الجمهورية الجزائرية الديمقراطية الشعبية
République Algérienne Démocratique et Populaire
Democratic and Popular Republic of Algeria
Ministère de l'Enseignement Superieur et de la Recherche Scientifique
Ministry of Higher Education and Scientific Research
وزارة التعليم العالي والبحث العلمي
École Nationale Supérieure Vétérinaire. Rabie Bouchama
Higher National Veterinary School. Rabie Bouchama
المدرسة الوطنية العليا للبيطرة

Order N°: 011

Domain: Natural and Life Sciences
Study: Veterinary sciences

Final study dissertation

To obtain **the Master's degree in Veterinary Sciences**

TOPIC

The impact of dystocia in post-partum period of dairy cows

Presented by:
Miss: Dina Aridje MESSAI
Miss: Yousra KARI

Publicly supported on 03/07/2024, before the jury:

Mr LAMARA ALI	Pr (ENSV)	President
Mrs AOUANE Nedjma	MCB (ENSV)	Supervisor
Mr SOUAMES Samir	Pr (ENSV)	Examiner

Academic year 2023-2024

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<u>Declaration of Honour</u>

I, the undersigned **MESSAI Dina Aridje**, hereby declare that I am fully aware that plagiarism of documents or parts of documents published in any form, including the internet, constitutes a violation of copyright and is considered a clear act of fraud. Therefore, I commit to citing all the sources I have used to write this thesis.

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Acknowledgments

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DEDICATION

To my parents, for their enduring moral support, heartfelt prayers, and comforting presence that have been a constant source of inspiration.

To my brother, for his reassuring presence, constant encouragement, and support that enriched my path.

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To all those who directly or indirectly contributed to the completion of this thesis, I humbly dedicate this work to you with gratitude and affection.

Dina.

DEDICATION

To my parents, whose constant and unconditional support, love, and sacrifice have been the foundation of my success. Your unwavering belief in me has given me the strength to overcome challenges and pursue my dreams. Without your endless encouragement and guidance, this achievement would not have been possible. I am eternally grateful for everything you have done for me.

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Abbreviation's list

1. **C-section:** cesarean section.
2. **Kg:** kilogram.
3. **BCS:** Body condition scoring.
4. **PGF:** Prostaglandin F2 alpha.
5. **FSH:** Follicle-stimulating hormone.
6. **LH:** Luteinizing hormone.
7. **GnRH:** Gonadotropin-Releasing Hormone.
8. **IGF-1:** Insulin growth factor.
9. **IgG:** Immunoglobulin G.
10. **BW:** Body weight.
11. **SCK:** Subclinical ketosis.
12. **BHB:** β-hydroxybutyrate.
13. **CM:** Clinical mastitis.
14. **Mm:** Millimetres.
15. **CL:** Corpus luteum.
16. **AFI:** Apparent fertility index.
17. **TFI:** Total fertility index.
18. **AC1:** Age at first calving.
19. **CFI:** Calving-first insemination interval.
20. **CCI:** Calving-conception interval.
21. **FIC:** First insemination-conception interval.
22. **CI:** Calving interval.
23. **CH1:** Calving-first heat interval.
24. **AI:** artificial insemination.

Abstract

A good reproduction rate signifies a good milk production. The relationship between dystocia and reproduction is crucial: dystocia directly affects reproductive performance in cows. As a common complication during calving in dairy cows, it poses significant challenges for animal welfare and farm economics. This study analyzed 191 calving events at the Technical Institute of Livestock (ITELV) in Baba Ali, Algiers, from 2015 to 2023, finding that 24.08% were dystocic. Dystocia significantly impacted postpartum health, increasing incidences of mastitis, metritis, and other conditions. Reproductive parameters showed delays, with prolonged calving intervals and variable calving-to-conception intervals. Calves born from dystocic births had higher mortality rates. These findings highlight the need for targeted management strategies to improve herd health and reproductive efficiency.

Key words: Dystocia, Reproductive parameters, Calf viability, Postpartum diseases, Calving management, Fertility.

Résumé

Une bonne reproduction signifie une bonne production laitière. La relation entre la dystocie et la reproduction est cruciale : la dystocie affecte directement la performance reproductive des vaches. En tant que complication fréquente lors du vêlage chez les vaches laitières, elle pose des défis significatifs pour le bien-être animal et l'économie des fermes. Cette étude a analysé 191 événements de vêlage à l'Institut Technique des Élevages (ITELV) à Baba Ali, Alger, de 2015 à 2023, et a constaté que 24,08% étaient dystociques. La dystocie a significativement affecté la santé post-partum, augmentant les incidences de mammite, métrite et autres conditions. Les paramètres reproductifs ont montré des retards, avec un intervalle de vêlage prolongé et des intervalles vêlage-conception variables. Les veaux issus de naissances dystociques avaient des taux de mortalité plus élevés. Ces résultats soulignent la nécessité de stratégies de gestion ciblées pour améliorer la santé du troupeau et l'efficacité reproductive.

Mots-clés : Dystocie, Paramètres reproductifs, Viabilité des veaux, Maladies post-partum, Gestion du vêlage, Fertilité.

ملخص

معدل التكاثر الجيد يعني إنتاجًا جيدًا للحليب. العلاقة بين عسر الولادة والتكاثر مهمة للغاية: عسر الولادة يؤثر بشكل مباشر على الأداء التناسلي للأبقار. باعتباره مضاعفة شائعة أثناء الولادة في الأبقار الحلوب، فإنه يفرض تحديات كبيرة على رفاهية الحيوان واقتصاديات المزارع. هذه الدراسة حللت 191 حدث ولادة في بابا علي، الجزائر، من 2015 إلى 2023، ووجدت أن 24.08٪ منها كانت عسر ولادة. أثر عسر الولادة بشكل كبير على الصحة بعد الولادة، مما زاد من حالات التهاب الضرع، والتهاب الرحم، وغيرها من الحالات. أظهرت معايير التكاثر تأخيرات، بفترات ولادة طويلة وفترات متغيرة بين الولادة والحمل. كانت العجول المولودة من ولادات عسرة الولادة لديها معدلات وفيات أعلى. هذه النتائج تؤكد الحاجة إلى استراتيجيات إدارة موجهة لتحسين صحة القطيع وكفاءة التكاثر

الكلمات المفتاحية: عسر الولادة، معايير التناسل، الامراض بعد الوالدة، إدارة الولادة، الخصوبة.

Introduction

The reproductive health and productivity of dairy cows are fundamental to the success of the dairy industry. Efficient reproduction ensures a consistent supply of milk, which is the primary source of income for dairy farmers. The ability of cows to conceive, carry pregnancies to term, and calve successfully is critical for maintaining high milk production levels and ensuring the economic viability of dairy operations.

However, dystocia, or difficult calving, is a significant concern in the dairy industry, impacting the health, productivity, and welfare of dairy cows globally. This condition, characterized by prolonged or difficult labour, poses immediate risks to both the cow and the calf, leading to various postpartum complications such as uterine infections, retained placenta, and delayed recovery times **(Mee, 2008).** These issues directly affect the cow's ability to return to optimal health and reproductive efficiency, thereby influencing the long-term productivity and economic viability of dairy farms **(Mee, 2008).** At the global level, the prevalence of dystocia in dairy cattle varies widely, with estimates ranging from 3% to 23% depending on the study and region **(Mee, 2008).** In the United States, for instance, the incidence of dystocia is reported to be around 10% in Holstein herds **(Meyer et al., 2001).** In Europe, the rates can be as high as 15%, with significant economic impacts due to veterinary costs and loss of productivity **(Mee, 2008).** Nationally, in Algeria, studies have indicated that the incidence of dystocia in Montbeliard cows is approximately 12% **(Houssou et al., 2023),** highlighting the need for effective management practices to mitigate this issue. The postpartum period is a pivotal phase in the reproductive cycle of dairy cows. Efficient and healthy recovery during this time is essential for the cow to return to oestrus and achieve subsequent conception, which is crucial for maintaining a profitable production cycle **(Markusfeld, 1987).** However, dystocia affects this critical recovery phase, leading to extended calving intervals and increased culling rates (Suthar et al., 2013). These challenges not only strain the resources and labour of farmers but also escalate veterinary costs and compromise animal welfare standards **(Giuliodori et al., 2013).** Despite advancements in veterinary medicine, genetics, and farm management practices, the incidence of dystocia remains a persistent issue. Understanding the rate of dystocia within a herd and determining if it is within the normal range is crucial for effective management **(Nielen et al., 1994).** Various factors contribute to the occurrence of dystocia, including genetic predisposition, the size and positioning of the calf, the nutritional status of the cow, and overall herd management practices **(Mee, 2008).** The central problem statement of this study is to comprehensively understand the rate of dystocia and its impact on dairy cows during the postpartum period, as well as its effects on the calves' lives. This research aims to explore severalkey questions: What is the rate of dystocia in the herd, and is it within the norm?

How does dystocia affect the immediate and long-term health of dairy cows postpartum? How does dystocia influence the overall productivity and reproductive efficiency of dairy cows? How does dystocia impact the survival and health of calves born from difficult births? By addressing these questions, this study seeks to provide valuable insights that can inform better management practices, improve animal welfare, and enhance the profitability of dairy farming operations.

Chapter I: Dystocia

1. Definition of dystocia:

The term dystocia originates from the Greek words 'dys' which signifies difficulty, and 'tokos', which refers to birth **(Mee, 2008),** refers to a challenging delivery often characterized by an unusual length of time in one or more stages of labour. Mild cases of dystocia typically necessitate minimal assistance with gentle or no forced traction, usually managed by a single individual for correcting foetal malposition. However, moderate or severe cases require more intensive obstetrical intervention, likely involving veterinary assistance. Dystocia accounts for approximately 10% of all calvings within a herd, with a higher incidence occurrence in heifers and notable variances observed between breeds and even among herds **(Simões et Stilwell, 2021).** However, the frequency can notably increase on individual farms **(Tenhagen *et al.*, 2007).**

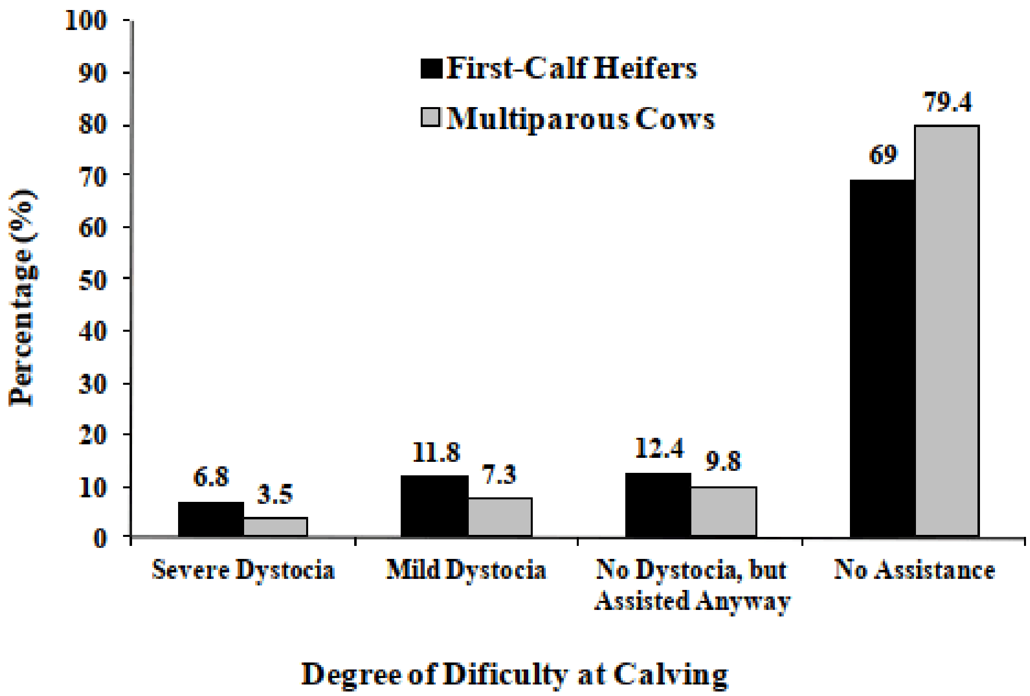


Figure 01: The distribution of dystocia varies according to the level of assistance provided during parturition in first calving heifers and multiparous Holstein dairy cows in the US **(Schuenemann, 2012).**

2. Scoring the degree of dystocia:

Over time, numerous scoring point scales have been suggested for categorizing the severity of dystocia, emphasizing the necessity for international standardization **(Simões et Stilwell, 2021).**

Table 01: Various scales of calving difficulty scores **(Simões et Stilwell, 2021)**,

Score points for assistance (1 = no assistance)				**References**
2	**3**	**4**	**5**	
One person	Two or more people	Mechanical extraction	Surgical procedures	**(Lombard *et al.*, 2007)**
One person with minimal effort	One person with moderate effort	One person with considerable effort or two people	Mechanical extraction or C-section	**(Hiew *et al.*, 2016)**
One person	One person + calf puller or >1 person	Veterinary assistance (caesarean section, C-section)		**(Mee, 2008a; Mee, 2008b; Mee, 2011)**
Minor manual assistance	Mechanical extraction	C-section		**(Bellows et lammogalia, 2000)**
Easy pull	Mechanical extraction	C-section or embryotomy		**(Phocas et laloë, 2004)**
Easy	Difficult but without veterinary assistance	Difficult with veterinary assistance		**(Hansen *et al.*, 2004)**
Mild dystocia	Severe dystocia	C-section		**(Tenhagen *et al.*, 2007)**
Light traction	Heavy traction			**(Jacobsen *et al.*, 2000)**
Assistance				**(Johanson et berger, 2003)**

3. Causes:

From a clinical point of view, the causes of dystocia can be classified according to their origin as foetal, maternal, or foeto-maternal. This pragmatic classification can be useful in clinical settings and is correlated to the three main components of the calving process: (1) foetal size (weight), shape, and disposition; (2) birth canal adequacy; and (3) expulsive forces **(Simões et Stilwell, 2021)** . Usually, dystocia is distinguished between maternal and foetal origins, but it is sometimes difficult to identify the primary cause. Two components must be considered during parturition: firstly, the expulsive forces, which must be significant enough, and secondly, the conformation of the pelvic canal, which must be in accordance with the size and presentation of the foetus **(Noakes *et al.*, 2001).**

