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Causes and Prevention of Dystocia and Stillbirth in an Ovine Herd

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1.0 ABSTRACT

Dystocia, described as a challenging birth requiring assistance, is a significant concern in veterinary medicine. This doctoral thesis delves into the complexities of dystocia and stillbirth in ovine herds, aiming to unravel underlying mechanisms and propose effective prevention strategies. Despite technological advancements, stillbirths persist, impacting ewes, lambs, and farmers. This research explores the multifaceted aspects of dystocia and stillbirth, emphasizing their implications for herd welfare and economic sustainability.

The objective is to contribute to practical veterinary approaches, prioritizing the health and prosperity of the animal.

2.0 INTRODUCTION

The Merck vet manual describes dystocia as a difficult birth or the inability to expel the fetus through the birth canal without assistance. Death just before birth is known as late abortion or stillbirth, lambs can become dead for many reasons such as infections, injury, malnutrition or malformations (Ridler *et al.*, 2022).

In veterinary medicine, dystocia emerges as a pivotal challenge, casting its shadow upon the delicate process of parturition. Defined as a difficult birth characterized by prolonged delivery requiring assistance (Jacobson *et al.*, 2020), dystocia presents a multifaceted concern that transcends the boundaries of mere obstetrical intricacies. Dystocia stands as a formidable obstacle, necessitating scholarly exploration and clinical intervention.

Stillbirth in an ovine herd refers to the birth of a lamb that shows no signs of life at the time of delivery, a lamb is born dead. Stillbirths can occur for various reasons, including complications during pregnancy, dystocia, nutritional deficiencies, genetic factors, infections, or environmental stress. Stillbirths continue to pose a challenge in veterinary medicine, persisting despite modern technology and scientific advancements. Unfortunately, ewes, lambs, and farmers still grapple with the occurrence of stillbirths in ovine herds.

This doctoral thesis looks into the complexities of dystocia and stillbirth, aiming to understand underlying mechanisms, and illuminate pathways towards effective prevention. Beyond the

realms of individual animal health, the significance of preventing dystocia and stillbirth extends far into the domains of herd welfare and economic sustainability.

As we delve into this, the overarching objective is to forge a deeper understanding of dystocia and stillbirth, paving the way for informed strategies that safeguard both the well-being of animal populations and the financial viability of livestock enterprises.

In essence, this thesis endeavors to contribute not only to the scientific discourse surrounding dystocia and stillbirth but also to the practical realms of veterinary practice, where the prevention of this obstetrical challenge emerges as an imperative for the holistic health and prosperity of animal populations.

3.0 LITERATURE REVIEW

Embarking on a pivotal aspect of my thesis, I delve into the realm of scholarly literature by conducting many comprehensive literature reviews around the theme of dystocia and stillbirth. As a foundational step in the research process, these literary reviews serve to distill key insights, identify gaps, and contextualize my studies. Through this systematic exploration, I aim to not only enhance my understanding of dystocia and stillbirth but also to contribute a nuanced perspective that builds upon and extends the current scholarly discourse. These reviews have guided my research toward a more informed and impactful investigation into the complexities of difficult births in veterinary medicine.

3.1 Mortality in lambs

Mortality rates in lambs range from 8 to 25%, (McHugh *et al*., 2020) suggesting significant potential for enhancing lambing performance traits through selective breeding (McHugh *et al*., 2020). A substantial majority of these deaths, approximately 74%, occur within the initial three days of life, as observed in extensive sheep farming practices. Data gathered from Australia, the UK, and New Zealand highlights that dystocia accounts for 19-67% of perinatal mortality, while starvation and mismothering contribute to 30-48%. The primary cause of fetal dystocia is the malpresentation of the fetus.

In maintaining high welfare standards across the UK's extensive farming management system, key areas are targeted, including optimal nutrition for pregnant ewes, heightened staffing levels during lambing season, and the management of ectoparasites and endoparasites. It is crucial to address issues such as footrot, which poses both financial losses and welfare concerns on farms. However, staying abreast of rapidly changing regulations from the European Union and meeting escalating client expectations present ongoing challenges for farmers. This article on the perception of sheep welfare in extensive systems, sheds light on these critical considerations (Goddard et al., 2006)

3.2 Dystocia, stillbirth and associated diseases, financial losses and keeping high welfare standards

Financial losses in the context of dystocia, stillbirth, and associated diseases in sheep farming refer to the economic impact incurred by farmers due to the challenges and complications associated with lambing. These losses can arise from various factors.

