Risk Factors Associated with Dystocia in Romanian Spotted Cows

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Abstract

The aim of the current research was to determine the risk factors associated to dystocia in 400 Romanian Spotted cows. Calf sex, season of calving, dam's parity, productive level and the type of birth were related to the incidence of dystocia. Calf sex was not associated to the incidence of dystocia, with no significant effect (25.25 *vs.* 22.25% for males and females, respectively, P>0.52). Season of calving had no significant effect on dystocia, comparable incidences of dystocia in the summer and winter seasons (26 *vs.* 20.5%, P>0.2) being recorded. A comparable incidence of dystocia was obtained according to cow's parity (27 *vs.* 23.5%, P>0.475) in primiparous and multiparous animals. High producing cows experienced a higher incidence of dystocia compared to lower producing cows (37.75 *vs.* 22.25%, P≤0.018). The twin pregnancies were the major factor related to dystocia in cows, causing a higher prevalence of dystocia compared to single (39.25 *vs.* 19.5%, P≤0.001). Concluding, the production level and type of birth were the main risk factors for dystocia. The sex of calves, the season of birth and the parity had no influence on dystocia incidence, conversely to other studies. In this respect, additional studies should be performed in order to include other factors and validate their influential level.

Keywords: cow, dystocia, risk factors, Romanian Spotted;

1. Introduction

In the dairy industry, where the primary revenue source is milk production, calf delivery is undervalued as areas of concern. The problem of dystocia has been almost ignored. Very few dairy producers incorporate breeding strategies to decrease dystocia occurrence, or have delivery management and new-born calf management protocols that specifically address the problem. Despite, or perhaps as a result of, the rate of dystocia in dairy farms is higher than in beef farms. The impacts of dystocia in dairy animals will logically include an increased death and disease in calves, reduced productivity in the dams, increased disease in the dams, and the economic impacts due to an increased treatment cost, reduced calf performance, and reduced reproductive efficiency. Dystocia is defined as difficult calving resulting from prolonged and severe assisted extraction. The calving itself represents a stress factor for the new-born calf. The contact with climatic conditions, surrounding noises or contact with farmers, represents influential factors for calves' welfare also. The dystocia rates appear to have a threshold of 4-10% with a slightly increased value for heifers. Higher values (up to 22%) were reported in the USA for Holstein Friesian [1]. Unfortunately, dystocia and stillbirth are strongly correlated. Unwanted events occurred at the calving, significantly reduce both reproductive and productive performances, also the longevity of dairy cows [2]. In order of descending financial importance, dystocia significantly affects production (41% of costs), fertility (34%) and cow and calf morbidity and mortality (25%) [3]. Numerous studies reveal that dystocia has a significant impact on cow fertility and subsequent

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milk yield also on the calf health [4, 5]. Production losses are greatest in high yielding cows and in primiparous [6]. The new-born calf survival proved to be critical for dairy farm's efficiency, especially in the intensive system characterized by an increased rate of cow's replacements. Numerous studies have been conducted in this regard, being identified different influential factors. Stillbirth is usually multi-factorial in nature. A set of non-genetic factors were included in the current research in order to establish the effect on calving ease. Some of these risk factors have been associated with twinning [7], gender of calves, calf birth weight [8], season of calving [9], gestation length [10] or others influential dam's factors such as pelvic area, especially width at ischia [11]. Generally, the occurrence of dystocia could be attributed to the correlation calf-dam's size. There are numerous studies which have been found as insignificant influence of dam's size, but just the calf size. Moreover, a decreased incidence of dystocia was found in small cows' which delivered a small calf. Studies of these effects were conducted mainly on specialized breeds (dairy or beef). Dual-purpose breeds were, somewhat, overlooked. Simmental is the second largest cattle strain in the world after the Holstein-Friesian; moreover, in Romania it has an important role in the agricultural economy. The aim of the study was to determine the risk factors associated with dystocia in Romanian Spotted dual-purpose cows.

