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Genetic and non-genetic factors affecting dystocia in cattle, Algeria

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Abstract

Dystocia or calving difficulties carry a guarded prognosis for life or future fertility in affected females; cattle are considered to be the most affected species having the highest incidence rate of dystocia. In this study, we used two different approaches to identify the causes of dystocia in cattle raised in Souk-Ahras wilaya during the period (2018 - 2020). First, a survey was conducted on 32 farms to collect data. Then, 103 Montbeliard cows' pelvic were taken. Our findings indicated that the dystocia was greater in the Montbeliard breed (40%) than in the other breeds ($P < 0.05$). The most common causes of Dystocia reported by vets were narrow pelvic 45%, uterine torsion 31%, uterine inertia 23%, and other causes 1%. The parity number was more frequent in primiparous with a rate of 62% than in multiparous 38% ($P < 0.05$). Dystocia was significantly more frequent in artificially inseminated (AI) cows than in natural breeding (NB) cows ($P < 0.01$). The dimensions of the pelvis were the width of the hips (53.85±5.06 cm), the width of the trochanters (47.77±6.05 cm), the width of the ischia (29.81±7.02), the length of the pelvis (54.42±2.29) and the Body Condition Score (2.51±0.46). In general, a significant correlation ($P < 0.01$) between chest girth and these measurements (Body Condition Score, live weight, hip width, trochanter width) was reported. It was concluded that the most common cause of dystocia in Algeria was mainly due to narrow pelvic or fetal-pelvic disproportion, so the use of pelvimetry will be a routine examination to predict dystocia in cattle.

Keywords: Algeria; cattle; dystocia; pelvimetry; reproduction.

الملخص

تعتبر عسر او صعوبة الولادة خطرا على حياة الخصوبة المستقبلية في الإناث المصابات؛ تعد الماشية من أكثر الأنواع تضرراً ولديها أعلى معدل للإصابة بعسر الولادة. في هذه الدراسة، استخدمنا طريقتين مختلفتين لتحديد أسباب عسر الولادة في الابقار التي تربى بولاية سوق أهراس خلال الفترة (2018 -2020). أولاً، تم إجراء استبيان، لذلك قمنا بجمع البيانات في 32 مزرعة. المرحلة الثانية أخذنا قياسات الحوض على103 بقرة من سلالة المونبليارد أشارت النتائج التي توصلنا إليها إلى أن عسر الولادة كان أكبر في سلالة. بقرة المونبليارد بنسبة % 40 مقارنة بالسلالات الأخرى عسر الولادة الناجم عن أسباب أمومية أكبر من أسباب الجنين، كانت الأسباب الأكثر شيوعًا التي أبلغ عنها الأطباء البيطريون هي ضيق الحوض بنسبة 45 ٪ والتواء الرحم 31 ٪ والقصور الذاتي للرحم 23 ٪ وأسباب أخرى 1 ٪. كانت النسبة الأكثر تكرارا في الولادة الأولى بمعدل ٪62 منه مقارنة بأبقار التكاثر الطبيعي .($P<0.01$) كان عسر الولادة شائعًا بشكل كبير في الأبقار الملقحة صناعيًا .($P<0.05$) في تعدد الولادة ٪38 كانت أبعاد الحوض هي العرض عند الوركين (53.85 ± 5.06) سم، والعرض عند المدور (47.77 ± 6.05) ((سم، والعرض عند الحافة ± 29.81 (7.0، طول الحوض (54.42 ± 2.29) ودرجة حالة الجسم (2.51 ± 0.46) بشكل عام وجود علاقة ارتباط معنوية ($P<0.01$) بين محيط الصدر وهذه القياسات (درجة حالة الجسم، الوزن الحي، عرض الورك، عرض المدور). خلص إلى أن السبب الأكثر شيوعًا لعسر الولادة في الجزائر يرجع أساسًا إلى عدم تناسق الحوض أو الحوض، لذا فإن استخدام قياس الحوض سيكون فحصًا روتينيًا للتنبؤ بعسر الولادة في الماشية

الكلمات المفتاحية: الجزائر؛ الابقار؛ عسر الولادة. قياس الحوض. التكاثر.