Dystocia and stillbirth contribute to a decrease in lamb survival rates. The loss of lambs means a reduction in the overall productivity of the flock, ewes may face challenges in subsequent reproductive cycles, leading to longer lambing intervals. Veterinary intervention may be required, leading to additional costs for farmers.

If ewes or lambs suffer from health issues related to dystocia or stillbirth, it may affect their suitability as future breeding stock. This can result in the need to cull or replace animals, incurring additional costs. Providing specialized care and nutrition for ewes and lambs may require additional resources. High-quality feeds and supplements can contribute to increased operational costs.

Dealing with dystocia and stillbirth demands more time and labour from farmers. Increased monitoring, intervention, and care for affected ewes and lambs contribute to labour costs (Menzies, 2007).

The overall health and productivity of a flock influence its market value. Farms with a history of high dystocia and stillbirth rates may face challenges in marketing their livestock at competitive prices.

Persistent issues with lambing difficulties and losses can impact the reputation of a sheep farm. Consumers and other stakeholders may perceive the farm negatively, affecting its branding and market positioning.

Exploring dystocia in sheep, reveals a historical focus on specific breeds and genetic lines tailored for effortless lambing (Goddard *et al.*, 2006). The objective has been to achieve natural lambing without the need for assistance and the ability to rear at least one lamb independently. Sheep bred with these traits exhibit higher survival rates, reduced lamb mortality, and require less human intervention. The strategic culling of undesirable dams, regardless of other performance parameters, has been a common practice. Notably, New Zealand frequently employs easy lambing sheep, while in the UK, an easy care approach involves importing sheep from New Zealand, such as the lleyn breed from North Wales, renowned for their inherent easy care properties (Jacobson *et al.*, 2020).

Several viruses, bacteria and parasites can contribute to stillbirth in ovine herds including:

Border Disease Virus: This virus can cause congenital abnormalities and stillbirth in lambs. Transmission: Border Disease Virus (BDV) is transmitted through contact with infected animals or their secretions, and it can also spread vertically from ewe to lamb in utero. BDV can cause congenital abnormalities, including cerebellar hypoplasia, leading to stillbirth or the birth of lambs with neurological issues.

Prevention:

- Biosecurity: Prevent contact between infected and susceptible animals.
- Test and cull: Regularly test and cull persistently infected animals.
- Isolation: Isolate infected ewes during lambing.

(Becher *et al.*, 1994)

Akabane Virus: Infection with Akabane virus during pregnancy can lead to stillbirth, along with other congenital abnormalities. Transmission: Akabane virus is primarily transmitted by Culicoides biting midges. Ewes become infected during the early stages of pregnancy. Infection during pregnancy can result in arthrogryposis (joint deformities), hydranencephaly (fluid-filled brain), and stillbirth.

Prevention:

- Vector control: Implement measures to control Culicoides midges, the primary vector.
- Vaccination: In regions where Akabane virus is prevalent, vaccination may be considered.

(Haughey *et al.*, 1988)

Bluetongue Virus: Infection with Bluetongue virus can cause fetal malformations and stillbirth in sheep. Transmission: Bluetongue is transmitted by Culicoides midges. It primarily affects sheep during the biting season. Infection with Bluetongue virus can cause congenital malformations, stillbirth, or the birth of weak lambs.

Prevention:

- Vector control: Control midge populations through environmental management.
- Vaccination: Use available vaccines, especially in endemic regions.

(Maclachlan *et al.*, 2008)

Schmallenberg Virus: This virus can lead to congenital malformations, stillbirth, and weak lambs. Transmission: The Schmallenberg virus is transmitted by biting midges. Ewes infected during gestation can transmit the virus to the developing fetus. Schmallenberg virus can lead to congenital malformations, stillbirth, or the birth of lambs with deformities.

Prevention:

- Vector control: Implement measures to control midge populations.

- Vaccination: In areas with a history of Schmallenberg virus, vaccination may be recommended.

(Lievaart-Peterson *et al.*, 2015)

Ovine Herpesvirus-2 (OHV-2): This virus can cause abortion storms and stillbirth in infected ewes. Transmission: OHV-2 is transmitted through contact with infected animals, especially during the lambing season. Infection with OHV-2 can cause abortion storms, stillbirth, or the birth of weak lambs.

