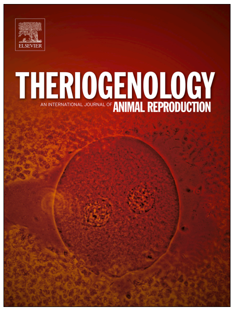

Prevalence, causes, resolution and consequences of bovine dystocia in Italy

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PREVALENCE, CAUSES, RESOLUTION AND CONSEQUENCES OF BOVINE DYSTOCIA IN ITALY

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Abstract

The aim of this study was to report prevalences and causes of dystocias in dairy and beef cattle, in primiparous and multiparous cows, as well as the mortality rate of calves and cows, obtained after 11 years of records across various farms in Italy. On a total of 14,575 records from dairy Italian Friesian cows, beef Romagnola and Marchigiana cows, a prevalence of 5.6% was observed, with a significant higher prevalence in primiparous ($p<0.0001$), and dairy cows ($p<0.0001$). Dystocias of fetal origin were higher than the ones of maternal origin ($p<0.0001$). Dystocia management, performed with manual correction in 96% of the cases, was associated with the 25% of calf mortality and the 11% of maternal mortality. When the combined effects of attitude and parity were assessed in relation to each fetal or maternal dystocia cause, dystocia resolution method and on calf, cow and calf-and-cow mortality, results showed a stronger association of dairy primiparous and multiparous cows than beef cows to several dystocia causes and calf-and-cow mortality. Taken together the results from the present study highlighted, once more, the importance of a correct breeding herd management and genetic selection programmes, especially in dairy cows, as well as the prompt diagnosis and correction of difficult calvings, for the effective management of dystocias aimed to reduce calf mortality.

Keywords: cow, dystocia, prevalence, resolution, consequences

1 INTRODUCTION

Dystocia (literally: difficult birth) has been defined as any birth that reduces calf viability, causes maternal injury, or reduces maternal reproductive potential [1], and represents an economic issue of major importance in cattle husbandry [2-6]. The prevalence of troubled deliveries affects the business economy as well as the handling of obstetrics emergencies [4-8]; other than that, there is a decline in production, as well as an increase in perinatal mortality and sub-fertility [4,9-13]. Further economic losses are related to maternal death [4].

With dairy cattle, economic losses encompass also the decline in milk production, a drop in both lipid and protein composition [4,14,15], as well as an increase in somatic cells [16].

The prevalence and the main causes of dystocia were reported to vary between dairy and beef cattle; also, the cow parity was demonstrated to affect the percentage of dystocia and the prevalence of certain causes. Additionally, some studies [5,16,17] showed a different geographic prevalence of dystocia, most likely due to a genetic influence, but also to the different herd, and especially calving, management.

Because of the recognised impact of dystocia in cattle industry, and because of the scarce information about the prevalence in Italy [18], the aim of this study was to report the prevalences and the causes of dystocias in primiparous and multiparous dairy and beef cows, as well as the resolution method and the mortality rate of calves and cows, obtained from 11 years of records across various farms in Italy.

2 MATERIAL AND METHODS

2.1 Animals

According to the guidelines of our Institutions, a formal approval from the Ethical Committee was not required since the resolution of dystocias was performed for routine therapy purposes. During a period of 11 years (2005-2015), a total of 14,575 records from dairy Italian Friesian (n=9,717) cows, and beef Romagnola (n=2,055) and Marchigiana (n=2,803) cows, belonging to herds in the provinces of Teramo and Bologna, were studied. The primiparous cows were 3,905, while the multiparous ones were 10,670. The average herd size was about 85 animals, registered in the Italian Herd Books, and all the herds were officially free of diseases, as recognised by the state prophylaxis.

The cattle were kept in free stalls and the animals were grouped as follows: the Friesian cows were classified as lactating cows, dry cows, pregnant heifers, calving cows, and heifers; Marchigiana and Romagnola cows were classified as lactating pregnant, pregnant, late pregnant, calving, and heifers.

Dairy cows were fed twice a day using a feed-mixer wagon for "unifeed" administration, with the ration varying depending on the group.