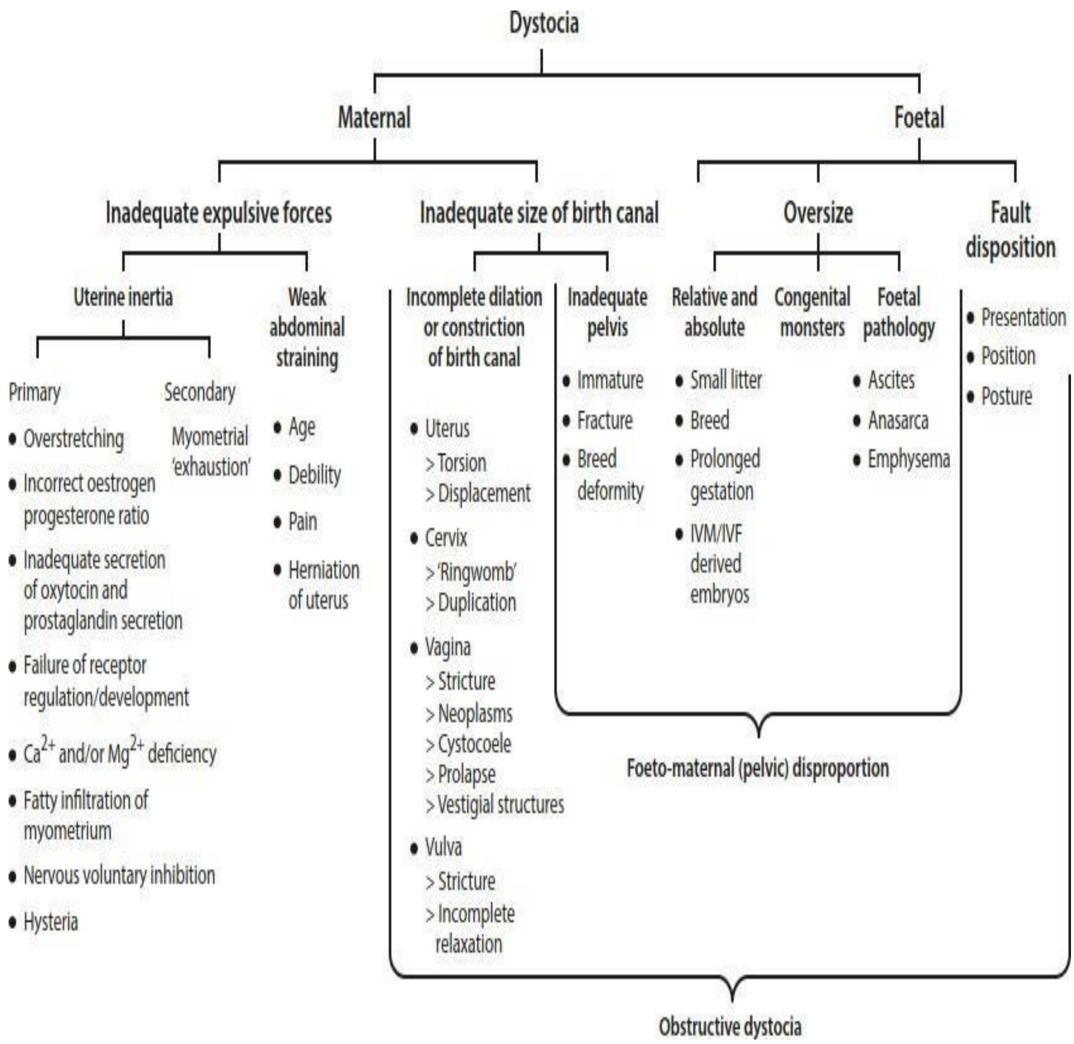


Figure 02: Maternal and foetal causes of dystocia **(Simões et Stilwell, 2021)**.

4. Common types of dystocia:

Foeto-maternal disproportions are the most common cause of dystocia, as illustrated in **Figure 03.** These types can be further categorized into:

- Absolute foetal disproportions: where the foetus is too large.
- Relative foetal disproportions: where the foetus is of normal size, but the pelvic canal is too small **(Noakes *et al.*, 2001).**

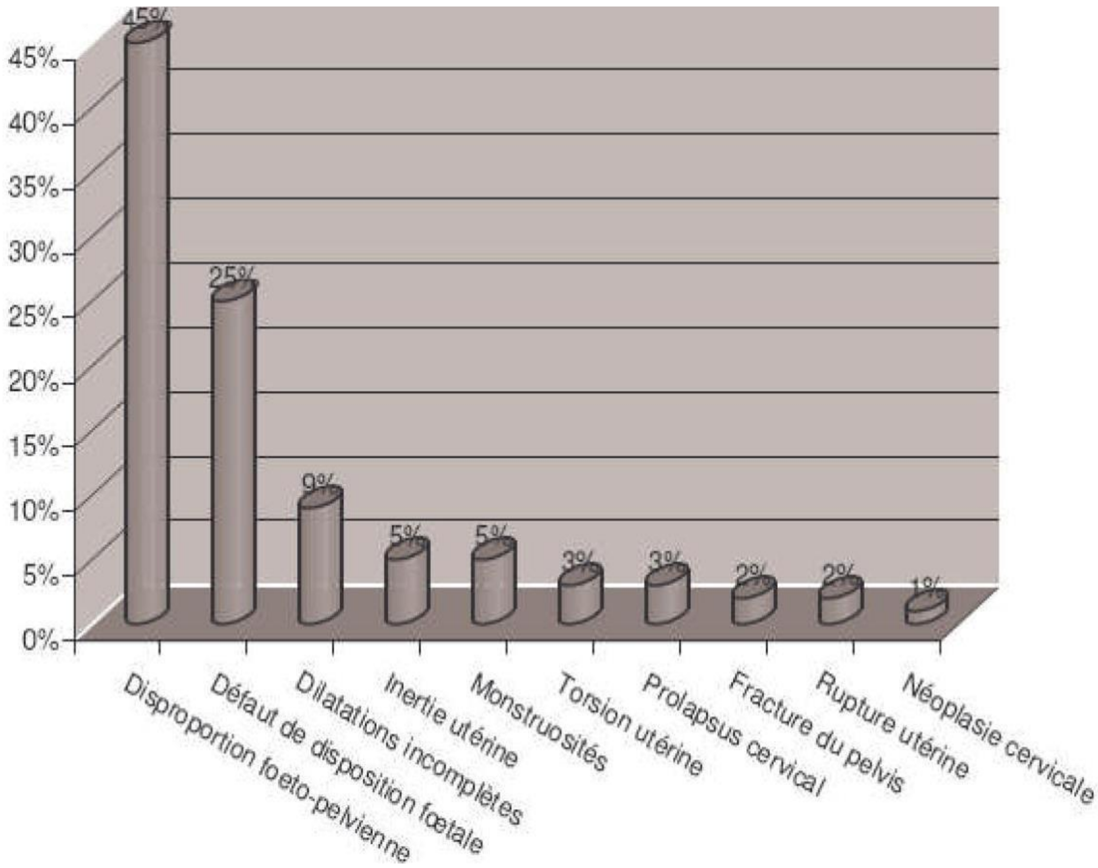


Figure 03: Causes of dystocia in cattle **(Noakes *et al.*, 2001)**.

5. Predisposing Factors for Dystocia:

Some of the major factors include the following:

5.1 Calf Birth Weight:

This factor is strongly associated with dystocia. In Holsteins, a 1 kg rise in calf birth weight led to a 13.0% increase in the likelihood of dystocia **(Zaborski *et al.*, 2009).**

5.2 Calf Sex:

Male calves tend to experience more hard births, primarily due to their larger size and greater birth weight **(Haskell, 2014)**. Additionally, pregnancies with male calves have longer gestation periods, which also contribute to an increased risk of dystocia **(Heins *et al.*, 2010).**

5.3multiple calvings:

In general, multiple calvings are more difficult than single ones. **Correa *et al.* (1993)** noted a 10.5 times higher probability of dystocia in twin calvings compared to single calvings. A mean percentage of malpresentation cases ranged from 7.2% to 78.9% for twin calvings and from 2.7% to 21.8% for single ones **(Zaborski *et al.*, 2009)**.

5.4. <u>Cow Body Condition During the Dry Period and at Calving:</u>

Maintaining an optimal body condition score is crucial for an easy calving. Overly conditioned cows face an increased risk of dystocia and metabolic disorders in early lactation. Conversely, heifers that are too thin may not achieve the appropriate body size by the time they calve at 24 months of age **(Schröder et Staufenbiel, 2006)**. The ideal range for body condition score is considered to be between 3.0 and 4.0 points, with a lower score indicating an energy deficiency **(Zaborski *et al.,* 2009)**, however **Ruegg et Milton (1995)** and **Berry *et al.* (2007)** didn't note any remarkable effect of BCS on dystocia in the perinatal period.

5.5. <u>Cow Age at Calving:</u>

Typically, younger cows experience more challenging calvings, regardless of the number of times they've given birth. The age of the cow at calving is directly connected to its size, which, in turn, affects the size of the calf. Smaller cows tend to deliver smaller calves, thereby reducing the risk of dystocia **(Abdela et Ahmed, 2016).**

5.6. <u>Nutrition:</u>

Inadequate nutrition for growing heifers stands out as the primary factor that can hinder both body and pelvic growth. Elevated feeding levels can potentially increase the risk of dystocia, particularly in heifers, due to excessive fat deposition in the pelvis, which can predispose them to difficult childbirth **(Bareille *et al.,* 2003).** On the other hand, intensive administration of vitamin D during the dry period may lead to increased dystocia, the mechanism by which excessive administration of vitamin D during the dry period can lead to dystocia in dairy cows is primarily related to its impact on calcium metabolism. Vitamin D plays a crucial role in regulating calcium levels in the body, which is essential for muscle function, including uterine contractions during calving. When there is an imbalance in calcium levels due to excessive vitamin D intake, it can disrupt the normal muscle function required for the birthing process, potentially leading to difficulties during calving, such as dystocia. Therefore, the disruption of calcium balance caused by intensive vitamin D administration can interfere with the smooth progression of labour and increase the risk of dystocia in dairy cows. Similar to the effects of insufficient calcium administration. It's also crucial to ensure the appropriate intake of vitamins A, D, and E. Furthermore, the type of diet can indirectly influence the level of dystocia **(Correa *et al.,* 1990).**

5.7. Genetics:

Genetics also plays a role in influencing the occurrence of foeto-maternal disproportion in cattle. Notably, beef cows experience a significantly higher rate of dystocia compared to dairy cows. Research has shown that there are variations in pelvic size among different cattle breeds, primarily attributed to differences in cow body weight, although there is a tendency for larger pelvic openings in larger cows. The breed of the cow has a significant impact on pelvic width, which in turn substantially contributes to the rate of dystocia. For instance, Hereford cows exhibit the smallest pelvic height, width, and area, whereas Braunvieh cows have the widest pelvis, and Charolais cows have the highest pelvic height and area **(Zaborski *et al.*, 2009).**

5.8. Management:

Pregnant animals that are not provided with exercise and are confined in close quarters are more susceptible to difficulties such as uterine torsion and inertia compared to those in natural conditions, such as being on pasture. Regular exercise enhances overall body tone, strength, and resistance, leading to more robust labor contractions, reduced fatigue, shorter duration of parturition, lower incidence of uterine inertia, and quicker postpartum recovery **(Abdela et Ahmed, 2016).**

6. Economic significance of dystocia:

a- Direct Losses:

Among the various factors that impact calf survival, dystocia stands out as the most critical contributor, it leads to calf and cow mortality (45,9 per cent), reduced productivity for both the mother and calf, and delays in reproduction rates **(Dematawewa et Berger, 1997)**. Dystocia can lead to extended periods of oxygen deprivation and increased acidity levels (acidosis). If it doesn't directly cause the death of a full-term foetus, it can result in weakness and prolonged inability to stand after birth. This can subsequently reduce the intake of colostral immunoglobulins, ultimately leading to a higher short to medium-term mortality rate. Furthermore, the stresses exerted on the foetus during delivery may contribute to cardiopulmonary issues, collectively diminishing the chances of neonatal survival **(Lombard et al., 2007).**

b- Indirect losses:

In a research study involving beef cattle, it was observed that extended labour during childbirth led to a minor delay in the commencement of oestrus after calving. This also resulted in a slightly increased number of mating attempts per successful conception and a decreased overall conception rate. Notably, this impact was more significant among heifers. **(Abdela et Ahmed, 2016).** Bovine dystocia is linked to an increased occurrence of retained foetal membranes, as well as uterine disorders such as endometritis, metritis, pyometra, and uterine rupture in cows. Additionally, it is associated with periparturient hypocalcaemia, commonly referred to as "Milk Fever" **(Mee, 2004).**

This involves selecting sires based on their calving ease and dams based on adequate pelvic size, a practice not commonly undertaken in the dairy industry. Additionally, heifers should be bred according to recommended height and weight, and they should receive optimal nutrition during pregnancy.

Chapter II: physiological postpartum and neonatal period

1. the dam:

The post-partum is that period after the completion of parturition, including the third stage of labour, when the genital system is returning to its normal non-gravid state (Noakes *et al.*, 2001). In cows, the normal length of this period is 40–42 days, simultaneous to the resumption of ovarian activity **(Simões et Stilwell, 2021)**.

1.1. Delivery of the placenta:

placental dehiscence is characterized by the separation of fœtal cotyledon from maternal caruncle crypts microvilli in all 60–80 placentomes. The dehiscence occurs through a mixed action of hormonal, immune, biochemical and mechanical elements calvings **(Simões et Stilwell, 2021)** as illustrated in **figure 04**.