Prevention:

- Biosecurity: Prevent contact with infected animals during the lambing season.
- Vaccination: In regions where OHV-2 is a concern, vaccination may be considered.

(Li *et al.*, 1998)

The prevention of stillbirths varies based on the specific risks posed to individual farms, considering factors such as location and climate. Disease control strategies may differ for farms with intensive or extensive keeping systems.

This thesis will specifically concentrate on addressing dystocia and stillbirth issues related to lambing challenges, rather than a broader focus on disease control.

Chlamydia: Chlamydial infections in ewes can result in abortion and stillbirth. Transmission: Chlamydia in sheep is caused by Chlamydia abortus. It is primarily transmitted through contact with infected placental tissues, vaginal discharges, or contaminated environments. Chlamydial infections can lead to abortion, stillbirth, or the birth of weak lambs. Ewes infected during pregnancy may shed the bacteria in subsequent lambing seasons.

Prevention:

- Biosecurity: Implement strict biosecurity measures to prevent the introduction of infected animals.
- Isolation: Isolate infected ewes to prevent the spread of the bacteria to other animals.

- Vaccination: Consider vaccination programs where appropriate.

(Entrican, Buxton and Longbottom, 2001)

Toxoplasmosis: Caused by the parasite Toxoplasma gondii, this infection can lead to fetal death and stillbirth. Transmission: Ewes can acquire toxoplasmosis by ingesting oocysts from contaminated feed, water, or pasture. It can also be transmitted through consumption of infected tissues. Toxoplasmosis during pregnancy can result in fetal death, mummification, or congenital abnormalities. It poses a particular risk during the early stages of gestation.

Prevention:

- Feed management: Ensure that feed, water, and pasture are not contaminated with cat feces.
- Hygiene: Practice good hygiene to reduce the risk of contamination.
- Control access: Minimize contact between ewes and potentially infected cats

(Innes *et al.*, 2009)

3.3 Dystocia etiology and breed variations

The etiology of dystocia encompasses various factors, including fetopelvic disproportion arising from either maternal conditions with an inadequately sized pelvis or fetal factors with an oversized fetus (McSporran and Fielden, 1979).

Distinct breed variations are evident, with Merinos displaying a predisposition to fetopelvic disproportion, while Dorner ewes exhibit tendencies towards uterine inertia (Fogarty and Thompson, 1974). This phenomenon is further linked to an increased birth rate of lambs. Maternal dystocia, attributed to fetal delivery obstruction, may stem from conditions such as ring womb, vaginal prolapse, uterine torsion, and inguinal hernia. Ring womb, characterized by insufficient softening and dilation of the cervix, may result from factors like vaginal prolapse, cervical damage, uterine inertia, breech, or malpresentations. Uterine torsion, though infrequent,

can be mistakenly identified as incomplete cervical dilation during clinical examinations (Ennen *et al.*, 2013). Uterine inertia, denoting the failure to expel a fetus, has primary causes rooted in metabolic diseases like hypoglycemia, pregnancy toxemia, endocrine disruption (e.g., excessive estrogen intake from sources like clover), and physical damage such as abdominal, uterine, or perineal hernias, as well as abnormal wall rupture. Stress, inhibiting uterine activity and labour progression, can also contribute to dystocia. Secondary inertia, resulting from the depletion of the myometrium due to prolonged labour, fetal malpresentation, loss of tone, or stress, can manifest in multiparous ewes through overstretching of the myometrium (Jackson, 2004).

Uncommon causes of dystocia include hydropic conditions and sciatic nerve paralysis. Fetal dystocia, resulting from malpresentation, accounts for approximately 50% of cases. Common malpresentations encompass flexion of the neck, shoulder, carpus, breech positions, posterior presentation with retained hindlimbs, and simultaneous presentations. Fetal malformation, hydrocephalus, and other complications can arise from improper confidential dissection. Dystocia is notably exacerbated in multiple-born lambs by fetal entanglement, malpresentation, and prolonged birthing processes (Jacobson *et al.*, 2020).

Fetal demise within the uterus can occur due to placental inadequacy, infection, toxic agents, metabolic disease, stress, or congenital defects. Autolysis, emphysema, or the presence of a dead fetus can adversely affect ewes and increase the risk of uterine damage during delivery (Menzies, 2007).

