely, as a result of inadequately provided obstetrical help or the unfolding of a foetus in the uterus (Ghavi Hossein-Zadeh, 2013; Dohmen et al., 2000).

In turn, diseases and injuries resulting from difficult calvings and perinatal mortality of calves lead to fertility disorders. The postnatal and inter-pregnancy period is longer and the effectiveness and delay of the first insemination is reduced (López de Maturana et al., 2007 a, Gaafar et al., 2011, Eaglen et al., 2011, Bicalho et al., 2007). In addition, more insemination procedures are necessary for effective fertilisation (Dematoviev and Berger, 1997). Dematawewa and Berger estimated that reduced fertility resulting from difficult calvings accounts for 30% of the costs associated with the occurrence of birth complications.

Health impairment and impaired fertility in cows after difficult births and those that gave birth to dead calves are associated with decreased milk yield (Dematawewa and Berger, 1997; Rajala and Gröhn, 1998; Berry et al., 2007; Thompson et al., 1983 Eaglen et al., 2011, Tenhagen et al., 2007). It is even higher when the birth is more difficult (Dematoviev and Berger, 1997). Heinrichs and Heinrichs (2011) showed that increasing the difficulty of calving by 1 degree (delivery process classified on a 3-point scale) resulted in a reduction in milk yield by 195 kg of milk and 2337 kg of milk over the entire period of use. In turn, the birth of a dead calf resulted in a reduction in the daily milk yield by 1.1 kg (Bicalho et al., 2008).

Complications occurring during calving and diseases resulting from difficult births and perinatal mortality of calves can lead to the death of cows (Dematawewa and Berger, 1997, Bicalho et al., 2007). It is estimated that complicated calvings cause 6 to 31% of deaths of cows registered in dairy herds (Stevenson and Lean, 1998, Thomsen et al., 2004, Menzies et al., 1995). Deaths most often occur within 48 hours after the calving (Ghavi Hossein-Zadeh, 2013). In addition, cows which have undergone fertility and decreased milk yield due to difficult births and calving mortality are more prone to culling, especially at the beginning and the end of lactation (Tenhagen et al., 2007; Rajala-Schulz and Gröhn , 1999, López de Maturana et al., 2007 b).

Factors affecting the occurrence of difficult calvings and perinatal mortality of calves can be divided into those related to the cow-mother and the calf itself. They are also divided into genetic and environmental character. The main cause of difficult calvings and increased mortality of calves, especially in the first calvings, is the maternal-foetal disparity (Meijering, 1984). It manifests itself as a disproportion between the surface of the pelvic canal and the size of the calf (Nogalski, 2003), which is a combination of the properties of the cow and the calf. It is estimated that more than half of difficult births are the result of labour disproportions (Citek et al., 2011).

Another important factor affecting the occurrence of difficult calvings and the mortality rate is the age (subsequent calving) of cows. The frequency of difficult calvings of the first-calving cows and the mortality rate of the calves are two to four times higher than those of multiparous cows (Philipsson, 1976, Meijering, 1984, Johanson and Berger, 2003). One of the reasons affecting the differences between the first-calving and multiparous cows is the aforementioned smaller area of the pelvic canal (Meijering, 1984). An important difference is observed in the construction of the rump part between the first-calving and multiparous cows, especially in the width of the rump and its angle (Nogalski, 2005; Wójcik and Kruk, 2010). In addition, the births of the first-calving cows are usually longer than the births of multiparous cows (Reklewska et al., 1993). Age differences in cows calving repeatedly do not affect the occurrence of difficult calvings and mortality of calves in the perinatal period (Meijering, 1984, Przysucha et al., 2005). Czerniawska-Piątkowska and Kotowska (2017) have compared the first-calving and multiparous cows in terms of their usefulness and the age of the first calving. It was found that the calves were characterised by larger increments. Compared to them, the multiparous calves were characterised by a larger birth weight.