Introduction

The reproductive performance of the cow herd is one of the factors the affecting efficiency of cow-calf systems. The major objective of cattle breeding is to produce one calf per cow every year (Noseir, 2003). Among all domestic animals, cattle and buffalo are considered to be the most suspicious species having the highest incidence rate of dystocia (Adugna et al., 2022). Dystocia is defined as delayed or difficult calving, sometimes requiring significant human assistance (Lombard et al., 2007; Mee, 2008; Boujenane, 2017) whether surgical or not. Both dystocia and stillbirths were correlated (Jeengar et al., 2015) and were undesirable calving-related disorders

that decrease fertility, milk production, and cow's productive lifespan (Bicalho et al., 2007). Several factors have been knotweed as risk factors for assisted calving with fetal-pelvic disproportion, the most common type of dystocia (Mee, 2008), although factors for heifers and multiparous cows can be distinguished, calf birth weight (CBW), gestation length (GL) (Dhakal et al., 2013), and calf sex (CS) (Olson et al., 2009; Dhakal et al., 2013). Numerous studies have provided important information about individual risk factors associated with dystocia and stillbirths (Helguera et al., 2016).

Pelvic area has been seen as a reliable measurement influencing calving difficulty, as larger pelvic areas were associated with reduced calving difficulty (Bellows et al., 1971), and is used to identify potential problem heifers with small pelvic sizes (Micke et al., 2010) that may be at risk for dystocia at calving. Pelvimetry is the "measurement of the capacity and diameter of the pelvis, either internally or externally or both, with hands or with a pelvimeter" (Hiew and Constable, 2015). Bovine practitioners use various applications of pelvimetry or radiopelvimetry to reduce the incidence of dystocia (Ko and Ruble, 1990).

Therefore, the objectives of this study were to: (1) investigate factors associated with dystocia in cows in Algeria (2) Evaluate the relationship of the pelvic area to calving difficulty in cattle.

Materials and Methods

Data collection

This study was carried out between 2018 and 2020 on 32 farms (*n*=739cows) in the wilayas of souk-Ahras, located in different municipalities.

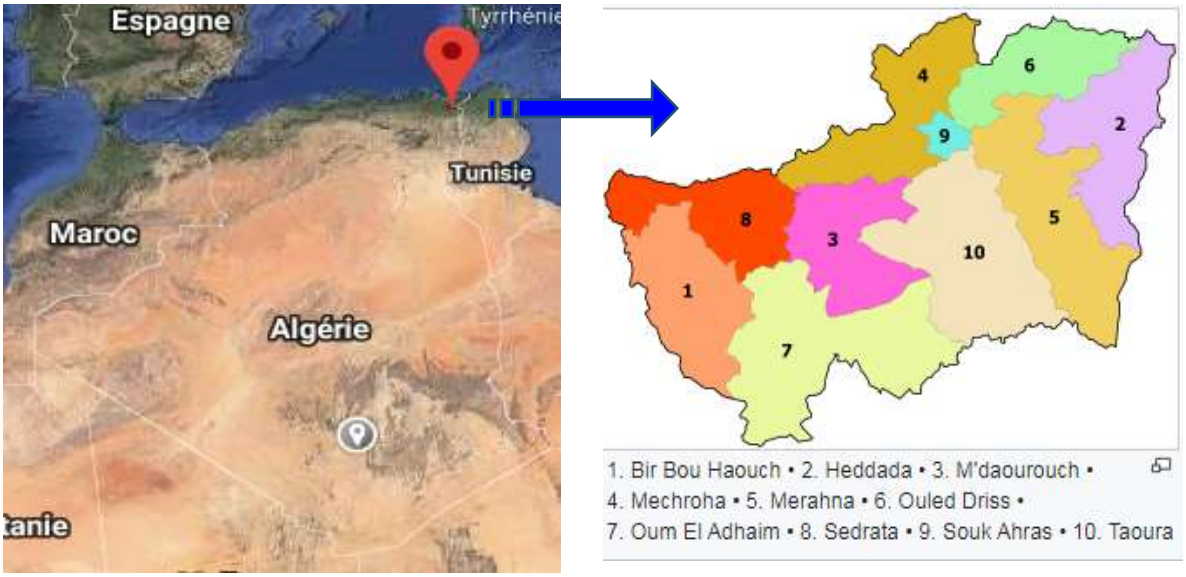

Figure 1. Situation of Souk Ahras wilaya.