A survey conducted during lambing revealed that 34% of farmers did not practice hand hygiene or use disposable gloves during lambing assistance, while 35% of sheep received prophylactic antibiotics after assistance. Additionally, 65% of farmers treated ewes only after the manifestation of illness subsequent to lambing assistance (Scott, 2003)

3.4 Postnatal lamb survival

The survival of lambs post-birth is contingent, in part, on the birthing process, where an extended parturition duration and the occurrence of dystocia amplify the risks of asphyxia, circulation problems, and central nervous system (CNS) lesions with edema. A notable 33% of newborns experience asphyxia, and twins are associated with a 15.6% higher risk of this condition. CNS

lesions, arising from hypoxia, can manifest ante or intra partum, and also postpartum if the lungs fail to inflate properly (Dutra and Banchero, 2011).

To mitigate these challenges, close monitoring of ewes in the near-term and proactive assistance during the delivery of lambs emerge as crucial interventions. Such measures aim to prevent the aforementioned problems, emphasizing the significance of vigilant care during the perinatal period for ensuring optimal lamb health and survival (Dutra and Banchero, 2011).

3.5 Parturition and maternal bonding

Prolonged parturition can subject the ewe to increased stress and fatigue. The physical strain and extended effort required during a prolonged labour may affect the ewe's energy levels and well-being. This, in turn, can influence her initial interactions with the lamb (Arnold and Morgan, 1975).

The maternal bond plays a vital role in ensuring the viability of lambs. The maternal bond establishes a strong connection between the ewe and the lamb, ensuring that the ewe provides care, protection, and guidance to the newborn. This is vital for the lamb's overall well-being and survival.

Prolonged parturition is linked to diminished viability, slower standing, and a delayed onset of sucking behavior. Lambs with lower sucking proficiency face challenges in accessing and absorbing immunoglobulins from colostrum, thereby impacting their overall health and immunity (Hinch and Brien, 2014).

The maternal bond is a cornerstone of lamb viability as it ensures the provision of essential care, facilitates natural behaviors, supports thermoregulation, contributes to the learning process, reduces stress, and establishes a foundation for positive herd dynamics (Mellor and Stafford, 2004).

3.6 Environmental factors and Body Condition Score (BCS)

The environment in which a lamb is born plays a crucial role, particularly for those impacted by dystocia. Such lambs are especially vulnerable to the effects of environmental elements,

exhibiting heightened sensitivity to cold temperatures and prolonged exposure to extreme weather conditions. The repercussions of dystocia extend to metabolic factors, as severe hypoxemia and acidemia have been correlated with decreased heat production 72 hours postpartum. The onset of dystocia-induced hypothermia may be attributed to either placental insufficiency and chronic hypoxemia over an extended period (Mellor and Stafford, 2004) or acute hypoxemia resulting from the transient occlusion of the umbilical cord (Eales and Small, 1985). These environmental challenges underscore the need for vigilant care and management practices to safeguard the well-being of lambs born under conditions of dystocia.

The condition of the ewe before birth is a critical factor influencing the outcome of lambing, with several noteworthy observations.

The BCS of pregnant ewes is closely associated with the rate of dystocia. Both high and low BCS in pregnant ewes correlate with an elevated incidence of dystocia.

Adequate nutrition is paramount for pregnant ewes, encompassing sufficient energy, protein, minerals, and vitamins. Ewes at their first parity exhibit a higher incidence of dystocia or injury during birth compared to subsequent lambings.

The difficulty of lambing tends to decrease up to approximately 4.5 years of age, after which there is an observed increase in the incidence of dystocia. This age-related trend implies that older ewes may encounter more challenges during lambing, emphasizing the importance of vigilant care and monitoring for ewes in the later stages of their reproductive years (McHugh, Berry and Pabiou, 2016).

3.7 Long term impact on ewe health

The health of ewes after experiencing dystocia is influenced by several factors, encompassing both immediate and potential long-term effects. Dystocia can inflict trauma, hemorrhaging, and septicemia upon ewes. Injuries may include uterine rupture, tears in reproductive organs, or damage to the rectum (Jacobson *et al.*, 2020).