2. Materials and methods

The study was carried out at the Research and Development Station for Bovine Arad, Romania. The animals included in the current research were reared in a semi intensive system, characterized by a moderate growth rate in young animals (500-750 g / day) and moderate productive yields for lactating cows (5500-6200 kg milk / lactation). Average lifetime for lactating cows was 5.2 lactations. New born calves were separated from their dam immediately after birth and kept in individual pens up to 10 days of age. From 11 to 90 days of age, calves were kept in small groups (6 heads /group), with free access to the resting area (0.5 m² / head), moving area (1.1 m² / head) and watering space (0.03 m² / head). Colostrum was administered within the first 72 hours of life from their own mothers, twice a day at 12 hours intervals. The experimental herd consisted in 400 Romanian Spotted dual-purpose breed cows. The incidence of dystocia was evaluated related to: a) calf sex; b) season of calving; c) dam's parity; d) productive level; e) twinning. The incidence of dystocia according to different influential factors was investigated using chi square test. The level of significance was considered $P \leq 0.05$. A multifactorial regression model was used to highlight the influence level of the studied factors. All analyses were performed using statistical software (Statistica – StatSoft) version 13.11.

Use of animals and the procedures performed in this study were approved by the Scientific and Ethics Committee of the Research and Development Station for Bovine Arad of the Academy for Agricultural and Forestry Sciences, Decision no. 51 issued on November 11, 2015, also in accordance with the European Union's Directive for animal experimentation (Directive 2010/63/EU).

3. Results and discussion

In the current study, the incidence of dystocia according to influential factors has been assessed using the chi square test.

Table 1. The incidence of dystocia according to influential factors

Gender of calves		Season of birth		Dam´s parity		Dam´s productive level		Type of calving	
Male	Female	Summer	Winter	Primiparous	Multiparous	High producing	Lower producing	Single	Twin
25.25[a]	22.25[a]	26[a]	20.5[a]	27[a]	23.5[a]	37.75[a]	22.25[b]	19.5[a]	39.25[b]

Different superscript per row differ significantly at $P \leq 0.05$, within the same influential factor

According to gender of calves, chi square test analysis reveals no significant differences ($p>0.052$) regarding the incidence of dystocia (25.25% *vs*. 22.25% in males compared to females calving). The risk of dystocia proved to be higher in males, singleton and calves from pluriparous due to a higher birth weights than those female, twins and calves from primiparous, respectively. Hadi (2011) recorded significant variation for dystocia according to gender of calves, with an increased frequency in males compared to females, due to higher birth weight of males [9]. Dystocia cases occurred more frequently when the calf that was born was male than female. Consistent results were reported in previous studies conducted by Johanson and Berger, McDermott *et al.* and Ettema and Santos who founded a higher incidence of dystocia in pregnancies associated with male calves than with female calves [8, 12, 13]. Therefore, birth weight is directly related to gender of calf being in agreement with results reported by Dhakal *et al.* and Johanson *et al.* who reported that increased birth weight is associated with increased incidence of dystocia and increased rate of calf mortality. They further suggested that, irrespective of breed, the birth weight of male calves is consistently higher than their female [14, 15]. Higher birth weight of male significantly increased the risk of dystocia at birth, as well as mortality and morbidity conditions. Olson et al. considered that the association between sex of calves, birth weight and type of birth increase the risk of dystocia by 3.86 times and the risk of mortality by 7.8 times. This association was also found by Linden *et al.* [16, 17]. Crossbreeding with beef breeds, or some dual-purpose breeds, particularly European continental breeds have traditionally been associated with increased risks of dystocia [18]. Among dairy breeds, pure breeding with Holsteins is associated with increased risk of dystocia compared to crossbreeding with some other dairy breeds. For example, previous study was recorded a significantly lower dystocia incidence and stillbirth rate in Holstein cattle inseminated with Norwegian Red semen compared to those inseminated with Holstein semen, similar results being reported for Brown Swiss and Scandinavian Red [19]. Furthermore, for each 1% increase in inbreeding in US Holstein primiparous, Adamec *et al.* (2006) found at 0.30–0.42% increase in probability of dystocia [20]. The heritability of dystocia has been reported to be 0.07–0.47 in calves born to heifers [21, 22]. Thus, the rates of dystocia can be manipulated genetically by selecting for animals with favourable genotypes. Increased incidence of dystocia reported in the current research could be due to the morpho productive type of herd, which is a dual purpose one. This type could provide calves with a higher birthweight in both male and female, thus increasing the incidence of dystocia.