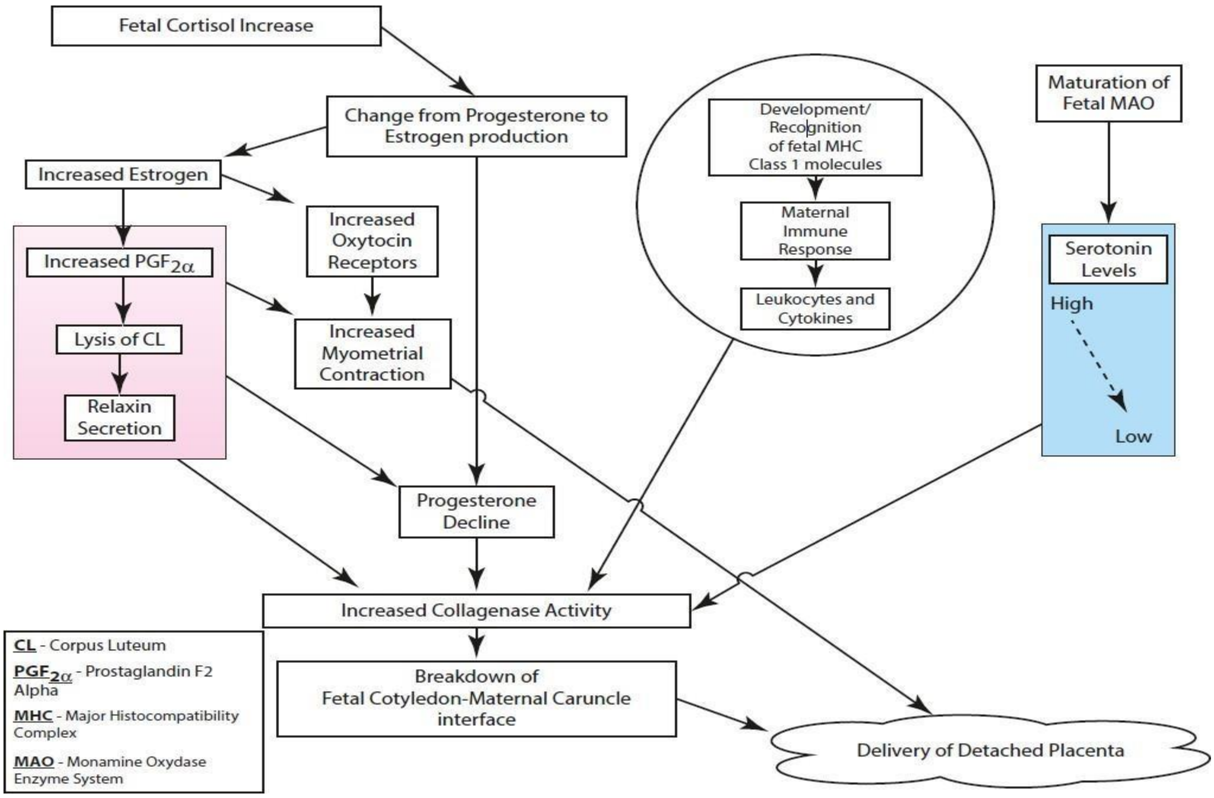


Figure 04: Hormonal and biochemical leading to the dehiscence of placenta **(Simões et Stilwell, 2021)**.

1.2. Uterine involution:

The process of uterine involution involves the restoration of the uterus to its original size and function after pregnancy. This includes the regeneration of the endometrium, a reduction in uterine blood flow and vascularity, as well as a decrease in muscle mass. In dairy cows, the uterus undergoes various changes both in morphology and function following parturition, ultimately returning to its pre-pregnancy state. This restoration is crucial for the proper initiation of the oestrus cycle and ensuring normal reproductive function in postpartum cows **(Dai *et al.*, 2023)**. Cows with normal puerperium have completed involution in the period from 38 - 45 days postpartum, while those with abnormal puerperium needed more time to complete it or required therapy of disturbed uterine status **(Cengic *et al.*, 2012).**

Following the expulsion of the foetal membranes, less intense uterine contractions continue during the immediate post-partum period under the influence of prostaglandin F2 alpha (PGF) and oxytocin to expel remaining uterine contents through the cervix **(Jordan, 1952).**Clinically, this material referred to as lochia is observed as odourless, mucoid, and bloody to reddish-brown-coloured discharge on the ground where a recently calved cow was laying, or may be seen adhering to the ventral commissure of the vulva and/or around the tail. The amount of lochia expelled is maximal during the first two to three days post-calving owing to the higher frequency of postpartum uterine contractions at this time. Thereafter, both the amount expelled and the appearance change such that astute observers may see a purulent or mucopurulent discharge by two weeks postpartum; however, it should not be visible after the third week postpartum in normal, healthy cows **(Sheldon, 2004)**.

1.3. Return of cyclical activity (ovarian rebound):

As a result of the absence or low output of gonadotrophins the ovary is relatively quiescent and the cow is in the anoestrous phase, which may be prolonged in suckler and high-yielding cows. However, during this postpartum phase the ovaries frequently contain numerous large anovulatory follicles which quickly become atretic; these are sometimes incorrectly diagnosed as cysts **(Noakes *et al.*, 2001).**

The anterior pituitary is capable of releasing FSH during the first few days postpartum, so that with the sporadic release of endogenous GnRH there is a gradual and sustained rise in plasma FSH. After about 7–10 days, this is sufficient to result in the emergence of the first follicular wave; this occurs at about 4 days in dairy cattle. The ability of the pituitary to release luteinizing hormone (LH) is much slower, for although the early release of GnRH causes some rise in LH, it quickly returns to basal levels. A dominant follicle may emerge from the first follicular wave, but ovulation will occur only if the dominant follicle produces enough oestradiol to stimulate adequate LH secretion; if this occurs, then there is a first ovulation at 21 days in dairy cows. Insulin growth factor (IGF-1) is also involved in the early onset of folliculogenesis and ovulation, by stimulating follicular granulosa cell aromatase activity and oestradiol synthesis. After ovulation, there is a luteal phase which may be of normal length with a return to oestrus after 18–24 days, or it may be much shorter, 14 days or less **(Noakes *et al.*, 2001).**

2. The calf:

2.1. Vital signs:

The evaluation of vital signs is crucial immediately following the extraction of the newborn. The foremost consideration is the assessment of ventilation. To achieve optimal lung expansion, it is recommended to position the calves in sternal decubitus, with their hind legs extended to each side of the body, thus reducing pressure on the diaphragm as illustrated in figure**(idk).** This positioning facilitates easy filling of the lungs. During this period, it is essential to conduct a comprehensive physical examination, including auscultation of the heart (with a normal range of 100-150 beats per minute), in order to detect any signs of trauma. In the event that the calf is to be separated from the dam and the environmental temperature is low, it is important to dry the calf thoroughly using a towel or dry straw **(Simões et Stilwell, 2021)**. All these vital signs and more can be evaluated using “the calf VIGOR Scoring System” **(Murray, 2014)**

Figure 05: positioning the calf in sternal decubitus with the hind legs extended to each side of the body for an easy breathing **(Simões et Stilwell,2021).**

<u>Table 02:</u> the calf VIGOR Scoring System **(Simões et Stilwell, 2021).**

Item	Points towards total score/category			
	0	1	2	3
Meconium staining	No stain	Anal area only	Extended over the body	Completely covered
Responsiveness				
Shake	Vigorous	Moderate	Twitches	No response
Eye reflex[a]	Active blink	Slow blink	No response	–
Tongue pinch	Active withdraw	Attempt withdraw	Twitches	No response
Tongue swelling	No swelling	Protruding and not swollen	Protruding and swollen	Head, tongue swollen
Heart rate[a]	80–100 beats/min.	<80 beats/min.	>100 beats/min.	–
Respiration rate[a]	24–36 breaths/min.	<24 breaths/min.	>36 breaths/min.	–
Mucous membrane colour	Bright pink	Light pink	Red	White/grey

2.2. Disinfection of the umbilical cord:

Simões and Stilwell (2021) recommend that navel disinfection, consisting of a single immersion of the umbilicus immediately after calf birth, will prevent contamination and accelerate the healing of the umbilical cord. Traditionally, 7% iodine tincture is used for disinfection, but **Robinson *et al.* (2015)** and **Wieland *et al.* (2017)** prefer less concentrated disinfecting solutions that do not cause tissue inflammation, such as 2–4% chlorhexidine, 10% trisodium citrate, and 0.1% chlorine-based solution. **George Stilwell (2021)** suggests an alternative or complementary approach to disinfection, which involves tightly tying the umbilical cord with a string and administering antimicrobials. However, antimicrobials should not be used if there is a possibility of umbilical contamination, such as in cases of unassisted calving in a dirty environment.

Figure 06: A dried umbilical cord to which a string was tied just after delivery **(Simões et Stilwell, 2021).**

2.3. Colostrum:

The calf is hypo- or agammaglobulinemic at birth. It needs to ingest colostrum during the first hours of life, because enterocyte pinocytosis, through which immunoglobulins reach the bloodstream, decrease progressively from 6 h after birth being completely null after 24–48 h.The route of ingestion may also play a role. Suckling from the dam or from a bottle is probably the best way to achieve good IgG absorption. Intubation may be stressful and should only be performed by trained staff but is sometimes the best way to get 10% of body weight (BW) into a recently calved animal **(Simões et Stilwell, 2021)**.

Chapter III: pathological postpartum and neonatal period

1. The dam :

1.1. Postpartum Pathologies :

Postpartum pathologies in dairy cows present significant challenges to herd health, productivity, and economic sustainability within the dairy industry. These conditions encompass a spectrum of disorders that manifest in the period following calving and can profoundly affect both the individual cow and the overall operation **(Sheldon *et al.*, 2006)**. From metabolic disturbances such as ketosis and milk fever to reproductive dysfunctions including retained placenta and metritis, postpartum pathologies reflect a complex interaction of physiological, environmental, and management factors **(Drackley, 1999; Goff, 2000).**

Managing postpartum pathologies effectively is crucial for optimizing dairy herd performance. Early identification, prompt intervention, and preventive measures play pivotal roles in mitigating the adverse effects on cow health, milk yield, and reproductive outcomes **(Sordillo et Raphael, 2013).** A comprehensive understanding of the underlying mechanisms, predisposing factors, and diagnostic protocols associated with each pathology is essential for successful management strategies **(Sheldon *et al.*, 2006).**

1.1.1. Retained placenta:

The expulsion of foetal membranes marks the third stage of labour and typically occurs within 6 hours after parturition **(Ball et Peters, 2004)**. In some cases, this process may extend to 12 hours, but if 24 hours pass without the expulsion of membranes from the uterus, it is likely due to pathological retention **(Noakes *et al.*, 2001)**. Within dairy farms, it is expected that retained placenta occurs in no more than 5% of calvings **(Simões et Stilwell, 2021)**.

1.1.2. Puerperal metritis:

Metritis, characterized by acute inflammation of the uterus, occurs when microorganisms adhere to the endometrial mucosa and colonize the epithelium. The majority, approximately 95%, of puerperal or clinical metritis cases manifest within the initial two weeks postpartum, with a peak incidence typically observed between the 5^{th} and 7^{th} days **(Galvão, 2012).** On average, the incidence of postpartum uterine infections stands at around 20%, although it can affect more than 40% of cows, particularly in problematic dairy farms **(Simões et Stilwell, 2021).** A severe form of metritis, commonly known as acute puerperal metritis or toxic septic metritis, can manifest within the initial week post-calving. Cows experiencing this acute condition typically exhibit body temperatures exceeding 39.5°C, along with an enlarged, flaccid uterus and discharge ranging from watery red-brown to purulent, often accompanied by a fetid odour and signs of toxemia are also evident **(Sheldon *et al.*, 2008; Haimerl *et al.*, 2014)**. Subsequent to an episode of metritis, cows commonly experience a significant decline (15–20%) in their first-service conception rate, an extended calving-to-conception interval of nearly one estrous cycle length, and an increased risk of being culled from the herd compared to their counterparts that have undergone normal uterine involution **(Fourichon *et al.*, 2000; Ordell *et al.*, 2016).**

<u>Table 03:</u> Risk factors for metritis.

Risk factors	References
▪ Retained foetal membranes	▪ **(Ghavi Hossein-Zadeh et Ardalan, 2011)**
▪ Stillbirth, twin births	▪ **(Ghavi Hossein-Zadeh et Ardalan, 2011)**
▪ Dystocia	▪ **(Ghavi Hossein-Zadeh et Ardalan, 2011 ; Giuliodori *et al.*, 2013)**
▪ Hypocalcemia	▪ **(Simões and Stilwell, 2021)**
▪ Clinical and subclinical ketosis	▪ **(Raboisson *et al.*, 2014 ; Abdelli *et al.*, 2017)**
▪ Negative energy balance	▪ **(Abdelli *et al.*, 2017)**

<u>1.1.3. Uterine prolapse:</u>

Uterine prolapse occurs in less than 0.5% of calvings, mainly within the first 2h after calf delivery, but can occur up to 24h. The endometrium surface, including the maternal caruncles or placentomes, is exposed to the environment, and the vascular system of the uterus may be totally or partially compromised**.** Predisposing factors for uterine Prolapse include hypocalcaemia, prolonged dystocia, uterine inertia, foetal oversize and excessive foetal traction; retained foetal membranes, malnutrition and chronic disease **(Simões et Stilwell, 2021).**

<u>1.1.4. Sub clinical Ketosis:</u>

Subclinical ketosis (SCK) is characterized by abnormal concentrations of circulating ketone bodies in the absence of clinical signs, as defined by **Andersson (1988)**. It is identified by concentrations of β-hydroxybutyrate (BHB) ≥1.2 to 1.4 mmol/L and is considered a predisposing factor for various metabolic and infectious disorders such as metritis, mastitis, clinical ketosis, and displaced abomasum **(Suthar *et al.*, 2013)**. The reported prevalence of subclinical ketosis during the first 2 months of lactation varies between 8.9% and 43% **((Dohoo *et al.*, 1983; Duffield *et al.*, 1998; McArt *et al.*, 2012).** Factors associated with an increased risk of subclinical ketosis include parity 2 and older, over conditioning of animals prepartum, the season, prolonged previous lactation length, and dry period length. Additionally, the amount of colostrum yielded, measured in litres, may also contribute to the risk **(vanholder *et al.*, 2015).**

1.1.5. Mastitis:

Clinical mastitis (CM) stands as one of the most common ailments impacting dairy cows globally **(Barnouin *et al.*, 1999; Ruegg, 2003; Halasa *et al.*, 2007)**. Its incidence rate varies from 13 to 40 cases per 100 cow years across different countries and housing systems **(Peeler *et al.*, 2002; McDougall *et al.*, 2007; Bar *et al.*, 2008b; Olde Riekerink *et al.*, 2008; van den Borne *et al.*, 2010)**.