In severe cases, dystocia may predispose ewes to conditions like Clostridium chauvoei, leading to postparturient gangrene. This can progress to necrotizing myositis and toxemia, potentially

resulting in fatal outcomes. The risk of such complications can be mitigated through good hygiene practices.

Ewes that experience dystocia during their first lambing are at a heightened risk for similar challenges in subsequent lambings. This suggests that the initial traumatic birthing experience may have lasting implications for the ewe's reproductive health (Jacobson *et al.*, 2020).

3.8 Choosing dam and sire for minimal dystocia rates

The risk of dystocia in sheep is intricately linked to the specific breeds of both ewes and rams. The choice of dam breed and sire breed significantly influences factors such as pelvis size, muscling, rates of malpresentation, and the size of the lambs. Careful selection of breeding pairs allows for the manipulation of dystocia risk, as certain breeds may exhibit more favorable characteristics in terms of ease of lambing.

Factors to consider in the selection process include the inherent pelvis size of the ewe, muscling traits that may affect the birthing process, and the historical rates of malpresentation associated with specific breeds. Additionally, the size of the lambs produced by different breeds plays a crucial role in determining the risk of dystocia (Speijers *et al.*, 2010a).

3.9 Assessing breeding parameters in Lleyn, North Country Cheviot, Scottish Blackface, Swaledale and Texel sheep

A comprehensive study conducted on hill sheep across six farms in Northern Ireland over three breeding seasons sought to examine the impact of sire breed on ewe dystocia, lamb survival, and the overall output of weaned lambs. The study encompassed diverse sire breeds, including Scottish Blackface, Swaledale, North Country Cheviot, Ileyn, and Texel, each crossed with purebred Scottish Blackface ewes (Speijers *et al.*, 2010a).

The findings revealed a significant influence of sire breed on lamb birth weight, with Scottish Blackface and Swaledale exhibiting the lowest weights, while Texel demonstrated the highest. Notably, dystocia rates were higher in Texel sires compared to Ileyn, Swaledale, and Scottish Blackface sires. Ewes mated to Cheviots experienced more dystocia than those mated to Scottish

Blackface and Swaledale. The primary factors contributing to dystocia were identified as increased lamb birth weight, larger litter sizes, and malpresentations (Speijers *et al.*, 2010a).

While Texel and Cheviot crosses displayed the highest live weights at weaning, mortality levels at birth were not significantly influenced by sire breed. Although certain sire breeds necessitated more assistance during lambing, the study did not find a significant impact on lamb mortality or ewe survival (Speijers *et al.*, 2010b).

Research reviewed which was conducted in 2010, sheds light on the intricate interplay between sire genetics, dystocia incidence, and lamb outcomes, providing valuable insights for genetic management strategies in sheep farming (Speijers *et al.*, 2010b).

3.10 Clover disease

Understanding the relationship between pastures, specifically the presence of estrogens in forage legumes, and the pervasive issue of clover-induced dystocia affecting ewe reproductive performance in southern Australia. Clover disease, a documented environmental factor, significantly impacts ewe fertility and lamb survival. Despite its long-standing recognition, the pathogenesis of clover-induced dystocia, often marked by primary uterine inertia, remains poorly understood.

An article on dystocia in sheep underscores the continued prevalence of clover disease as a major contributor to poor ewe reproductive outcomes in southern Australia. The study highlights the persistent challenges in unraveling the underlying mechanisms of dystocia in the context of clover-induced pathogenesis (Jacobson *et al.*, 2020).

Historically high levels of clover, specifically trifolium subterraneum L, with 'clover disease,' linking it to ewe infertility. The consequences are profound, manifesting in prolapsed uterus, dystocia, and heightened lamb mortality (Bennetts, Underwood and Shier, 1946).

Research from 1961 presents alarming statistics, revealing a 40% increase in dystocia rates, a 20% rise in ewe mortality, and a staggering 60% surge in lamb mortality associated with clover-induced dystocia (Moule, 1961).

4.0 QUESTIONS

Within the domain of sheep husbandry, dystocia and stillbirth stands out as an intricate challenge, representing the delicate initiation of life and the potential obstacles it may face.

Through a series of 10 questions, we will navigate the landscape of literary reviews undertaken, probing into the depths of knowledge acquisition and research exploration. Each question serves as a gateway, unveiling insights and intricacies discovered during the process of reviewing the existing literature. Our aim is not only to comprehend the intricacies surrounding dystocia but also to unearth pragmatic solutions that nurture the welfare of both ewes and their progeny.