In the beef cattle, feed rations were distributed in the traditional manner, and consisted mainly of lucerne hay and grasses, or silo grass, supplemented by commercial feed, flour or flakes (corn, barley and soybeans) for the milking cows.

At calving, a clinical examination was performed, including a complete obstetric examination as reported by Arthur [19]. In case of uterine torsion, a direct manual untwisting or a Caesarean section was performed. In some cases, after the clinical examination, emergency slaughter or killing was chosen. Aware of the difficulty of detecting the exact causes of dystocia episodes, often of multifactorial origin, in the present study dystocias were classified as fetal or maternal, avoiding classifying dystocias on the base of degree severity.

The calf status, considered as alive or dead, and the occurrence of stillborns, considered as calves born alive, but died within 24 hours, were recorded at calving [20,21]. The number of cows culled without dystocia resolution, and the number of cows died during or following dystocia management, were also recorded.

2.2 Statistical analysis

The prevalence of dystocia according to the parity, animal type (dairy/beef)and causes (maternal/fetal) was statistical analysed by the Chi-square test. Significance was considered for $p<0.05$.

In order to evaluate the effect played by the combination of attitude and parity on several variables, such as each fetal or maternal causes of dystocia, each resolution method, calf, cow or calf and cow mortality, four groups of cows were identified: dairy primiparous, beef primiparous, dairy multiparous and beef multiparous.

To assess the effect played by the group on each variable, a multiple factor analysis (MFA) was applied: in this way, the associations among groups of cows and variables were defined. After MFA procedure, the euclidean distance between the group centroids and the coordinates of the outcomes was calculated: distances <1.5 were considered as high association.

3 RESULTS

During the 11 years of study, 819 dystocias were recorded on a total of 14,575 cattle, with an overall prevalence of 5.6%. With respect to parity, a significant higher prevalence was observed in primiparous (419/3,905=10.7%) as compared to multiparous cows (400/10,670=3.75%)($p<0.0001$). When attitude was considered, the prevalence of dystocia was higher ($p<0.0001$) in dairy cows (606/9,717=6.2%) than in beef cattle (213/4,858=4.4%).

When the cause of dystocia was considered, 657/819 (80.2%) cases were due to fetal causes, while 162/819 (19.8%) cases were related to maternal causes, with a significant difference between them ($p<0.0001$).

The detailed descriptive distribution of fetal and maternal causes in the 819 recorded dystocias in relation to dairy primiparous (DP, n = 309), beef primiparous (BP, n = 112), dairy multiparous (DM, n = 297) and beef multiparous (BM, n = 101), is reported in Table 1 and 2.

Table 1. Descriptive distribution of the 657 fetal causes of dystocias, in relation to dairy primiparous (DP), beef primiparous (BP), dairy multiparous (DM) and beef multiparous (BM) groups

	DP (n=257)		**BP (n=91)**		**DM (n=233)**		**BM (n=76)**		**TOT (657)**
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Malposition	109	30.2	42	11.6	153	42.4	57	15.8	361
Macrosomia	135	54.2	44	17.7	55	22.1	15	6.0	249
Malformations	4	21.1	3	15.8	10	52.6	2	10.5	19
Pre-partum death	9	32.2	2	7.1	15	53.6	2	7.1	28

Table 2.

Descriptive distribution of the 162 maternal causes of dystocias, in relation to dairy primiparous (DP), beef primiparous (BP), dairy multiparous (DM) and beef multiparous (BM) groups

	DP (n=52)		**BP (n=21)**		**DM (n=64)**		**BM (n=25)**		**TOT (162)**
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Uterine torsion	16	23.9	7	10.5	35	52.2	9	13.4	67
Uterine atonia	6	14.3	5	11.9	19	45.2	12	28.6	42
Cervical stenosis	7	29.2	3	12.5	10	41.7	4	16.6	24
Feto-maternal disproportion	23	79.3	6	20.7	0	0.0	0	0.0	29

Tables 1 and 2 showed that, among all the causes of dystocia, the great majority was represented by fetal malposition and fetal macrosomia, accounting for more than 70% of the total, while uterine torsion plus uterine atonia accounted for about 13% of the total causes of dystocia.