There are previous studies reporting that calves size and bodyweight significant influence the calving ease. Also, studies regarding dam's size reveal conversely outcomes, according to which the dam's size did not influence it. However, some results indicate that small cows deliver small calves, thus reducing the incidence of dystocia, in both males and female calves [23]. Not at least, recent research found that stillbirths of single male calves of heifers were more frequent for breedings with sexed semen than conventional semen [24]. No significant differences ($p>0.02$) were found related to season of calving (26% *vs.* 20.5% in summer compared to winter). Many conversely outcomes were found. Internationally researches conducted over time suggested that greater calf birth weight and calving difficulty may be expected in the winter following severe spring temperatures [11, 25]. The aetiology and type of dystocia are various and different factors can influence its incidence. Many previous studies have shown that season significantly influenced the incidence of dystocia in cattle [26]. Seasonal differences in dystocia risk have been attributed, generally, to an increased gestation length and increased calf birth weight. Generally, a decreasing incidence of dystocia was recorded in late spring and summer season characterized by chronic heat, due to a decrease in calf birth weight, associated with a decreased dry matter intake. Majeed *et al.* (1989) reported a higher risk of dystocia during the winter and autumn as compared with spring or summer [27]. The highest incidence of dystocia was found in autumn and winter. The high rate of dystocia in winter coincided with high birth weights. Cold weather from winter has been associated with increased dry matter intake, increased thyroid hormone concentration and increased nutrient flow to the uterus, leading to increased birth

weight and dystocia [8, 28]. The higher risk of dystocia in the winter can be explained by the fact that more calvings occur during this season, as a consequence of a higher fecundity from spring and early summer. Conversely, Mee *et al.* (2008) reported a greater likelihood of calving assistance and of dystocia in spring and autumn, which is in disagreement with the results of the other studies in which dystocia during spring or autumn was found less probable compared to that in winter [11]. Consistent outcomes were reported by the Ghanem *et al.*, 2013, which recorded more cases of dystocia in the summer, perhaps due to the thermal stress [29]. Related to dams' parity, a slightly increased incidence of dystocia was associated with primiparous cows (27%) compared to multiparous (23.5%), the difference being insignificant from the statistical point of view ($p>0.475$), conversely to results obtained in previous studies [11, 30]. The most important dams' influential factor that affects ease of calving proved to be the dams' parity. The frequency of dystocia is two to four times higher in primiparous than in multiparous cows especially due to feto-maternal disproportion [31]. The incidence of dystocia in primiparous was quantified to be 10-50 % of all births whereas, in multiparous the incidence of dystocia ranged between 4-30 % [32, 33]. Mee *et al.* reported 40 and 28% incidence in primiparous and multiparous for calving assistance, and 9.3 and 5.8% for severe dystocia, respectively [11]. Conversely, Grohn *et al.* (1990) reported that the risk of dystocia increased with increasing parity [34]. On the contrary, parity of the cow had no effect on the incidence of dystocia [35].