Parity and the early lactation period emerge as significant risk factors for clinical mastitis (CM) **(Hertl *et al.*, 2011; Elghafghuf *et al.*, 2014)**. Within the first 30 days in milk (DIM), the incidence rate of CM was found to be 4.6 and 2.0 times higher than during the remaining lactation period in multiparous and primiparous cows, respectively **(van den Borne *et al.*, 2010; Hammer *et al.*, 2012)**. Additionally, elevated herd somatic cell counts (SCS) **(Nash *et al.*, 2000; Wolf et *al.*, 2010; Elghafghuf *et al.*, 2014)**, teat-end callosity **(Neijenhuis *et al.*, 2001; Zadoks *et al.*, 2001)**, trampled teats, and milk leakage **(Elbers *et al.*, 1998)** have been identified as further risk factors for CM.

The adverse impacts of clinical mastitis encompass substantial milk losses **(Gröhn *et al.*, 2004; Steeneveld *et al.*, 2008; Schukken *et al.*, 2009)**, diminished milk quality **(Barbano et al., 2006),** escalated treatment expenses **(Bar *et al.*, 2008b)**, veterinary charges, additional labor **(Pérez-Cabal *et al.*, 2009)**, and heightened likelihood of mortality and culling among the affected dairy cows **(Bar *et al.*, 2008b; Hertl *et al.*, 2011; Cha *et al.*, 2013)**.

1.1.6. Milk fever:

Milk fever, classified as a metabolic condition **(Horst *et al.*, 2005)**, stands as one of the most prevalent mineral-related metabolic disorders affecting dairy cows. It typically arises just before or shortly after parturition due to the significant loss of calcium from the blood, amounting to approximately 50 grams per day, which is necessary to facilitate rapid milk synthesis **(Crivei *et al.*, 2021).**

Some predisposing factors for milk fever and its economic consequences are represented in Figure **07**.

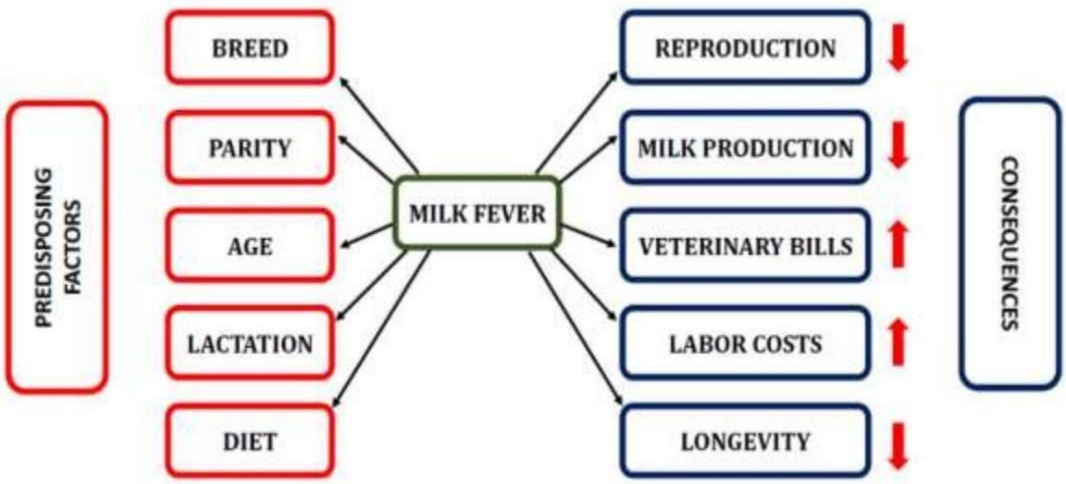


Figure 07: Predisposing factors for milk fever and its economic consequences **(Dervishi E. *et al.*, 2017)**

1.1.7. Postpartum anœstrus:

Postpartum anoestrus is characterized by a lack of observed or reported oestrus in dairy cattle for several weeks following calving, often extending to the end of the voluntary waiting period **(Ambrose, 2021)**. Although a brief period of ovarian inactivity is typical during the immediate postpartum phase, it becomes concerning when ovulation has not transpired by day 50 postpartum **(Ball and Peters, 2004)**. Extended anoestrus in non-suckled cattle, such as dairy cows, could have negative ramifications on the timely reestablishment of pregnancy **(Thatcher et Wilcox, 1973; Kim *et al.*, 2012)**. Typical prevalence rates at the end of the elective waiting period (60–80 days after calving) are in the range of 10–30% **(Francos et Mayer, 1988; Ambrose et Colazo, 2007)**, whereas higher rates of up to 59% have been reported in individual herds **(Lucy, 2001; Stevenson *et al.*, 2006; Walsh *et al.*, 2007)**.

The classification of anovulatory conditions in cattle is based on three functionally critical follicular diameters relating to emergence (~4mm), deviation (~9mm), and ovulation (10–20mm) as proposed by **Wiltbank *et al.* (2002)**. Building upon this classification, **Peter *et al.* (2009)** described four types of anoestrus, labelled as Types I to IV.

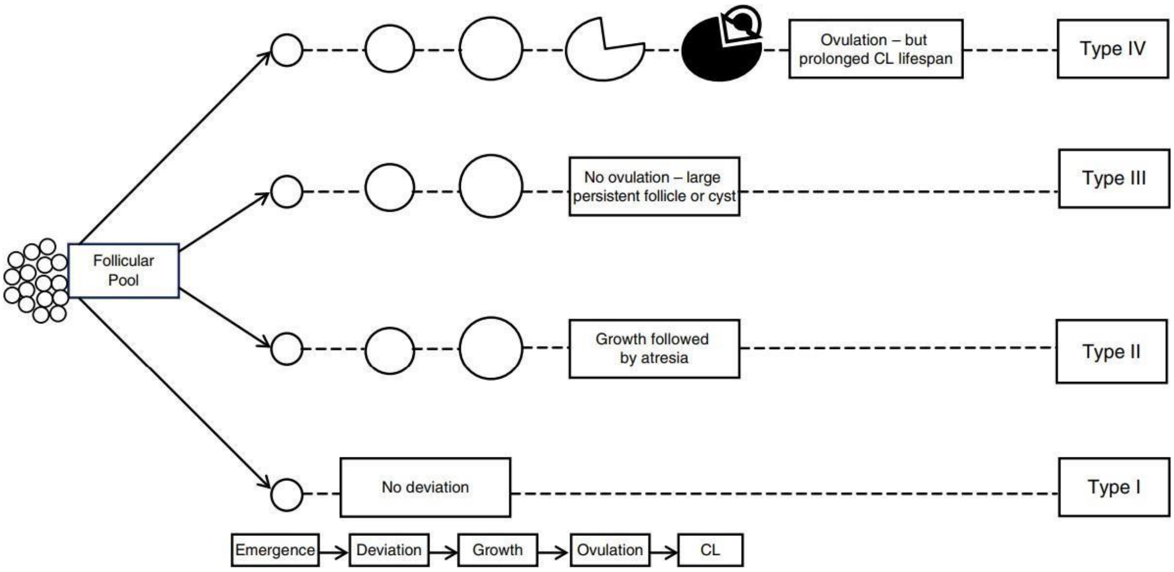


Figure 08: schematic representation of types of anoestrus conditions based on ovarien follicular dynamics (Ambrose,2021)

- **Type I:** In this type, there is an absence of follicular deviation, leading to a lack of selection of a dominant follicle. This form of anoestrus is presumed to be due to extreme malnutrition, which may negatively impact FSH production, suppressing follicular growth. Ovaries in this type may be described as either "inactive" or "smooth" **(Ambrose, 2021)**.
- **Type II:** Both follicular deviation and growth occur in Type II, followed by regression, in some cases, after a follicle attains dominance. The regression of a dominant follicle is typically followed by the emergence of a new follicular wave, two to three days later. Sequential emergence of follicular waves may precede the eventual occurrence of the first ovulation in this type of anoestrus **(Ambrose, 2021)**.
- **Type III:** This type involves the failure of ovulation of the dominant follicle, resulting in a persistent structure that may either linger as an anovular follicle or continue to grow and develop into a cystic follicle. Anovular follicles are distinguished from cystic follicles by the disruption of feedback mechanisms in the hypothalamic–pituitary axis in cows with the latter condition **(Vanholder *et al.*, 2006)**.
- **Type VI:** Adominant follicle ovulates and forms a CL, but the luteal phase is prolonged due to the absence of timely luteolysis followed by CL regression. Aberrant follicular growth patterns, resulting in the absence of an estrogenic dominant follicle at the ideal

time to trigger luteolysis, could contribute to this condition of persistent CL **(Wiltbank *et al.*, 2002)**

1.1.8. Lameness:

lameness is an important disease in dairy cattle because of economic and welfare considerations and frequency of occurrence **(Warnick *et al.*, 2001).**

Economic losses include decreased milk production, weight loss, death, culling, decreased reproductive performance, and treatment costs **(Weaver, 1984)**. In addition, because of the pain, discomfort, and high incidence of lameness in dairy cows, this disorder is an animal-welfare issue of concern **(Garbarino *et al.*, 2004).**

2. The calf:

2.1. Neonatal pathologies:

In the immediate perinatal period, dystocic calves can experience severe hypoxia and acidosis **(Massip, 1980; Breazile *et al.*, 1988)**. These conditions can lead to impaired breathing and inadequate functioning of oxygen-deprived organs. **Berglund *et al.* (2003**) said that calves born from dystocia may also suffer from internal injuries, such as haemorrhages, petechiae, and fractures, which significantly reduce their viability. These injuries usually result from the pressure exerted during calving assistance.

Muscuzza *et al.* (2014) stated that calf navel pathologies are associated with the hygiene conditions during parturition. In a normal calving, after the rupture of the umbilical cord, the urachus, arteries, and umbilical vein typically retract into the abdomen, which helps prevent environmental contamination. Therefore, it is believed that umbilical inflammatory processes have a septic cause. Pyogenic bacteria such as **Arcanobacterium*, *Streptococcus*, *Staphylococcus**, and **Escherichia coli** can colonize the remnants of the umbilical cord **(Shearer, 1986). Ymes-Mulon *et al.* (2005)** observed that improper maturation of the umbilical cord, without correct retraction of the vascular structures, Favors bacterial contamination.

2.2. Stillbirths:

Stillbirth is defined as birth in which a calf born after at least 260 days of gestation is born dead or dies within 24 hours after its birth **(Szücs *et al.*, 2009).** Several studies have implicated dystocia as contributing factor to stillbirth **(Meyer *et al.*, 2001 and Lombard *et al.*, 2007)**, as demonstrated in the study done by **Morsli et al. (2022)** the incidence of stillbirth was 47.6 per cent in 212 cases of dystocia.

Additionally, live calves born from dystocia were 2.4 times more prone to suffer illnesses during the first 45 days of life, as compared to calves from natural births **(Noakes, 1997)**.

Chapter IV: Reproductive parameters

1. Reproductive cycle:

Reproductive performance of dairy cattle is a major concern for breeders and their technical supervisors, as it tends to decline year after year on dairy farms globally **(Mimoune *et al.*, 2017).** Therefore, ensuring the reproductive cycle requires significant attention and skill from the breeder. It is essential for the farmer to effectively control the cows' reproductive cycle **(Fig. 9)**, manage oestrus detection, and maintain a comprehensive record system for mating and calving **(Zigo et *al.*, 2019).**

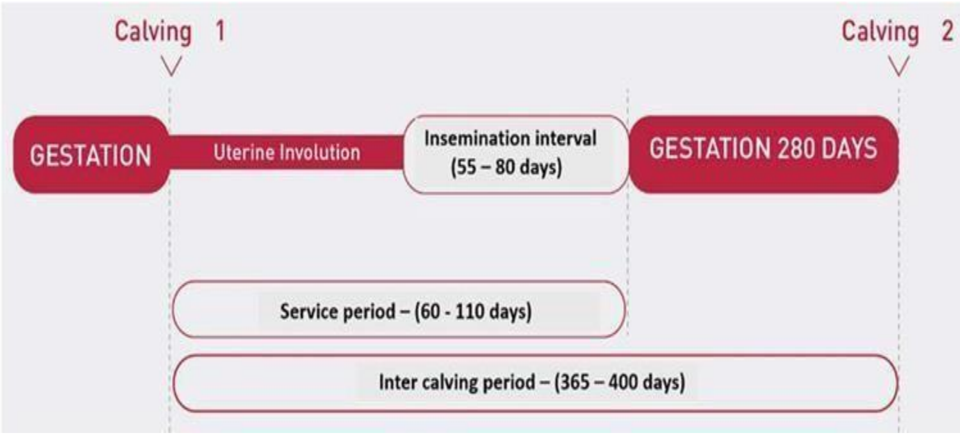


Figure 09: Reproductive cycle in dairy cows **(Zigo *et al.*, 2019).**

2. Fertility:

Fertility, defined as the capacity to reproduce, particularly pertains to females' ability to produce fertilizable oocysts **(Bouchard, 2003**). In evaluating herd fertility across various specifications, researchers analyse the success rate of gestation post-first insemination and calculate the total number of inseminations needed to achieve gestation **(Hanzen, 1994).**

2.1. Standards for evaluating fertility:

Various criteria need to be taken into consideration, namely:

2.1.1. The fertility index:

It is defined by the number of natural or artificial inseminations needed to achieve gestation (**Hanzen, 2005).**