The length of pregnancy affects the course of labour and the frequency of still-born calves. Both too short and too long pregnancy are associated with more difficulties during delivery and increased calving mortality in the perinatal period (Brzozowski et al., 2016, Bleul, 2011). Too short pregnancy leads to an increase in perinatal mortality of calves and, consequently, contributes to earlier and more difficult calvings (Fiedlerová et al., 2008). In addition, animals born after short pregnancies are characterised by poorer vitality (Zaborski et al., 2014). Increased perinatal mortality after short pregnancies is probably caused by the immaturity of the internal organs of calves (Bleul, 2011). Difficult births after longer pregnancies are the result of greater birth weight and size of calves (Mee, 2008), which, in turn, are associated with increased mortality.

Factors affecting the occurrence of difficult calvings and mortality of calves in the perinatal period are primarily sex, calf weight, multiple pregnancies and abnormal presentation of the foetus. There are more difficult births and increased mortality among male calves than female ones (Fiedlerová et al., 2008, Mee et al., 2008, Bleul, 2011, Lombard et al., 2007), which may be related not

only to their greater birth weight, but also to morphological differences between the sexes (Philipsson, 1976, Bleul, 2011). Berger et al. (1992) showed that even with equal masses of birth, the births of male calves were more often associated with greater complications than the births of female calves, which may be a consequence of the influence of various hormones on the delivery process (Philipsson, 1976). The impact of the sex of calves on the course of labour and the occurrence of perinatal mortality of calves is also evident during twin births, where difficult births and stillborn births dominate among single-sex male calves (Gregory et al., 1996).

The birth weight of calves is a factor unquestionably linked to the course of births and perinatal mortality of calves. Too high calf mass at birth increases the risk of difficult calving and the death of the calf (Mee, 2008; Johanson and Berger, 2003). The interdependency between calf weight at birth, calving ease and perinatal mortality is probably not linear (Meijering, 1984), which means that more vulnerable are both very light and very heavy calves (Kornmatitsuk et al., 2004; Mee, 2008; Piwczyński et al., 2013).

Multiple pregnancies more often than single ones are associated with more difficult births and higher rates of stillbirth (Berry et al., 2007, Benjamínsson, 2007, Przysucha et al., 2009, Bleul, 2011). Labour difficulties occur twice as often after multiple pregnancies than after single pregnancies (Kuźma and Kuźma, 1994, Mee et al., 2011). The frequency of mortality of calves in perinatal period after single pregnancies is within the range of 3.6-7.8% and after multiple pregnancies it ranges from 14.3 to 28.2% (Sawa, 1994; Gregory et al., 1996; Silva del Río et al., 2007). The increase in the number of difficult births in cows bearing twins is the result of incorrect positioning of one or both foetuses during delivery (Lombard et al., 2007; Echternkamp et al., 2007), a higher total foetus birth weight (Max, 1996) and more dead calves (Bell and Roberts, 2007) and a long and painful delivery - both for the mother and the offspring (Bayram et al., 2015). In turn, Max (1996) asserts that the cause of reduced survival of calves in the perinatal period is a shorter pregnancy.

The foetal presentation is described by means of three concepts: location, posture and position. Effortless calving can only take place if the calf is in the straight position, the upper posture, and the straightened head and neck lie on the straightened limbs (Holland et al., 1993). Incorrect positioning of the foetus contributes to the occurrence of labour difficulties or even excludes the possibility of the foetus passing through the female genital tract. The frequency of abnormal foetal presentation during delivery varies, according to different authors, from 1 to 6% (Meijering, 1984, Nix et al., 1998, Bennett and Gregory, 2001, Mee, 2008). Incorrect foetal positioning is the main reason for difficult births in multiparous cows, in which it is responsible for 20-40% of complicated calvings (Meijering, 1984). Calf births that have had an abnormal delivery presentation are twice as much at risk of maternal delivery complications (Mee, 2008) and a fivefold higher risk of perinatal calf mortality (Gundelach et al., 2009).