The following data were recorded for each calving: date of birth, parity, the bovine sector, the breed, age, criteria for deciding to perform forced extraction, cesarean section, and fetotomy.

The age of the cows was determined using their dental formula. We worked on (*n*=103) Montbeliard cows that presented dystocia in the past. From the measurements used in the cattle, the following body measurements were taken: pelvis length (LB), hip width, trochanter width, ischium width and chest girth, more detailed in the work of (Bellows et al., 1971; Coopman et al., 2003). The body weight of each cow (BW) was calculated according to Branton and Salisbury (1946). The body condition score (BCS) was evaluated on a scale of 1 to 5 according to Edmonson et al. (1989).

Statistical analysis

All data were coded and recorded in to excel sheet. The descriptive analysis of the data was established using the SPSS version 20 tool focused on the determination of the mean values, standard deviations, minima, and maxima of the studied parameters. Correlation analysis among the body variables was also conducted based on SPSS.

Ethical statement

The cows used in this study had their origin on pastoral farms with a traditional management system. They were standardized and regulated by international guidelines for animal welfare (Terrestrial Animal Health Code 2018, section 7. Art 7.1) and national executive decree No. 95-363 of November 11, 1995 (Algeria).

Results

First part: survey

Table 1 reports the distribution of cattle breeds raised in the Souk-Ahras region. 739 cows were raised in 32 farms in the region of souk-Ahras. The dystocia was affected significantly by the breed (P<0.005), it was dominant in the Montbeliard breed with a percentage of 40%, followed by Prim' Holstein with 28 % and the other breeds with a percentage of 14%, 12% and 6% respectively for Mixed (all breeds), Normand and the local population.

Table 1. Distribution of responses according to the breed

The breed	Rate (%)	p
Montbeliard	40	
Prim' Holstein	28	
Mixed (all breeds)	14	*
Normand	12	
Local population	6	

**: significant at P<0.05*

Figure 2 indicated that the parity number was more frequent in primiparous with a rate of 62% than in multiparous 38% (P<0.05).

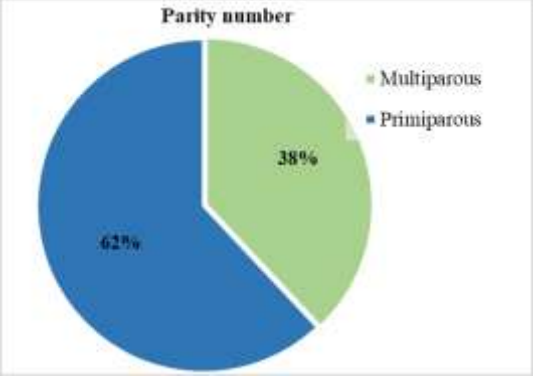

Figure 2. Distribution by cow parity (P<0.05).

Table 2 showed maternal causes were the predominant causes of dystocia (60%), compared to fetal causes (40%), also the predominance of the narrow pelvis with a rate of 45% in maternal cause dystocia. We noted that malposition predominates with a rate of 50% in fetal cause dystocia.

Table 2. Distribution according to causes related to maternal and fetal (P>0.05).

Maternal cause (60%)		Fetal cause (40 %)	
		ns	
Anomaly	Rate (%)	Anomaly	Rate (%)
Narrow pelvis	45	Malpresentation	40
Uterine inertia	23	Malposition	50
Uterine torsion	31	Malpostur	10
Other	1		

ns: non-significant

Figure 3 showed that dystocia was significantly more frequent in artificially inseminated (AI) cows than in natural breeding (NB) cows (P<0.01) with respective rates of 92% and 8%. The Algerian veterinarians tried to reduce the total retroversion of the head and neck by 96%, while 8% do a cesarean section systematically and 8% did a partial frenotomy of the head. Almost all veterinarians 92% usually perform a cesarean section while standing, 88% perform a cesarean in the left flank and 12% in the right flank