4.1 What variations exist in mortality rates between different farming methods, such as extensive and intensive practices?

4.2 How can we strike a balance between minimizing financial losses and upholding the highest welfare standards for both ewes and lambs in sheep farming? Does higher welfare standards equate to lower mortality in ovine herds?

4.3 What are the root causes of dystocia, and what measures can be implemented for its prevention? Additionally, what are the most prevalent factors contributing to dystocia?

4.4 Following dystocia, does the risk of post-birth issues increase, and if so, what are the most common complications? How crucial is acquiring proper colostrum, and what steps can be taken to ensure its availability?

4.5 What significance does maternal bonding hold, and what strategies can be employed to cultivate an optimal environment for fostering strong maternal bonds?

4.6 In practical farm settings, what environmental conditions contribute to maximizing lamb survival rates, and how can these conditions be optimized? Additionally, what factors contribute to the ewe's condition before birth, and what effects do they yield?

4.7 After experiencing dystocia, how can ewe health be effectively enhanced, and are there lasting effects that necessitate mitigation? What strategies can be employed to minimize the impact on ewes in the long term?

4.8 Considering the existing infrastructure, what breeds align best with the system in place, and how can one go about selecting the most suitable breeds?

4.9 Is it possible to selectively breed lambs to minimize the risk of dystocia, and if so, what criteria should be considered in the breeding process?

4.10 In the pursuit of an ideal pasture, are there specific considerations or supplements that should be integrated for optimal sheep nutrition and well-being?

5.0 METHOD

Having established a comprehensive set of 10 questions, above, that delve into the intricacies of dystocia within the realm of sheep husbandry, the subsequent section outlines the methodology employed to unravel these queries. The forthcoming elucidation encapsulates a systematic approach designed to provide insightful and evidence-based responses to each posed question.

By drawing on a synthesis of literature reviews, empirical data, and practical observations, this methodology aims to construct a robust framework for addressing the challenges posed by dystocia. The ensuing exploration will delve into the subtle and intricate aspects of each item, leading to pragmatic solutions that contribute to the welfare of ewes and their progeny.

5.1 Exploring sheep husbandry practices in various farming methods

Gathering data from various farming methodologies and diverse geographical locations to examine the causes and prevention methods for dystocia. By encompassing a range of farming practices and global contexts, to provide insights into the complexities of dystocia management in sheep husbandry.

In a comprehensive 5-year study examining the provision of shelters for lambs demonstrated noteworthy benefits. The study reported a 10% improvement in single lamb survival rates and an impressive 32% increase for multiples. However, pre-lambing shearing had no discernible effect on survival rates (Pritchard *et al.*, 2021).

A New Zealand hill country sheep study highlighted environmental influences on lamb survival. Singles exhibited an 83% survival rate, while multiples had a 73% rate, with most deaths occurring between 1 to 3 days. Dystocia was a predominant cause for singles, while exposure played a significant role for multiples (Hinch and Brien, 2014) .

In the hills of Northern Ireland, dystocia was found to be influenced by sire breeds. Ewes mated to Cheviot sires experienced more dystocia than those mated to Scottish Blackface and Swaledale sires. Increased lamb weight, rather than litter size, was identified as a primary cause. Despite the need for more assistance during lambing, certain breeds like Ileyn and Texel, when crossed with Scottish Blackface ewes, demonstrated increased flock output with no detriment to lamb or ewe survival. Swaledale, Cheviot, Lleyn and Texels showed increased malpresentations. Lamb weight at weaning was higher in Texel, Cheviot and Lleyn versus Scottish Blackfaces and Swaledale. Mortality at birth is not affected. Mortality at weaning lower for leyn. So Lleyn and Texel with Scottish Blackface ewe have an increase in flock output but more assistance at lambing however no detriment to lamb survival or ewe survival. Dystocia for singles 10.4% and multiples 13.8%. Mortality in crossbred 7.5% and purebred 11.8%. Birth weight 4.4% for multiples and 5.3% singles (Speijers *et al.*, 2010).

The correction of dystocia involves proper tools and skilled intervention. Strategies include gentle manipulation to avoid tears, epidural injections, and specific procedures for various dystocia-related challenges such as retained front limb, maternal disproportion, uterine torsion, and inertia. Cesarean sections were also mentioned as a viable intervention method.