2.1.2. Conception rate:

It is equal to the inverse of the corresponding fertility index multiplied by 100. It is expressed as a percentage **(Hanzen, 2005).**

2.1.3. Apparent fertility index (AFI):

Is calculated by dividing the total number of inseminations performed on gravid animals by the number of these animals. The numerator includes the number of inseminations carried out during the assessment period on only those animals whose pregnancy has been confirmed by early and/or late methods. Pregnancy can be determined either by veterinary examination or by the absence of heat after 65 days **(Fetrow *et al.*, 1990).** The objective of AFI ranges from 1.5 **(Etherington *et al.*, 1991).**

2.1.4. Total Fertility Index:

Is calculated by dividing the total number of inseminations performed on confirmed gravid, non-gravid, present, or culled animals by the number of gravid animals. The numerator includes the number of inseminations carried out during the assessment period on animals whose gestation has been confirmed and on those which, after insemination, were culled without being confirmed pregnant. The denominator represents the number of animals whose gestation has been confirmed **(Hanzen, 1994).** Objective values are 2.2 according to **Etherington et al (1991).**

3. Fecundity:

Fecundity refers to a female's ability to carry a gestation to term within the required timeframes. It encompasses fertility, embryonic and foetal development, parturition, and new born survival. It's an economic concept, adding a time parameter to fertility. Fecundity is typically expressed as the interval between calving and conception **(Hanzen, 1994).**

3.1. Standards for evaluating fecundity:

Different factors should be considered, specifically:

3.1.1. Age at first calving:

The assessment of this parameter holds significance as it directly impacts the productivity of the animal throughout its tenure on the farm. Achieving a younger age at first calving brings several advantages, including reduced expenses, lower feed costs, decreased overstocking, and increased daily herd production, while a higher age at first calving correlates with reduced chances of conception **(Goodger *et al.*, 1989**). Research indicates that cows calving for the first time at over 27 months have lower conception rates compared to those calving at under 28 months **(Maizon *et al.*, 2004).**

3.1.2. Calving-first insemination interval:

It is a parameter that reflects both the resumption of cyclicity and the quality of heat detection, as well as the breeder's decision to inseminate or not **(M'sadek et Mighri, 2014).**

3.1.3. Calving-conception interval or days open:

It is influenced by calving-first insemination interval and by the number of inseminations required to achieve conception; a too long interval may result from poor heat detection and late inseminations. It is worth noting that all cows must be declared pregnant no later than between the 85th and 90th day after calving, except for first lactation cows or those with high production potential, for which a difference of one month or more is acceptable according to **Seegers and Malher (1996).**

3.1.4. First insemination-conception interval:

This interval depends on successful inseminations and the number of cycles needed for conception, reflecting fertility. For cows not impregnated during the first insemination will return to heat regularly or irregularly. Most should have a regular heat return (between 18 and 24 days); returns between 36 and 48 days are also common but may indicate a detection failure or repeat breeding issue **(Cauty et Perreau, 2003).**

3.1.5. Calving interval:

According to **Cauty and Perreau (2003),** this interval combines three periods: the delay before the start of reproduction, the time lost due to insemination failures, and the duration of gestation.

3.1.6. Calving-first heat interval:

The evaluation of this parameter allows quantifying the importance of postpartum anoestrus. It is important because the animal's subsequent fertility partly depends on an early resumption of ovarian activity after calving. The average value is determined from the intervals between each first heat detected by the farmer during the assessment period and the previous observed or unobserved calving during this period **(Hanzen, 2005).** This interval aims to achieve a maximum proposition within 60 days and a total within 45 days **(Seegers, 1996).**

4. The factors influencing reproductive performance:

Various factors that increase the risk of infertility and/or subfecundity and may alter the normal reproductive timeline of each female from birth until culling, are of diverse nature. These factors can affect individuals (individual factors) or entire herds (collective factors). They directly or indirectly contribute to infertility and/or subfecundity and can act independently or in combination. These factors impact not only the animals themselves but also those responsible for their health and management. They encompass anatomical (congenital or hereditary pathologies), infectious (uterine infections), hormonal (postpartum anoestrus), therapeutic (hormonal induction or synchronization protocols for oestrus), or zootechnical aspects (nutrition programs, heat detection) **(Hanzen *et al.*, 2013).**

5.1. Factors related to the cow:

5.1.1.The breed:

The analysis of intervals between artificial inseminations in dairy cows reveals a significant number of late returns, defined as cows that do not conceive within the expected timeframe after an AI (more than 365 days). These late returns prolong the interval between two calving's, which can impact the overall performance of the herd. In the Normande and Montbeliarde breeds, a relatively high and stable frequency of late returns is observed over time. However, in the Prim'Holstein breed, this frequency is lower and gradually decreasing **(fig.10) (Boichard *et al.*, 2002).**

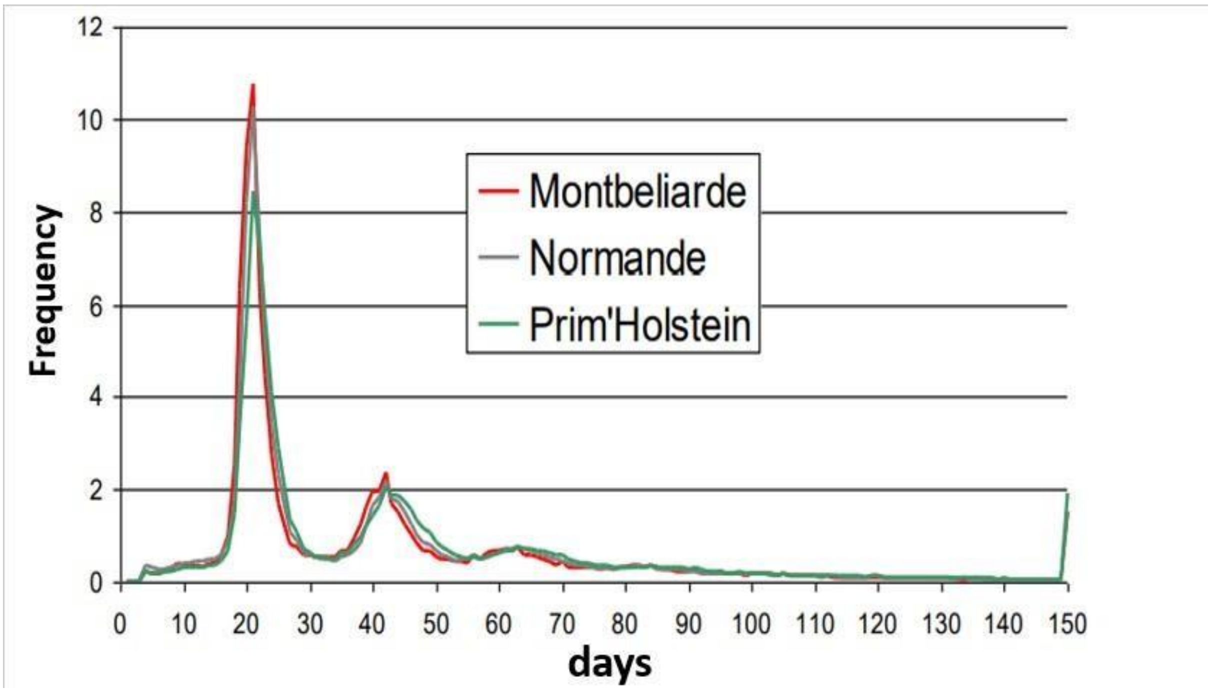


Figure 10: Variation in the intervals between artificial inseminations over the course of 2001, stratified by breed **(Boichard *et al.*, 2002).**

In more recent findings, they also observe conception rates of 38%, 46%, and 51% respectively for the Prim'Holstein, Normande, and Montbeliarde breeds **(Dezetter *et al.*, 2015).**

5.1.2. The age:

The resumption of ovarian activity takes longer in younger animals. Similarly, the extension of the postpartum anoestrus period and the CI is more pronounced in heifers calving at 2 yearsold than in those calving at 3 years old **(Short *et al.*, 1990).** Thus, it is observed that primiparous animals are more susceptible to reproductive failure than adult cows, and cows intheir second parity have a better chance of conception than primiparous ones **(Maizon *et al.*, 2004).**

5.1.3. Lactation:

An increase in milk production is often accompanied by extended intervals between calving and the first heat cycle, as well as the timing of the first successful insemination, leading to a reduction in fertility **(Hanzen, 1994).** Moreover, certain authors **(Harrison *et al.*, 1990)** have not observed a direct link between the level of milk production and the resumption of ovarian activity. Diseases such as metritis and mastitis, as well as farming practices like culling, have a more significant impact on fertility than milk production itself **(Lucy, 2001).**

5.1.4. Body condition score:

The level of body condition, referred to as Body Condition Score, significantly impacts various aspects of reproduction in dairy cows. Cows with either excessive or insufficient bodyfat can experience challenges such as decreased fertility, irregular oestrous cycles, and lower conception rates. Maintaining an optimal body condition during calving contributes to shorter calving intervals. Conversely, cows with inadequate body condition after giving birth may be predisposed to metabolic disorders, which can impair reproductive performance. Additionally, body condition score influences the quality of embryos, hormonal balance, and overall reproductive success. It's vital to monitor and manage body condition through proper nutrition, balanced feeding plans, and regular assessments to improve reproductive performance and safeguard the health of the dairy herd **(Otto *et al.*,1991).**

5.2. Factors related to calving conditions and peripartum disorders:

5.2.1. Dystocic birth:

The higher incidence of dystocic births and caesarean section among primiparous cows compared to multiparous cows contributes to increasing the frequency of postpartum pathologies and decreasing the subsequent reproductive performance of the animals **(Hanzen *et al.*, 1986).** Additionally, dystocic birth and placental retention would lead to a decrease in the first insemination pregnancy rate of approximately 6% and 10%, respectively **(Hanzen, 2005).**

5.2.2. Placental retention:

Placental retention in dairy cows is a significant factor influencing their reproductive performance. Research has shown that cows experiencing this condition encounter delays both in the days preceding first insemination and those preceding conception, with shorter retention periods exacerbating these delays. These delays can have a significant impact on theoverall efficiency of herd reproduction. Therefore, it is crucial to implement effective management strategies to minimize the negative effects of placental retention on dairy cow reproductive performance and overall herd productivity **(Fourichon *et al.*, 2000).**

5.2.3. Metritis:

Metritis, characterized by inflammation of the uterus shortly after calving, is a prevalent postpartum uterine disease in dairy cows **(Sheldon *et al.*, 2006).** This condition is known to have substantial economic implications due to its association with decreased milk production, prolonged calving intervals, increased veterinary costs, and higher culling rates **(Drillich *et al.*, 2018).**

Studies underscore that metritis significantly impacts reproductive performance in dairy cows. It can lead to delayed uterine involution, prolonged periods of oestrus, and reduced conception rates **(Sheldon et al., 2006; Drillich et al., 2018). Hanzen et al (1986)** highlighted that metritis not only increases the risk of infertility but also plays a decisive role in the decision to cull cows due to poor reproductive outcomes.

Metritis often occurs concurrently with other postpartum pathologies like retained placenta and endometritis, collectively termed as the uterine disease complex **(Sheldon *et al.*, 2006).** Effective management strategies, such as hygiene protocols, early detection, and appropriate treatment with antibiotics, are crucial for mitigating the incidence and severity of metritis in dairy herds **(Drillich *et al.*, 2018).**

Understanding the underlying mechanisms and risk factors associated with metritis is essential for implementing preventive measures and improving overall herd health and productivity **(Drillich *et al.*, 2018).** By addressing metritis comprehensively, dairy producerscan minimize its adverse effects on fertility, enhance reproductive efficiency, and optimize economic returns from their operations.

5.2.4. Delayed uterine involution:

Delayed uterine involution in dairy cows affected by metabolic diseases can greatly affect different aspects of reproduction. This delay can slow down the quick return to cyclicity, leading to longer open days and requiring more services per pregnancy. Additionally, cows with delayed uterine involution may experience lower conception rates after insemination, which impacts their overall reproductive efficiency **(Paiano *et al.*, 2019).**

5.3. Herd related factors:

5.3.1. Nutrition:

Nutritional mistakes frequently lead to reproductive difficulties in cows. The consequences vary depending on the physiological stage of the cow when they occur **(Gilbert *et al.*, 2008).** It's important to avoid any abnormalities in the balance, quantity, or distribution of the feed, particularly as the cow nears the end of gestation and enters lactation **(Enjalbert, 1994).**

Experimental part

A normal or eutocic calving presents risks for both the new born calf and the mother, and these risks increase in the case of difficult or dystocic calving. Calving management practices can have critical consequences for the mother's health, extending into the subsequent lactation period. For calves, half of the mortality before weaning occurs within the first day of life. In this context, we conducted a retrospective study on the impact of dystocia during the postpartum period in dairy cows. This study focused on the effects of dystocia on postpartum diseases and reproductive parameters of the dams, as well as on the viability of the calves. The study was carried out at ITELV in Baba Ali, Algiers, collecting calving, health and reproductive history records from 2015 to 2023, followed by a statistical analysis of the gathered data.

Study Objectives:

The aims of this study are to:

1. Assess the rate of dystocia on the farm.
2. Evaluate the incidence of postpartum diseases in dystocic calvings.
3. Determine reproductive parameters in dystocic cows and compare them with reproductive objectives for dairy cattle.
4. Determine the viability rate of calves born from dystocic calvings.

Materials and methods:

1. Study farm:

The Baba Ali Experimental Station **(Fig.11),** part of the Institut Technique des Élevages (ITELV), is a significant agricultural research and development hub in Algeria, spanning 454 hectares. This station supports diverse agricultural and livestock activities, focusing on both polygastric animals like cattle, sheep, and goats, and monogastric animals such as poultry and rabbits. It maintains a variety of local breeds to preserve genetic heritage and includes advanced facilities like incubation and hatchery units, a fromagerie, and a feed production unit. Additionally, the station cultivates forage crops and conducts experimental trials to enhance agricultural techniques. With a mission to integrate modern technology and education, Baba Ali collaborates with educational institutions, providing practical training for students and professionals. It also engages in community outreach, sharing best practices through workshops and demonstrations, thereby contributing to sustainable agricultural development. The station's efforts in preserving local breeds, conducting extensive research, and fostering education highlight its crucial role in advancing agricultural science and supporting Algeria's agricultural sector.