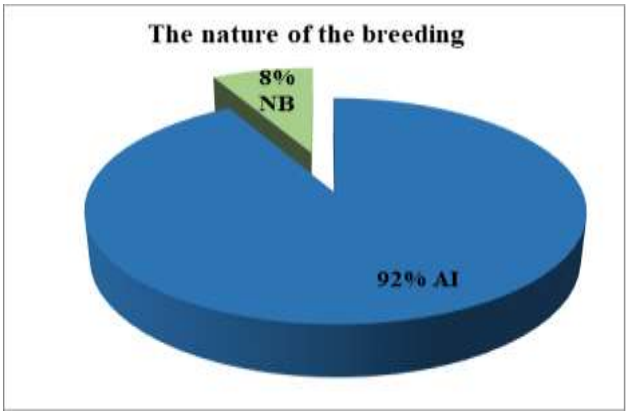

Figure 3. The relationship between the types of insemination (P<0.01).

Second part: pelvic measurement

Table 3 provided the list of the seven measurements, which were carried out on 103 Montbeliard cows, in particular that of the pelvic area.

Table 3. Descriptive analysis of body measurements of Montbeliard cows.

Variables	Minimum	Maximum	Mean	SD	Variance
Age	2.0	10.00	6.07	1.97	3.91
BCS	1.75	3.00	2.51	0.46	0.22
Live weight (kg)	141.72	407.07	259.77	69.02	4764.13
TheChest girth (cm)	121.00	172.00	146.88	13.63	185.79
Pelvic lenght (cm)	48.50	60.80	54.42	2.29	5.25
Hip width (cm)	44.50	60.20	53.85	5.06	25.68
Width at trochanters (cm)	36.00	52.30	47.77	6.05	36.62
Ischia width (cm)	24.00	34.50	29.81	7.02	70.46

Table 4 showed the results relating to the correlations between different body measurements. The values of r between the width at the hips and the measurements vary from 0.18 and 0.74 (P<0.01). The values of r between the width at the trochanters and the measurements vary from -0.10 to 0.52 (P<0.01). A significant correlation (P<0.01) between chest girth and the following measurements: BCS, live weight, hip width, and trochanter width.

Table 4. Correlations between body measurements of Montbeliard cows.

r	Age	BCS	Live weight (kg)	Thechest girth (cm)	Pelviclenght (cm)
Age	1	0.27	0.27	0.29	-0.19
BCS	0.27	1	0.51**	0.52**	0.03
Live Weight (kg)	0.27	0.51**	1	0.99**	0.14
Pelvic lenght (cm)	-0.17	0.03	0.14*	0.75**	1
Hip width (cm)	0.29	0.21	0.34**	0.74**	0.18
Width at trochanters (cm)	-0.09	0.48*	0.51**	0.52**	0.03
Ischiumwidth (cm)	-0.02	-0.31	-0.27	-0.33	-0.27

***. The correlation is significant at the 0.01. *. The correlation is significant at the 0.05 level.*

Discussion

First part: survey

In our investigation, 76% of dystocia breeds were very frequent in mixed herds in the Souk-Ahras region. The frequency of dystocia prediction in cattle breeding is between 0.9 and 32% (Bendixen et al., 1987). Whereas Jackson (2004) finds that the incidence of difficulty of calving was very variable, and was influenced by many factors. The overall incidence is in the 3% to 10% range but can be much higher. This difference was explained by the presence of several factors that predispose dystocias, such as the influence of the environment and diet, and even the wrong choice of males and the time of the first service of the heifers.

In our analysis, we found that the Montbeliard breed was the most predisposed to dystocia with a rate of 40% (P<0.05). Jackson (2004) estimated that the influence of bovine dystocia is most often found

in Frisian-Holstein 6%, Charolais 9%, Simmental 10%, and Blanc Bleu Belge 80%. This theory was particularly marked in the beef breeds, it is explained by the fact of the excessive development of the hindquarters, which generally goes together with the narrowing of the anterior strait of the pelvis of the cows(Houssou and Djaout, 2021). We found, 62% of dystocia was observed in primiparous versus 38% in multiparous, similarly, Noakes et al. (2001) noted that 66.5% of dystocia was observed in primiparous and 23.5% in second calving.The frequency of dystocia decreases with the increase in the age and parity of the cows (Gaafar et al., 2011).