5.2 Financial analysis and cross-herd comparisons

In the realm of ovine husbandry, financial considerations take precedence, driven by the predominant profit-oriented nature of the majority of sheep herds. Contemporary societal expectations emphasize the need for more sustainable and ethical animal processes, albeit with the acknowledgment that higher welfare standards often incur elevated costs.

In response to financial imperatives, farms strategically engage in specialization, directing their focus either towards wool or meat production, and intensifying overall production methods. This cost-conscious approach frequently involves the utilization of fewer and less qualified labourers.

Additionally, farms adapt to economic demands by incorporating precision livestock farming (PLF) , leveraging cutting-edge technologies to enhance efficiency. Such adaptions not only seek to minimize stress on animals but also aim to elevate welfare through refined husbandry practices (Ferguson *et al.*, 2014).

The application of PLF is exemplified in targeted worming strategies. This approach not only achieves a 46% reduction in anthelmintic use but also demonstrates tangible labour-saving benefits, with on-farm labour reduced by 36%, potentially equating to a financial gain of up to £3 per ewe. The study focuses on a 900-ewe flock, comprising 600 Scottish Blackface ewes and 300 Lleyn ewes, divided into two groups—one with PLF management and one without (Morgan-Davies *et al.*, 2018). Key areas investigated include winter feeding practices for pregnant ewes and anthelmintic treatments (Montossi *et al.*, 2013).

Furthermore, recognizing a significant economic impact, particular attention is given to foot problems in ovine herds, particularly during gestation when increased ewe weight heightens pressure on their feet. The critical role of hoof care emerges as an essential component in mitigating economic losses associated with foot-related issues in ovine herds (Smith *et al.*, 2022).

5.3 Techniques and strategies for optimal lambing outcomes

In a comprehensive study encompassing 158,561 lambings from both crossbred and purebred Irish sheep, an evaluation of lambing traits such as lambing difficulty, dystocia, perinatal mortality, and birth weight was conducted. The study revealed significant genetic variation with distinct heritability characteristics across these lambing traits (Haslin *et al.*, 2023).

In contemporary times, heightened awareness of animal welfare and elevated standards of animal husbandry have taken precedence. Consumer expectations have risen, placing increased importance on the well-being of animals in agricultural practices. Notably, the study recognizes the welfare concerns associated with pain resulting from dystocia during birth, emphasizing the imperative of addressing such issues in alignment with evolving societal values and expectations (Haslin *et al.*, 2023).

Various farm types, including hills, upland, and lowland, exhibit distinct characteristics in the monitoring of sheep. Notably, 54% of these farms engage in continuous monitoring, ensuring that the well-being of the sheep is observed and managed around the clock (Binns *et al.*, 2002).

5.4 Lamb viability post-dystocia

Analyzing data from various sources regarding lamb viability post-dystocia reveals that prolonged parturition, while often associated with negative impacts, does not significantly affect standing and sucking in this particular study (Jacobson *et al.*, 2020)

Maternal under-nurturing has been identified as a factor contributing to lower birth weights and impaired postnatal survival in lambs. A 35% reduction in ewe nutrient intake during pregnancy has demonstrated negative effects on maternal bonding, as evidenced by decreased grooming time and increased aggression towards lambs observed in ewes subjected to the altered diet. Additionally, lower birth weight in lambs is associated with delayed standing and sucking, indicating a dual negative impact on both ewe and lamb in cases of maternal under-nurturing (Dwyer *et al.*, 2003).

5.5 Comparative analysis of maternal bonding in ewes and lambs to identify best practices, common issues, and effective solutions

Maternal care is induced by estradiol during late gestation, promoting the expression of oxytocin receptors. The birthing process, which involves the stretching of the vaginocervical canal, activates a spinal reflex that triggers the release of oxytocin. Variability in the manifestation of maternal care has been observed in primiparous ewes compared to multiparous ones, in different sheep genotypes, under conditions of undernutrition and stress during pregnancy, and following a challenging delivery. Additionally, variations in ewe temperament may also influence the expression of maternal care (Dwyer, 2014).