Figure 11: The location of the ITELV (Technical Institute of Livestock) in Baba Ali, Algiers, Algeria.

2. Description of the Study Method:

For our descriptive study, we conducted field visits to gather data from various registers. We systematically searched for all cows that calved, particularly those experiencing dystocia or difficulty during calving. Calving events labeled as "aided calving" and "dystocic calving" were both considered dystocic calvings. We examined health records to identify pathologies occurring after dystocia and noted the sex and outcome of the calves. We also collected reproductive history post-dystocia until the next calving, including dates of successful and non-successful AI. Information about breed, parity, and peri- and postpartum alimentation was not collected. Data was collected from 191 cows from 2015 to 2023 and documented in tabular form for further analysis.

3. Descriptive analysis:

In our descriptive analysis, we used MICROSOFT Excel to process the data extracted from the formed table.

RESULTS AND DISCUSSION

1. Results Obtained:

In this section, we will delve into the outcomes of our study on the impact of dystocia on the postpartum period in dairy cows at the Technical Institute of Livestock (ITELV) in Baba Ali, Algiers, spanning from 2015 to 2023. Our aim was to assess the effects of dystocia on postpartum diseases, reproductive parameters, and calf viability. We will present the collected data and conducted analyses to better understand the implications of dystocia in this bovine population. This section will highlight the observed associations between dystocia and the various studied variables, as well as the practical implications of these findings for managing dystocic calvings and overall herd health in dairy farming.

I. About the dam:

I.1. Dystocia rate:

Among the 191 calvings observed, 46 were dystocic, indicating a dystocia rate of 24.08%, which is approximately 24%. This highlights the significant prevalence of dystocia within the study population. Further analysis will be conducted to explore the implications of dystocic calvings on postpartum health outcomes and reproductive parameters **(see Table 1).**

Table 04: Rate of Dystocia among Calvings.

Total number of calvings	**Dystocic calving**	**Eutocic calving**
191	46	145

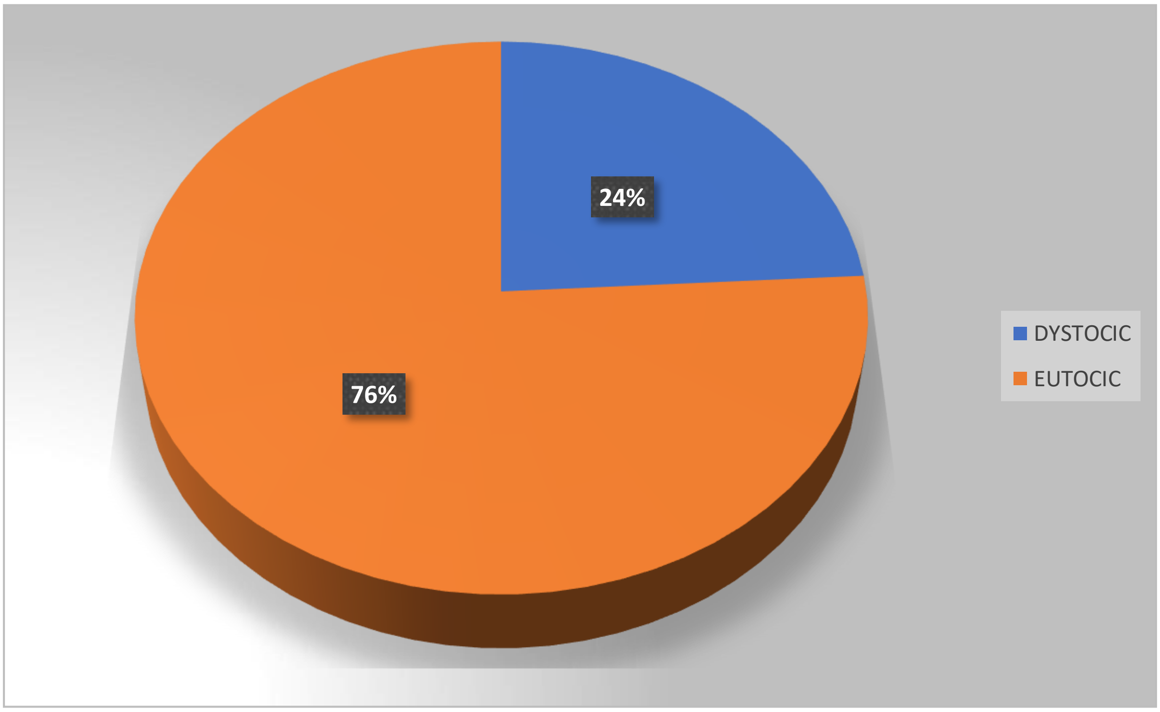


Figure 12: Distribution of Dystocic Calvings among Total Calvings.

The pie chart above illustrates the distribution of dystocic calvings compared to the total number of calving events observed in the study. It is evident that dystocic calvings constitute 24% of the total, indicating a significant portion of the calvings. Further analysis of these findings will provide insights into the impact of dystocia on overall herd health and reproductive outcomes.

I.2. Post-partum pathologies rates:

The following table presents a detailed breakdown of postpartum diseases observed among 46 dystocic cows. These findings offer insights into the health complications that can arise following difficult calvings in dairy cows. The data underscores the diversity and prevalence of postpartum conditions such as lameness, mastitis, metritis, and others, providing valuable information for understanding the implications of dystocia on cow health and welfare.

Table 05: Distribution of Postpartum Diseases Among Dystocic Cows.

Postpartum disease	**Number of cases**
Lameness	2
Ketosis	1
Vulvar injury	2
Sternal decubitus	2
Mastitis	18
Cervical masses	1
Metritis	5
Uterine prolapse	2
Retained placenta	13
Total	**46**

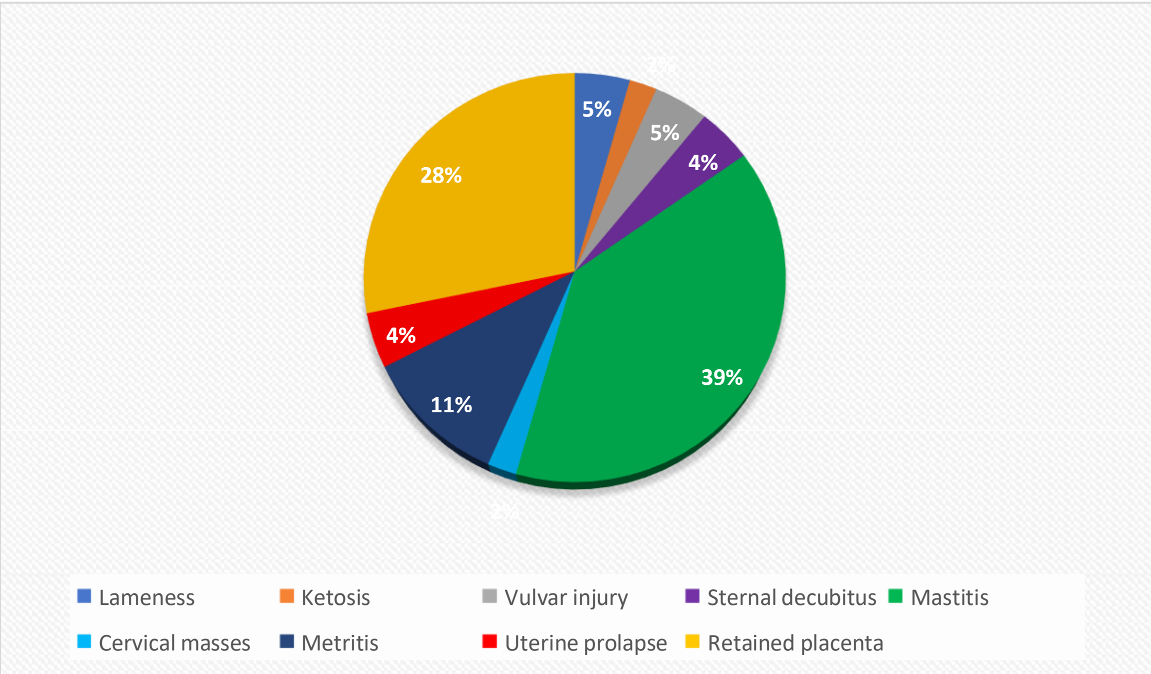


Figure 13: Frequency of post-partum diseases among Dystosic Calvings.

The pie chart illustrates the distribution of various postpartum diseases among the 46 dystocic cows in our study. The most common disease observed was mastitis, affecting 39% of the cows, followed by metritis with 11% of the cases. Other conditions included vulvar injury (5%), lameness (5%), sternal recumbency (4%), uterine prolapse (4%), cervical masses (2%), and ketosis (2%). Notably, 28% of the cows had retained placenta. This distribution highlights that mastitis, retained placenta and metritis are significant health concerns in cows that have experienced dystocia, underscoring the need for targeted health management strategies to mitigate these conditions and improve overall cow health and productivity.

I.3. Reproductive Parameters:

Among the 46 cows that experienced dystocia, we could only obtain complete reproductive parameters information for 10 cows. This limitation is primarily due to two factors: firstly, a lack of recorded information in the registers, secondly, the systematic recording of reproductive parameters only began in 2019. These gaps in the available data restrict our analysis, but the collected information still provides valuable insights into the trends and impacts of dystocia on the reproductive performance of dairy cows.

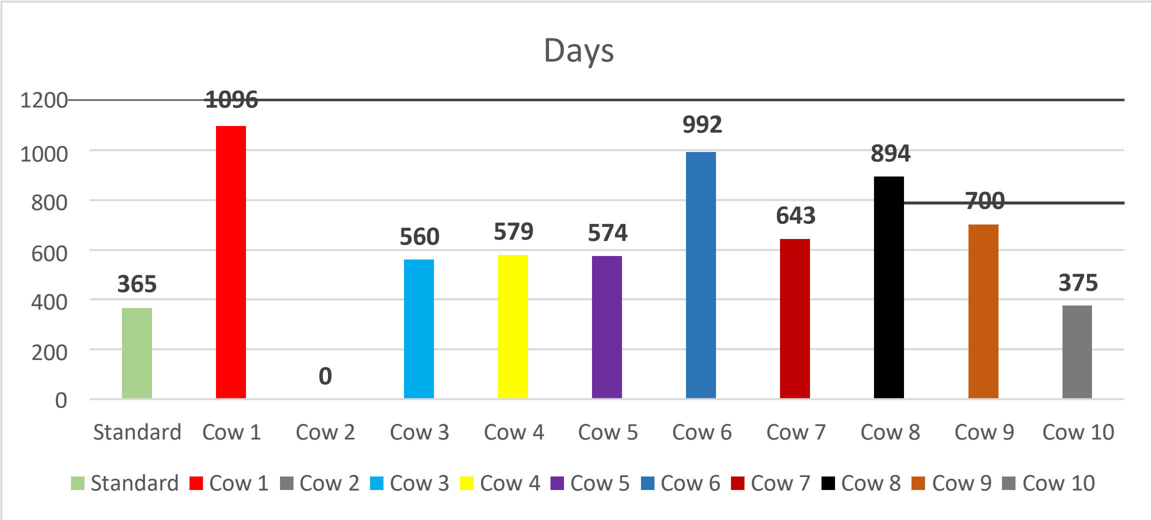
I.3.1 Fecundity:

I.3.1.1. calving interval:

is calculated with the dystocic calving and the one after it, where 9 out of 10 of the cows calved again and 1 aborted.

The average for the 10 cows is calculated, CI= 641 days

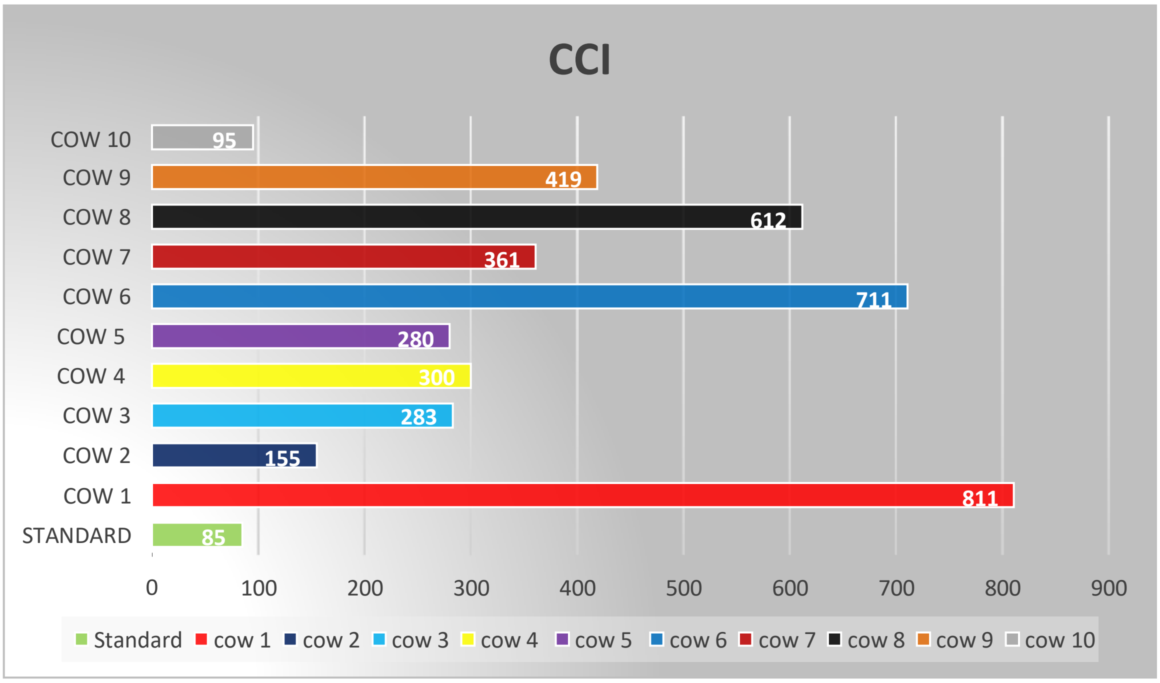
therefore, fecundity index= 365/641= 0.57



<u>Figure14:</u> calving interval for the dystocic cows.