Maternal causes were the significantly predominant cause of dystocia (60%), compared to fetal causes *(40*%) (P<0.05). In addition, Rahawy (2019) reported that the incidence of dystocia due to maternal greater (62.85%) than foetal causes. The most common causes reported by vets were narrow pelvic 45%, uterine torsion 31%, uterine inertia 23%, and other causes 1%. Bovine uterine torsion was a common form of dystocia encountered by veterinarians around the world. 1 to 20% of assisted calving cases were reported (Frazer et al., 1996). We observed high frequencies compared to those reported by Noakes et al. (2001) with 3% rates for uterine torsion.

Anecdotally, it has been suggested that the incidence was increasing, although there were relatively fewer vets than the most basic forms of difficulty of calving due to the improved obstetric proficiency demonstrated by farmers (Laven and Howe, 2005). A UK study in Holstein Friesian cattle estimated the incidence at 0.24%, which represents up to 22% of all veterinarian-assisted dystocia (Lyons et al., 2013). The small number on which we worked does not allow us to obtain representative results. It would be interesting to continue these investigations to know the causes of the difficulties of calving of maternal origin in our farms.

The prevalence of malposition was the highest, at 50%, followed by malpresentation at 40% and malpostural at 10%. Boujenane (2017) and Jackson (2004) found that feto-pelvic disproportions were much more prevalent than poorly presented with respective rates of 45% and 26%. The difference between our survey and the theoretical data was explained by the very marked problems of undernourishment in cattle breeding, so no excessive development of the fetus, and in addition, there is no accumulation of fat deposits in the pelvic cavity of the cow.

In our survey, we noted that dystocia was more frequent and significantly encountered in artificially inseminated cows than in those covered naturally (P<0.01) with respective percentages of 92% and 8%. Indeed, the breed of the bull was a major factor in the variation in the size and weight of the foetus at birth (Peters and Ball, 1995). Our results reflect the fact that calving was met especially in artificially inseminated. This could be explained by the fact of the use of the meat breed semen and the insufficient preparation of the female for calving. In fact, a female should not be put into reproduction until she had reached two thirds of her adult weight. The majority of veterinarians, 92% usually perform the caesarean section while standing, in the left flank 88%. Adugna et al. (2022) noted that caesarean sections were almost systematically performed on a cow in a standing position and the left flank is the most commonly used approach for uncomplicated dystocia.

Second part: pelvic measurement

Our observations showed no signs of negative BCS on calving,similar to the findings of Nguyen-Kien and Hanzen (2016). However, Avendano-Reyes et al. (2010) had different results. BCS (>3.5) at calving were more frequently affected by dystocia.Mihajlovičová and Mudroň (2020) reported that the changes in the BCS before parturition affect productivity and reproductive parameters.

A significant correlation (P<0.01) between chest girth and these measurements (BCS, live weight, hip width, trochanter width. Hiew and Constable (2015) report a significant correlation (P<0.001) between internal pelvimetry and pelvic dimensions with measurements taken outside the animal. While Kolkman et al. (2012) found that withers height and heart chest were better predictors of internal pelvic dimensions than external pelvic dimensions. Holm et al. (2014) classified heifers based on their pelvic area and adjusted for body weight using a regression coefficient. Additionally, there is also an equation to predict the calving difficulty score using hoof circumference at the coronary band, measured during stage II of parturition and pelvic dimensions (Ko and Rouble, 1990). Holm et al. (2016) published a study that showed using pelvic area measurement with conventional reproductive tract scoring (RTS) evaluation was more prognostic for poorly performing heifers than RTS alone.

Conclusion

In conclusion, the causes of dystocia in Algeria were mainly due to narrow pelvic, which was mainly linked to the fetal-pelvic disproportion. Monbeliard is the most affected breed. The use of pelvimetry should be a routine examination and prerequisite for controlling dystocia. The desirability of these studies will allow us to assess the utility of pelvimetry.

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Author's Contributions

Houssou H.: morphometric sampling, Statistics and Drafting the article

Bensalem M.: translation of the article

*Belhouchet H. and Hezam HE:*morphometric sampling

Khenenou T. **:** Corrections

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