In Table 3, the descriptive distribution of dystocia resolution method in relation to dairy primiparous, beef primiparous, dairy multiparous and beef multiparous group is reported. Two dairy, primiparous cows were culled before dystocia resolution, because of the impaired clinical conditions; therefore data showed in Table 3 refer to 817 cows.

Table 3. Descriptive distribution of dystocia resolution method in relation to dairy primiparous (DP), beef primiparous (BP), dairy multiparous (DM) and beef multiparous (BM) groups in the 817 cows (2 dairy primiparous cows were culled before dystocia resolution)

	DP	**BP**	**DM**	**BM**	**TOT**

	(n=308)		(n=118)		(n=296)		(n=95)		(817)
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Manual correction	303	38.5	115	14.6	279	35.5	90	11.4	787
Caesarean section	5	17.9	3	10.7	15	53.5	5	17.9	28
Fetotomy	0	0.0	0	0	2	100	0	0.0	2

Table 3 showed that the most frequent method used for dystocia resolution was the manual reduction, accounting up to 96% of cases.

The descriptive distribution of calf mortality, the cow mortality and calf-and-cow mortality associated to dystocia management in relation to dairy primiparous, beef primiparous, dairy multiparous and beef multiparous group is reported in Table 4.

Table 4. Descriptive distribution of calf, cow, or calf and cow mortality associated to 817 dystocia managements, in relation to dairy primiparous (DP), beef primiparous (BP), dairy multiparous (DM) and beef multiparous (BM) groups

	DP (n=85)		**BP (n=58)**		**DM (n=72)**		**BM (n=38)**		**Tot (253)**
Mortality	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	
Calf	69	42.6	42	25.9	46	28.4	5	3.1	162
Cow	9	18.4	7	14.3	17	34.7	16	32.6	49
Calf and cow	7	16.7	9	21.4	9	21.4	17	40.5	42

The calf mortality was 19.8%, the cow mortality was 6%, while the calf-and-cow mortality was 5.1%, so that the cumulative mortality in cows with dystocia resolution was 24.9% for calves and 11.1% for cows.

The detailed MFA analysis of association between fetal causes, maternal causes, resolution methods, calf, cow, calf-and-cow mortality, and dairy primiparous, beef primiparous, dairy multiparous and beef multiparous groups, is reported in Table 5.

Table 5. Detailed MAF analysis of association between fetal causes, maternal causes, resolution methods, calf, cow, calf-and-cow mortality, and dairy primiparous (DP), beef primiparous (BP), dairy multiparous (DM) and beef multiparous (BM) groups. Data are expressed as the euclidean distance between the group centroids and the coordinates of the outcomes; distances <1.5 were considered as high associations

Variable		DP	BP	DM	BM
Fetal causes	Malposition	1.02*	2.71	0.39*	1.27*
	Macrosomia	0.67*	2.39	0.96*	1.85
	Malformation	1.73	2.51	0.37*	1.69
	Prepartum death	0.74*	2.89	0.24*	1.55
Maternal causes	Uterine torsion	2.27	1.71	1.28*	1.38*
	Uterine atonia	2.67	1.81	1.08*	1.48*
	Cervical stenosis	1.34*	2.06	1.21*	1.97
	Feto-maternal disproportion	0.69*	1.32*	2.53	2.03
Resolution method	Manual correction	0.66*	2.46	0.84*	1.74
	Caesarean section	2.83	1.69	0.7*	1.8
	Fetotomy	3.97	3.11	1.98	2.64
Mortality	Calf	0.52*	2.59	1.7	2.6