I.3.1.2. Calving-conception interval:

In the context of reproductive performance, the interval between calving and successful insemination is a critical parameter. This interval reflects the time required for a cow to conceive again after calving, which can be significantly influenced by dystocia. Understanding CCI helps in assessing the impact of calving complications on subsequent fertility and overall herd productivity.



<u>Figure 15:</u> Calving-conception interval for dystocic cows.

Figure 15 illustrates the CCI for each cow. The CCI values range from 0 to 811 days, highlighting the huge time difference between the standard and the values obtained from dystocic cows. Cow 1 has the longest CCI of 811 days, indicating significant reproductive challenges. In contrast and Cow 2 has the shortest CCI of 155 days among those that carried to term. The variability in these intervals underscores the importance of individualized reproductive management to enhance fertility outcomes in cows experiencing dystocia.

I.3.1.3. The waiting period:

defined as the interval between the first calving and the first insemination, is a critical factor in managing the reproductive efficiency of dairy cows. This period can reflect the readiness of cows to return to reproductive activity after calving. The bar chart below illustrates the waiting period for the 10 dystocic cows in our study.

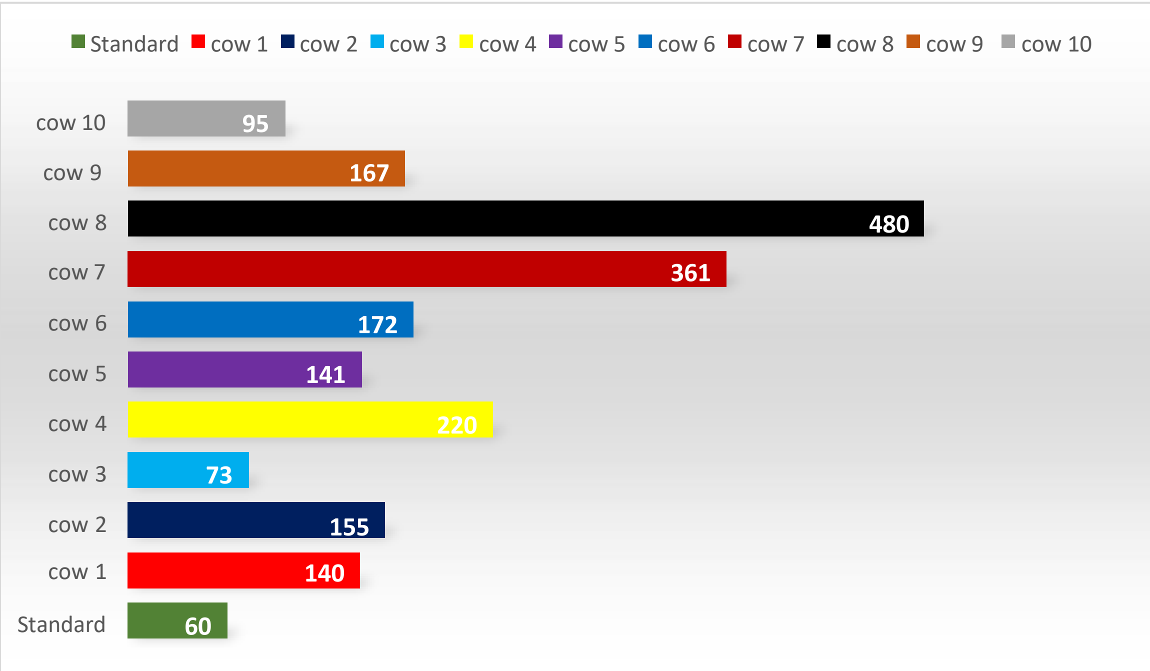


Figure 16: Waiting Period (days) for Dystocic Cows.

Figure 16 shows the waiting period for each cow where all cows presented a longer WP than the standard. This interval can provide insights into the management practices of the farm and health status of the cows following a dystocic calving. A longer waiting period may indicate delays in recovery, other reproductive issues or lack of reproductive management, whereas a shorter period suggests a quicker return to reproductive activity.

I.3.1.4. First insemination-conception interval:

This interval can provide insights into how quickly cows are able to conceive after initial insemination attempts. The bar chart below illustrates the rest period for the 10 dystocic cows in our study.

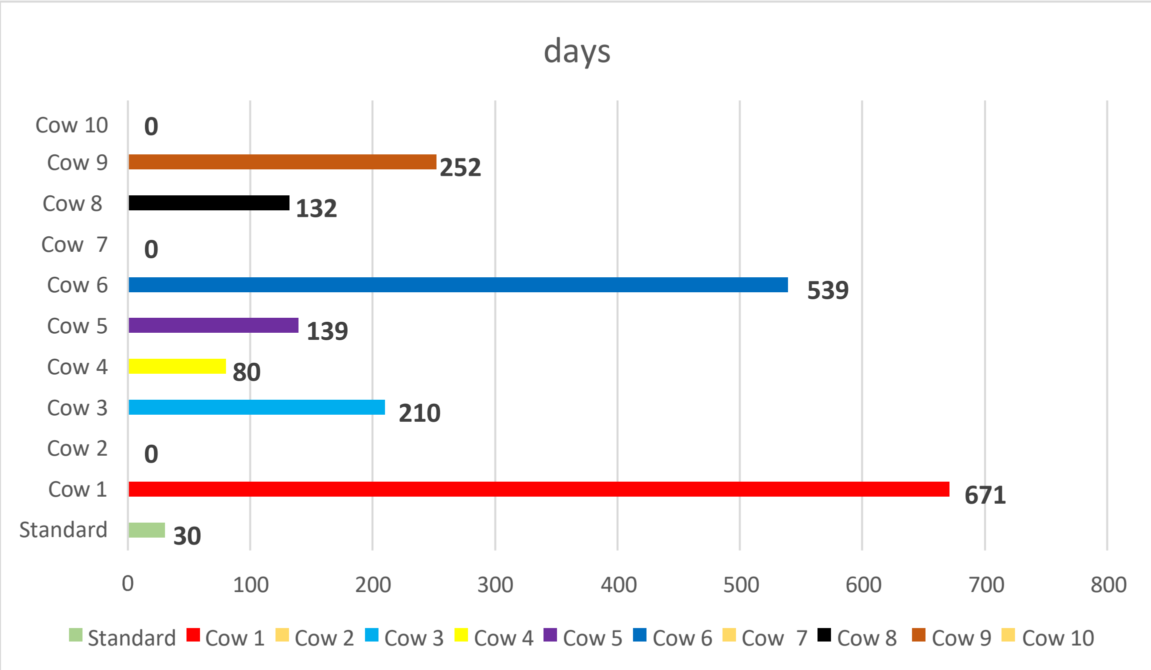


Figure 17: First insemination-conception interval for Dystocic Cows.

The bar chart shows that the FIC interval for the 10 dystocic cows is longer than the standard period which is 30 days. Cow 2, Cow 7, and Cow 10 had an FIC of 0 days meaning they were gravid at their first insemination. Among the others, the shortest rest period was 80 days (Cow 4) and the longest was 671 days (Cow 1).

I.3.1.5. Gestation period:

It represents the duration of a gestation.

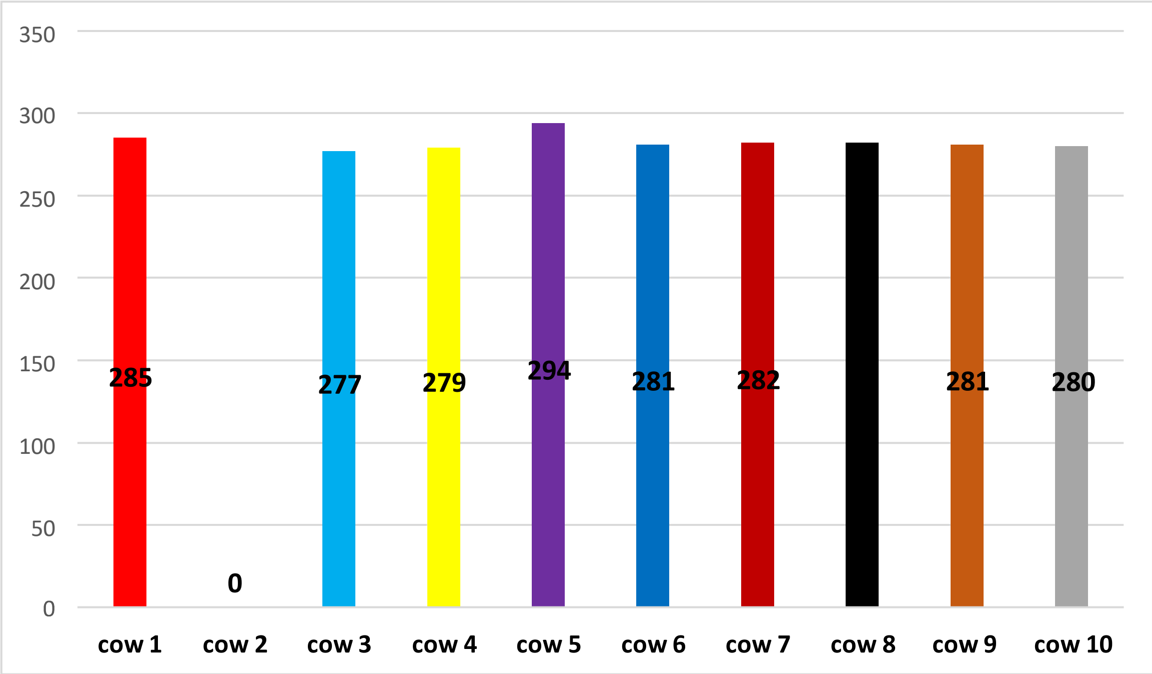


Figure 18: Curve Representing gestation Periods of Dystocic Cows.

The curve below illustrates the GP for the 10 dystocic cows in our study. Cow 3 had the shortest pregnancy period of 277 days, while Cow 5 had the longest at 294 days. Cow 2 had a GP of 0 days due to an abortion.

I.3.2. fertility:

I.3.2.1. Fertility index:

Assessing the number of inseminations required to achieve gestation provides insight into the reproductive challenges faced by cows' post-dystocia and the reproductive management of the farm. The bar chart below **(fig. 19)** illustrates the distribution of inseminations required to achieve gestation.

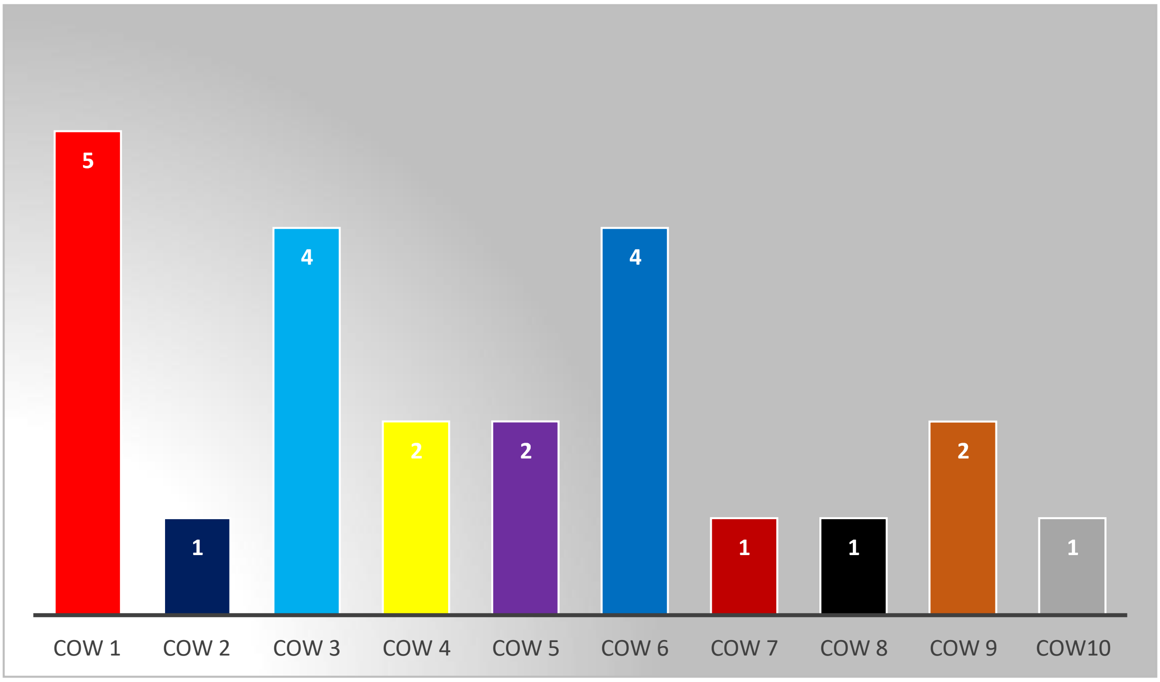


Figure 19: Number of Inseminations to achieve gestation for Cows with Dystocia.

The bar chart illustrates the number of inseminations required for the 10 dystocic cows in our study to achieve gestation. The data reveals that while some cows achieved conception with a single insemination, others required up to five attempts. This range highlights the variability in reproductive success among the dystocic cows, suggesting potential differences in theirfertility, the quality of the sperm used and the technique of insemination including heat detection and the moment of insemination. These findings underscore the need for tailored reproductive strategies to find the issue and improve conception rates and minimize the number of inseminations needed for successful breeding.

I.3.2.2. Fertility index:

FI= 23/9=2.56

I.3.2.3. Conception rate:

CR=1/FI*100 Therefore: CR=1/2.56*100 CR=39.06%

II. About the calf:

II.1. Calves' outcomes:

Among the 46 dystosic calving events, 54 calves were born with 8 cases of twins and 38 single births. In this section, we will examine the viability, survival rate, and common health complications observed in calves following dystocic calving.