Genetic influences in the first place are related to cross-breed differences. Generally, cows of meat breeds are characterised by a higher percentage of difficult births and stillbirths as compared to cows of dairy breeds (Zaborski et al., 2009, Bleul, 2011). The largest proportion of difficult births is found in the Belgian White-Blue cows, in which over 90% of births are resolved by caesarean section (Kolkmann et al., 2007, Zaborski et al., 2009). When comparing the population of dairy cows with respect to difficult births and stillbirths, many authors show the highest proportion of birth complications and stillbirths in the Holstein-Friesian cows (Berry et al., 2007, Heins et al., 2006, Ferris et al. 2014, Olson et al., 2009). In addition, the effect of cross-breeding on the course of labour was demonstrated. Heins et al. (2006) estimated that the Holstein heifers had statistically significantly more cases of difficult calvings and dead births (17.7 and 14%, respectively) as compared to the heifers of hybrid Normandy breeds (11.6 and 9.9%, respectively), Montbeliarde (7.2 and 6.2%, respectively), Scandinavian Red (3.7 and 5.1%, respectively) and Holstein.

Among the environmental factors that do not have genetic components, the most important include the calving season, the calving year and the herd. The calving season affects the occurrence of difficult births and the mortality of calves in the perinatal period, however, not all the studies have found a determinate seasonality. The general opinion is that the summer season favours easier calving

and the survival of calves (Steinbock et al., 2003, Johanson and Berger, 2003, Mee et al., 2008). The opposite opinion is presented by Przysucha et al. (2006) and Meyer et al. (2001), who reported the largest share of difficult births and stillbirths in the summer months. Easier calving in the summer season is facilitated by a longer daylight, easier access to the pasture, greater possibility of movement, and, thus, improvement in the condition of cows (Philipsson, 1976). In turn, colder months are associated with prolonged pregnancy, increased calf weight and more difficult births, i.e. factors affecting the occurrence of stillbirths.

In the case of the impact of the year of calving on the course of labour, it is difficult to speak of any regularities. Some authors have found a tendency in the period they studied to reduce the number of calvings that require assistance or difficult calvings (Meyer et al., 2001; Brzozowski et al., 2016), while others showed an upward trend (Steinbock et al., 2006). In most of the works on changes in the frequency of stillbirths, however, there was a tendency to increase mortality rates of calves in subsequent years (Meyer et al., 2001, Benjamínsson, 2007).

Among the herds, one can notice differences in the percentage of difficult births and the perinatal mortality of calves. The herd's influence includes a group of factors related to, among others, the maintenance system and the number of animals in the herd. The free-maintenance system has a beneficial effect on the ease of calving (Majewska, 2006), but calves born in this type of cowshed are more at risk of the perinatal death (Gulliksen et al., 2009). It is assumed that with the size of the herd the share of difficult calvings increases (Pogorzelska and Nogalski, 2010). However, Bleul (2011), comparing herds of fewer than 30 basic herd cows with the larger ones, found that problems with difficult calving occur more frequently in herds of fewer animals.

The importance of the calving ease and the perinatal mortality of calves, resulting from the consequences of difficult calvings and dead births, is reflected in the global and specific selection indices and breeding programs implemented in the world. For example, in Norway, delivery and perinatal calf mortality were included to the total Norwegian bovine breeding stock index in 1978. As a result, in 2007, the perinatal calf mortality rate was 2%, and 95% of calvings were easy (Heringstad et al., 2007).

Summary

The research results quoted in this study indicate the importance of the course of delivery and the perinatal mortality of calves in improving the high-production population of dairy cattle. Difficult births and the increasing perinatal mortality of calves have a significant impact on the economy of milk production. They increase the costs associated with veterinary care as well as shorten the cows' longevity. Therefore, in many countries these features are included in the selection indices, and the selection leads to the decrease in the perinatal mortality of calves and a favourable increase in the frequency of easy births.

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CALVING EASE AND PERINATAL MORTALITY – CAUSES AND IMPLICATIONS

Summary

Calving ease and perinatal mortality are functional traits of high economic importance. The losses caused by difficult calvings and perinatal mortality include loss of calf, death of dam, reduced fertility, increased risk of subsequent health problems, milk yield decrease and increased culling. The factors affecting calving ease and perinatal mortality can be divided into maternal (cow pelvic area, dam age and parity, gestation length), foetal (calf sex, calf birth weight, multiple calvings, malpresentation), genetic (breed), and environmental (year and season of calving).

Key words: calving ease, perinatal mortality