	Cow	1.81	2.3	0.81*	1.02*
	Calf and cow	1.6	2.34	1.97	0.6*

*denotes within row high association

4 DISCUSSION

Because previous papers demonstrated a different geographic prevalences of dystocia, the present study was aimed to report the prevalence of bovine dystocia across various farms in Italy. The overall prevalence of dystocia on 14,575 cattle was 5.6%, that is similar to the 6.9-7% reported by Berry et al [16], and Gaafar et al [6]. However this difference is reasonable, because, when attitude was concerned, also in the present study dystocia rate was significantly higher (6.2%) in dairy as compared to beef (4.4%) cows, with a prevalence in dairy cows very similar to the 6.9% reported by Gaafar et al [6], in dairy Friesian cows, and lower when compared to the 10.8% reported by Atashi et al [22] in dairy Holstein cows in Iran. The prevalence in beef cows was a bit lower than the 6% reported by Nix et al [23] in several beef breeds cows.

Parity of the dam is also recognised as a factor affecting the incidence of dystocia in cattle [6,22], with decreasing percentage of dystocia associated to the increasing parity of the cow [6]. The significantly higher prevalence of dystocia in primiparous as compared to multiparous cows (11% vs 3.5%) observed in the present study, is in agreement with the reported greater prevalence of dystocia in primiparous (16-19%) than in multiparous dams (4-8%) in beef and dairy cattle [22-24].

A reduction of the prevalence of dystocia proportional to the number of pregnancies was already reported by several authors [16,25,26] and seems to be related to several identifiable risk factors in young subjects, such as the immaturity of skeletal development, especially of the pelvis, with a consequent lower compliance of the birth canal [27].The feto-maternal disproportion is, indeed, is considered one of the major causes of dystocia in heifers [27], and also in the present study this cause of dystocia, with a prevalence of 3.5%, was observed only in primiparous cows, significantly associated to both dairy and beef attitudes. Fetal malposition prevalence was reported to range widely, from 1% to 51% [23] and it was found to be a cause of dystocia especially in multiparous cows [28]. In the present study, fetal malposition prevalence was 44% and resulted significantly associated to multiparous condition in both dairy and beef cattle, in agreement with literature, but also significantly associated to dairy primiparous cows. Another condition that can cause incompatibility between the size of the fetus and the birth canal, is fetal macrosomia, accounting for 30% of the dystocias, with a significant association to with dairy primiparous and multiparous cows. Fetal malformation accounted to 2.3% and was significantly associated with dairy multiparous cows, while pre-partum fetal death (3.4%) was associated with dairy primiparous and multiparous cows. Fetal macrosomia, fetal malformation and prepartum fetal death resulted therefore significantly related to the dairy attitude. Although finding a suitable explanation for these data is difficult, it could be supposed that an underlying genetic cause related to the dairy attitude could be responsible for these fetal abnormal conditions, and more appropriate breeding herd programmes should be advised. As a matter of fact, as reported by Mee [5], the so called “Holsteinization” (the increase of Holstein North American genes in a cattle population) could have influenced several reproductive aspects, including the occurrence and causes of dystocia.

Uterine torsion and uterine atonia are considered as relatively uncommon causes of dystocia, usually accounting for 5% and 10% of the total causes, respectively [5,28-30]. In the present study the prevalence of uterine torsion was about 8% and the one related to uterine atonia was about 5%; both uterine torsion and atonia were significantly associated to multiparous condition in dairy and beef cows. This predisposition of multiparous cows to uterine torsion could be explained by the decreased uterine stability at term, due to a possible greater laxity of the broad ligaments in older cows [27,29]. Also for uterine atonia, several causes [27,31] have been hypothesised for explaining the more frequent occurrence in multiparous cows [30].

Cervical stenosis due to several causes and, among them, the hormonal asynchrony [5], was reported to occur occasionally as cause of dystocia in cattle [32], even if it there could be an underestimation [5]. In the present study its prevalence was about 3%, and was significantly associated to dairy primiparous and multiparous cows. Although also for this finding an underlying genetic cause, related to dairy attitude, can be supposed, many other factors affecting the timing of the hormonal control of calving could be suspected, as reported by Mee [5].