Table 06: Distribution of Calves' Conditions Following Dystocic Calving.

	Number of Calves	**Percentage**
Stillbirths	10	18.5%
Rejected by Mother	1	1.9%
No pathology mentioned	43	79.6%
Total	54	100%

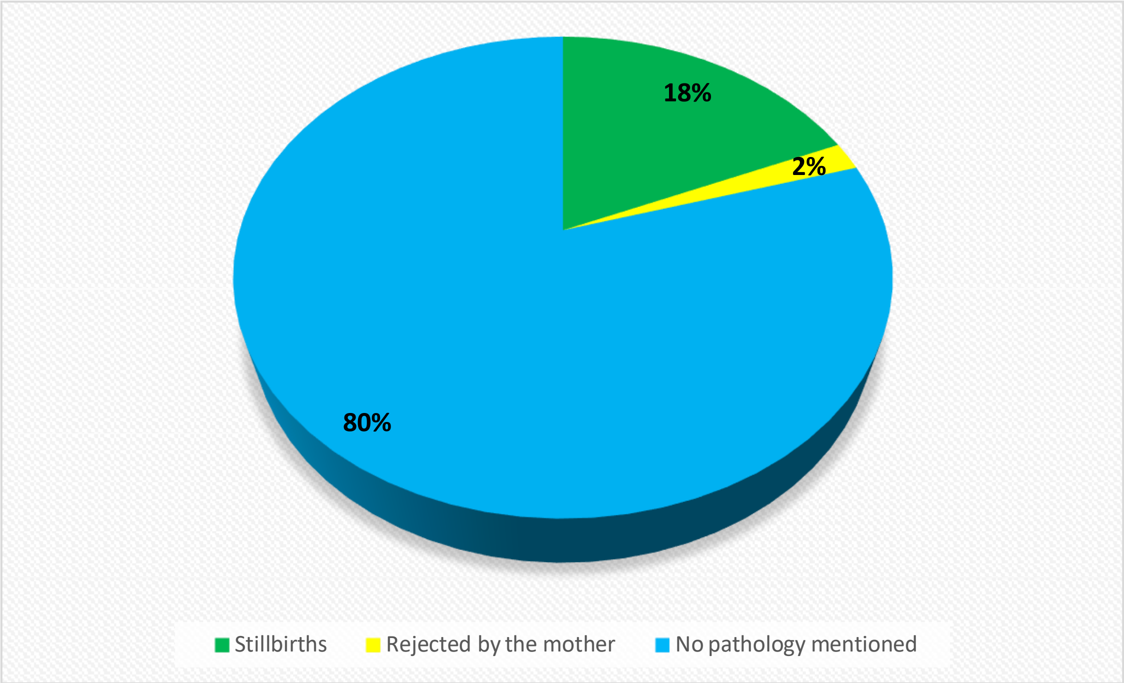


Figure 20: Distribution of calves' outcomes following dystocic calving.

II.2. Significance of Calf Sex:

Among the various predisposing factors to dystocia examined previously in the literature review, our study confirmed that calf sex is significantly associated with dystocic births. Out of the 54 calves, 28 calves were male. This suggests that males may be a risk factor for difficult calvings in our sample.

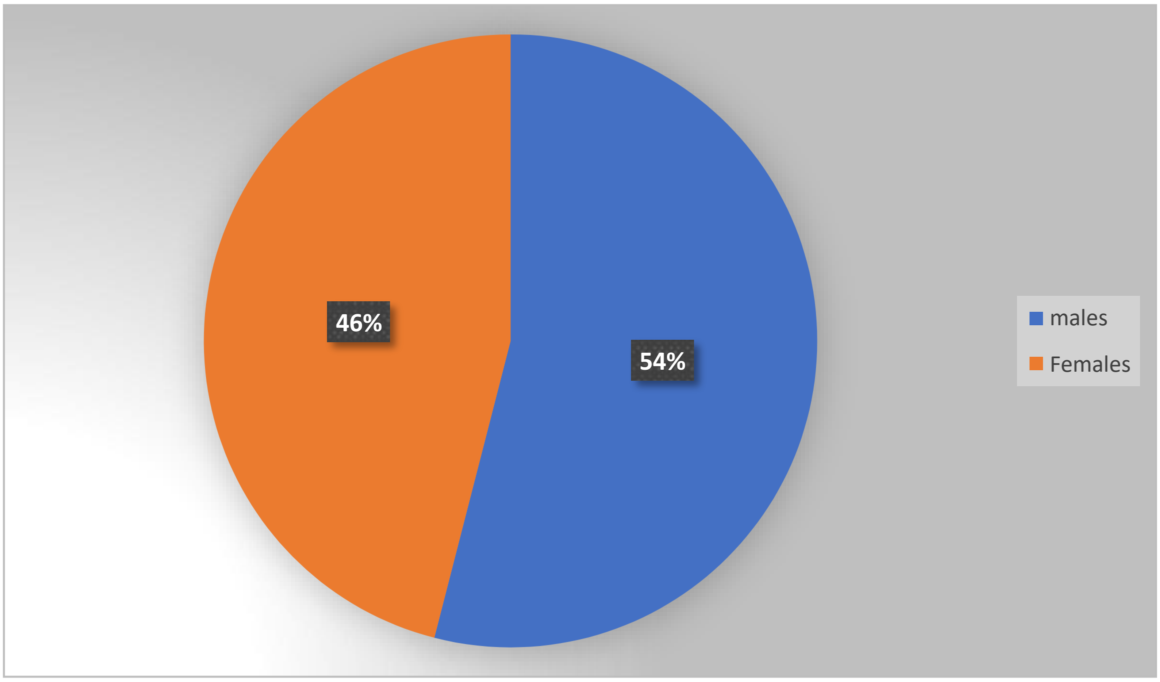


Figure 21: Proportion of Male Calves in Dystocic Calvings.

The pie chart illustrates the distribution of calf sexes in dystocic calvings observed in our study. It is evident that a significant proportion of dystocia cases involved male calves, comprising 54% of the dystocic births. Female calves accounted for 46% of the dystocic cases. This observation highlights the predominance of male calves among dystocic births and suggests a potential relationship between calf sex and the incidence of dystocia in dairy herds. Understanding these patterns is essential for targeted management strategies to mitigate dystocia risks effectively.

Discussion:

1. Dystocia rate:

Our study revealed a dystocia prevalence rate of 24.1% among the cows examined, highlighting the significant occurrence of difficult calvings in our sample. This finding underscores the challenges posed by dystocia in dairy farming, impacting both cow and calf health outcomes specially since There are different causes and risk factors associated with dystocia in dairy cattle which can result from both maternal and foetal factors **(Purohit *et al.*, 2011)**. Internationally, dystocia rates in dairy industries with similar genotypes vary between 2% and 7% **(Mee, 2008).** In contrast, a study by **Houssou *et al.* (2023)** in Algeria reported a 40% dystocia rate in Montbeliard cows, significantly higher than other breeds. This was followed by a 28% rate in Prim' Holstein, 16% in mixed breeds, 12% for Normand, and 6% for the local population. These disparities emphasize the potential influence of breed, management practices, and environmental conditions on the prevalence of dystocia. Unlike Houssou's study, our analysis did not focus on specific breeds, which may account for the differences observed. It is important to note that while our study provides valuable insights into dystocia prevalence.

Moreover, Dystocia is much more common in primiparous than in multiparous cows **(Gizaw *et al.*, 2007; Hossein-zadeh, 2014)** due to their smaller stature and the slow maturation of pelvic dimensions **(Hiew, 2014)**

Twin calves are a risk factor due to the increased possibility of malpresentation, while bull calves and heavier calves have an increased risk of experiencing dystocia **(Johanson et Berger, 2003; Jason *et al.*, 2013)**

various unexplored factors may have influenced these results, suggesting the need for further investigation into the underlying causes and potential preventive measures for managing dystocia in dairy cattle.

2. post-partum diseases:

Our study delves into significant aspects of postpartum diseases in dairy cows affected by dystocia, highlighting both the findings and limitations. Firstly, our investigation identified various postpartum diseases among dystocic cows, but a limitation arose due to the inability to distinguish between primiparous and multiparous cows based on data constraints from the

ITELV registers. This limitation may affect the comparability of our findings with studies like **Drillich *et al* (2006)**, which emphasized significant differences in metritis prevalence between primiparous and multiparous cows. In addition to our findings, **Roche *et al* (2023)** explored the long-term implications of dystocia, revealing that cows requiring assistance during calvingare at increased risk of developing retained placenta and facing culling during lactation. Theirstudy underscores the intricate relationship between dystocia and subsequent health and productivity outcomes in dairy cattle.

It is important to recognize the multifactorial nature of almost all diseases and their interconnected risk factors **(LeBlanc *et al.,* 2006)**. for example, **Guterbock (2004)** observed that hypocalcemia can also cause dystocia due to poor uterine motility, which increases the risk of retained placenta and metritis.

Therefore, it is crucial to consider all other factors not detailed in our study that could affect the prevalence of postpartum conditions. Additionally, it is important to transparently discuss limitations that could impact the interpretation and comparison of our findings with another research. Addressing these considerations is essential for advancing the understanding and management of postpartum health in dairy cattle.

3. Reproductive parameters:

Our study revealed that reproductive parameters of dystocic cows exhibited notable delays, corroborating findings by **Gaafar et al (2010)**. Specifically, dystocic cows had longer intervals including CI, CCI, FIC and the waiting period, possibly indicating a delayed return to reproductive activity post-calving and suggesting difficulties in achieving successful insemination and conception following dystocia, it is worth noting that in our study farm insemination is mostly after synchronising oestrus using planned breeding protocols such as Ovsynch. Additionally, the gestation period remained consistent between dystocic and non-dystocic cows in both studies, implying that dystocia primarily affects post-calving reproductive parameters rather than gestation duration. These results align with those obtained by **López de Maturana et al (2007)**, who reported significant delays in pregnancy periods in cows due to dystocia. These findings highlight the significant impact of dystocia on reproductive performance, emphasizing the need for effective management strategies to mitigate calving difficulties and improve overall herd productivity.

It is worth noting that

4. Fate of calves after dystocic calving:

Our study revealed significant mortality and morbidity rates among calves born from dystocic calvings, with a stillbirth prevalence of 18.5% and 1.9% re rejected by the mother, and 79.6% with unknown outcomes due to incomplete register entries. This aligns with findings from **Lombard et al (2007),** who reported increased calf mortality and health complications associated with dystocia. Similarly, **Barrier et al (2013)** found that dystocia not only increases the risk of stillbirth but also contributes to higher incidences of neonatal calf mortality and morbidity. Furthermore, **Johanson et Berger (2003)** indicated that calves born from dystocic births exhibit higher mortality rates within the first 48 hours post-birth compared to those born from normal calvings. The study by **Meyer et al (2001)** also supports these observations, indicating that calves experiencing dystocia are more susceptible to health issues such as respiratory distress and failure to grow. These comparative insights emphasize the critical need for effective management and intervention strategies to improve neonatal outcomes in dystocic births.

5. Significance of Calf Sex in Dystocic Calvings:

Our study confirmed that the sex of the calf is a significant factor in dystocic calvings, with a higher prevalence of male calves (29 out of 54) in dystocic births. This observation aligns with numerous studies that highlight the impact of calf sex on the incidence of dystocia. According to **Hossain *et al* (2013)**, male calves are generally larger than female calves at birth, which contributes to a higher risk of dystocia. **Mee (2008)** also reported that male calves are associated with a higher incidence of difficult calvings due to their larger birth weights.

Moreover, **Berger *et al* (1992)** found that male calves were significantly more likely to be involved in dystocic births compared to female calves. Their study indicated that the odds of dystocia were approximately 1.5 times higher for male calves than for female calves. This increased risk is primarily attributed to the greater size and weight of male calves, which can complicate the birthing process and lead to increased incidences of dystocia.

Our findings, which show that 54% of dystocic births involved male calves, further support the existing literature. These results underscore the necessity for dairy farmers and veterinarians to consider calf sex when managing and anticipating calving difficulties. Proactive measures, such as close monitoring of pregnant cows expected to deliver male calves, can help mitigate the risks associated with dystocia and improve calving outcomes.

In summary, the significant association between calf sex and dystocia observed in our study concurs with findings from other research, reinforcing the need for targeted management strategies to address the challenges posed by male calves in dystocic calvings.

CONCLUSION

This work offers significant insights into the prevalence and impact of dystocia in dairy cows, focusing on critical reproductive parameters such as calving intervals, insemination success rates, and post-partum health outcomes. Through meticulous analysis and comparison with existing literature, the reliability of findings has been reinforced. Challenges encountered include incomplete data and a limited sample size of dystocic cows, highlighting weaknesses such as the need for more comprehensive data collection and the absence of breed-specific analysis. Conducted at a single site, the research may not fully encompass regional variations, suggesting a need for broader geographical studies.

Looking forward, several promising opportunities for future research and practical applications emerge. Standardizing data collection practices across multiple sites and breeds could yield more robust datasets, enhancing validity and generalizability. Genetic studies aimed at understanding breed-specific predispositions to dystocia hold promise for targeted breeding strategies to reduce dystocia rates. Moreover, findings underscore the importance of refining management practices during calving to improve reproductive outcomes and enhance calf health.

However, addressing challenges and threats is essential to facilitate the application of research findings in real-world settings. Inconsistent data collection practices and economic constraints within the dairy industry could hinder the adoption of advanced management strategies and technologies recommended to mitigate dystocia. Moreover, variations in environmental conditions and management practices across regions pose challenges in implementing standardized recommendation

In conclusion, this work contributes valuable insights that advance understanding of dystocia management in dairy farming. By addressing identified weaknesses and leveraging opportunities for future research, more effective strategies can be developed to optimize dairy cow welfare and productivity. Ultimately, these findings aim to inform and guide dairy farmers, veterinarians, and researchers towards sustainable practices that enhance the health and performance of dairy herds.

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