The ability of primiparous cows to keep the foetus due the fact that the uterus has steadier ligaments and a lower incidence of retained placenta was earlier demonstrated by previous study conducted by Chegini (2016) [36]. Primiparous cows have not achieved their full development and mature body size yet, and the pelvic inlet area might relatively increase till maturity which leads to a higher incidence of dystocia. This situation is widely common in the dairy specialized breed. The current research aimed a dual-purpose breed characterized by a large body dimension. Also, the primiparous cows had a large percentage out of adult cows' biometric measurements, including the pelvic dimensions which seems to lead to close incidences of dystocia. Higher repeatability of dystocia was recorded in herds (over 82%) representing a major issue requiring serious attentions in order to keep it under control. Significant correlations were calculated between incidence of dystocia and dams' parity. The number of difficult calving required assistance had a tendency to increase related to each following lactation. Vida J *et al.* (2017) studying these issues highlighted that 35% of primiparous and over 40% of multiparous needed assistance and these rates increased according to the rank of lactation [37]. Significant differences related to the incidence of dystocia were recorded according to dams' milk yield. High yielding cows recorded a higher incidence of dystocia compared to lower producing cows (37.75% *vs.* 22.25%). These results are conversely to those found by Ingvartsen (2003) according to there is little evidence that high yielding cows have an increased risk of dystocia [38]. There is a limited material aimed the impact of high yielding on calving ease. Generally, the previous studies highlighted no significant relationship between milk yield and the risk of dystocia. The milk production has been proved to have an indirect effect on calving ease and implicitly in the subsequent calf welfare condition through altering the metabolic status of cows. In this respect high yielding cows are characterized by a huge availability of metabolic rebalancing conferred by the hereditary dowry. These cows recorded an increased share of twinning, which could increase the risk of dystocia occurrence. In the current research, the share of dystocia associated to a low yielding cows (4000-5000 kg milk) ranged in 19-23% interval compared to a share of 35% associated to high yielding cows (over 7000 kg milk). Twinning provides a chance to improve the efficiency of farms. Increased frequency of twinning would increase the potential for obtaining more progeny from cows with higher genetically dowry [39]. Cows with twins produce more milk, fat and protein compared to cows with single calves, these results being contradictory among the different studies [40, 41]. Twinning induce several influential disadvantages especially in dairy cattle herds, increasing problems in the dams and calf. Twinning is associated with increased incidence of retained placenta, higher mortality rates, frequent occurrence of reproduction issues, and lower potential of calf survival, poor reproductive performance and increased culling

rate [35, 42]. A study conducted in Egypt, reported a culling rate of 61.53% for twin calving cows versus 30.73% for single [43]. According to parity the twinning rate range between 3-6% and increase with parity (1-2% in primiparous *vs.* 5-6% in multiparous). Calf stillbirth recorded to be greater in twin births (18-20%) compared to singleton births (4-7%) [44]. Four times higher mortality rate in twin born calves was observed due to an increased dystocia and a reduced gestation length. A study conducted by Guerra-Martinez *et al.* (1990) reported more dystocia in heifer than in cows (28% *vs.* 10%, respectively) [45]. Gregory *et al.* (1996) demonstrated cows calving twins have had more dystocia incidence (42.2%) than cows that have singles at birth (20.4%) [46]. Similarly, an incidence of dystocia in cows gestating twins was much higher (22.5%) than cows calving a single (7.22%) in the recent study reported by Mostafa [43]. However, incidence of dystocia due to malpresentation was found to be 38.6 *vs*. 4.5% in twin and single calving, respectively. Their most recent study also showed that a high rate of dystocia in twin birth was associated with lower calf survival rate. Beerepoot *et al.* (1992) estimated about $109 economic loss for every twin birth, compared with singleton births [47]. Eddy *et al.* (1991) studying the effect of twinning on the production, reproductive performance and welfare of dairy cattle, estimated $135 average loss of income per cow [48]. In addition, Kossaibati and Easlement (1997) examined economic output according to different common diseases such as udder diseases, type of calving, calf mortality estimated an economic loss due to twinning about $201 [49]. In the preweaning calf, Patterson *et al.* reported a 45.9% incidence of deaths due to dystocia, and Laster and Gregory reported that calves born to cows experiencing difficult births were four times as likely to die as were calves born to cows not experiencing dystocia [50, 51].

4. Conclusions

Knowledge of the dam and calf related factors with negative effects on the calving ease helps to eliminate them by including in optimized and adapted breeding programs. Removing unwanted influential factors helps to reduce losses caused by dystocia calving among new-born calves and dams' performances with direct effect on the farm's profitability. Finally, this study highlights the potential influential factors on the calving ease, specific to dual purpose breed. At the animal level, control of dystocia is dependent upon calving management. Future research should prioritise across genetic evaluations for calving ease, marker assisted selection for calving traits, the impacts of dairy breed on calving performance, setting up a calving/dystocia 'alarm' threshold.

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