When the method for dystocia resolution was concerned, the manual correction accounted for the vast majority of cases (over 96%), with a significant association to dairy primiparous and multiparous cows. Although the prevalence of manual correction of dystocia was very similar to the 97% reported by Nix et al [23] in beef cattle, in the present study no significant association was reported between manual correction and beef cows. This statistical finding is difficult toexplained: on one hand the great majority of manual resolutions in dairy cows highlight that most of the dystocias were not severe enough to need a Caesaeran section. On the other hand, even in beef cows, differently to what is reported for Belgian Blue cows [33], in which more than 90% of calving are performed by Caesaeran sections, in the present study most of the dystocias in Romagnola and Marchigiana beef cows were solved by a manual correction. In the present study, the Caesaeran section, whose prevalence was 3.4%, resulted similar to the 3% reported by Nix et al [23] in beef cattle, but was associated to dairy multiparous cows. The Caesarean section was carried out only in the following specific cases: severe uterine torsions (degree of torsion > 270°), in agreement with [29]; in cases in which it was difficult to reach the fetus trans-vaginally; in cases in which the time elapsing between the onset of the condition and the treatment was prolonged.

Fetotomy was used to solve dystocia only in 2 dairy multiparous cows, accounting for about 0.2% of the cases, to avoid the possible sequelae, such as placenta retention, followed by lochiometra, vaginal injuries, pelvic phlegmons and neurotripsya [34].

In the present study the total calf mortality was 25%, and resulted significantly associated to dairy primiparous. The effect of dystocia on calf mortality was recognised by several authors [1,13,21,23,35-36], and Lombard et al [21] reported a prevalence of observed stillbirth of 8.4% and 37.2% in mild and severe dystocias, respectively. Therefore, the overall prevalence of calf mortality observed in the present study, in which dystocia severity was not recorded, can be considered in agreement with literature. Moreover, in the present study calf mortality was significantly associated to dairy primiparous cows, in agreement with the reported influence of parity on perinatal mortality [31], and the increased odds of stillbirth in heifers compared to cows [20].

The higher risk of primiparous' of having stillbirths was explained by Hansen et al [37] by the disproportion between the size of the calf and the maternal pelvis, which leads to difficult calving.

In this study, a total of 91 (11%) cows submitted to dystocia resolution, plus 2 cows (0.2%), culled before dystocia management because of the worsening general conditions, were lost. The percentage of loss in cows submitted to dystocia management is in agreement with the 13% of cow death following uterine torsion correction and with the 9% of cows needing slaughtering or euthanasia because of the compromised conditions of the uterus, reported by Frazer [29]. A significant association was found between mortality of cows submitted to dystocia resolution and multiple parity in both dairy and beef cows. A similar relation between maternal death and increasing parity was previously reported also by Dematawewa and Berger [4].

5 CONCLUSIONS

The data obtained from an Italian clinical trial showed that the overall percentage of dystocia in a sample of both dairy and beef cattle is comparable with data previously reported internationally, with a significant higher prevalence in dairy than in beef cows. Dystocia was furthermore proved to be more common in primiparous than multiparous cows, and fetal causes more common than maternal ones. Dystocia management, mainly performed by manual correction, was associated to a relatively high percentage of calf mortality and, to a lower extent, also to maternal mortality. When the combined effect of attitude and parity on each fetal or maternal dystocia causes, on dystocia resolution method and on calf, cow and calf-and-cow mortality, was assessed, the results showed a stronger association of dairy primiparous and multiparous cows than beef cows to several dystocia causes and calf-and-cow mortality. Taken together, the results from the present study highlighted, once more, the importance of a correct breeding herd management and genetic selection programmes, especially in dairy cows, as well as the prompt diagnosis and correction of difficult calvings, for the effective management of dystocias aimed to reduce calf mortality.

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Prevalence, causes, resolution and outcome of 819 bovine dystocia in Italy

Data drawn from 14,575 records from Italian Friesian and Romagnola and Marchigiana cows

Dystocia prevalence was higher in dairy than beef and in primiparous than multiparous cows

Dystocias of fetal origin were higher respect to maternal origin

Dairy cows stronger associated to several fetal causes and to calf and to cow mortality