The intake of colostrum by lambs plays a crucial role in enhancing the future production and reproductive efficiency of offspring. Colostrum significantly influences immunity and increases the likelihood of overall survival. Higher quality colostrum is derived from ewes with excellent health status that consume high-quality diets (Agenbag *et al.*, 2021).

There are notable differences between primiparous and multiparous ewes. Primiparous ewes often experience higher rates of dystocia compared to multiparous ewes. Additionally, bonding between the ewe and offspring tends to be more robust in multiparous ewes (Freitas-de-Melo *et al.*, 2021).

If a ewe experiences undernutrition, the impact may be more significant when she has only one lamb compared to multiparous ewes, as multiparous ewes typically give birth to larger lambs. Triples generally exhibit smaller sizes at birth. These smaller sizes can result in metabolic challenges, and the triplets may receive less colostrum compared to twins. As a consequence, lower colostrum intake may contribute to decreased survival rates among triplet lambs (Freitas-de-Melo *et al.*, 2021).

Ewes form a bond with their offspring in the initial hours post-birth. During the gestation period of 30-143 days, ewes were provided with a daily intake of 6-10 kg dry matter per 100 kg body weight. The diet consisted of crude protein ranging from 6.4 to 6.7%, and metabolizable energy was maintained at 2-2.1 mcal/kg dry matter. Ewes had free access to water. Pregnant ewes experienced a 30% increase in energy requirements and a 60% increase in protein requirements (Freitas-de-Melo *et al.*, 2021).

From day 100 to lambing, ewes received a supplement of 300g per animal, consisting of rice bran with 88% dry matter, 14% crude protein, 9% acid detergent fiber, and 24% neutral detergent fiber. Even at day 143, there was a 12% negative protein balance, but a positive energy balance of 56% was observed. The diet was supplemented with an additional 300g of rice bran after parturition. Throughout this period, body weight and BCS were recorded, and blood samples were taken to monitor the nutritional status of the ewes (Freitas-de-Melo *et al.*, 2021).

When feeding a lactating ewe weighing 80 kg with twins, it is recommended to increase her energy intake by 60% and protein intake by 44%. This adjustment in nutritional requirements is crucial to support the increased metabolic demands associated with milk production and nursing twin lambs (Freitas-de-Melo *et al.*, 2021).

5.6 Collection of data on lamb survival rates

The periparturient period and its impact on production in extensive farming systems remain poorly understood, posing challenges in monitoring and data collection. Dystocia emerges as a significant factor influencing production outcomes. In Australia, a substantial proportion (20-30%) of lambs succumb before weaning, with the majority of losses occurring in the initial days of life. New Zealand exhibits lower mortality rates (15-18%) overall, with higher mortality observed in twin and triplet births compared to singles. Extensive farming methods, prevalent in countries such as China, South America, and South Africa, face challenges related to dystocia, starvation, mis-mothering, maternal dystocia, and fetal dystocia (Bruce *et al.*, 2021).

Ewe mortality ranges from 2-10% on Australian sheep farms, and the financial implications of these challenges remain inadequately understood. The contrast between sheep housed in barns and those in dry lots outdoors adds another layer of complexity to the dynamics of sheep production in extensive systems (Bruce *et al.*, 2021).

Identifying weak lambs promptly is crucial, as hypothermia and hypoglycemia commonly contribute to lamb mortality. Early detection is vital, and immediate treatment is recommended. Tube feeding is a preferred method to avoid aspiration pneumonia. Administering colostrum at a rate of 50 ml/kg body weight within 5-10 minutes is essential. The use of a heat pad or lamp is recommended to address hypothermia. Lambs older than 5 hours require energy supplementation before warming to prevent central nervous system damage due to hypoglycemia, and intraperitoneal administration of 20% dextrose is advised (Menzies, 2007).

Various risk factors contribute to hypoglycemia and hypothermia in lambs, including poor maternal nutrition during gestation, low or high birth weight, hypoxia, trauma during dystocia, mismothering due to inexperience, illness, insufficient milk, and diseases like Maedi-Visna. The period from high-risk birth to 5 hours is critical, with the risk shifting to hypothermia secondary to hypoglycemia from 5 hours to 7 days. Subsequent risks include entropion, clostridium, coccidiosis, diarrhea, and pneumonia. Vigilant monitoring and appropriate interventions are crucial for ensuring the well-being and survival of weak or vulnerable lambs (Menzies, 2007).

5.7 Ewe BCS

Evaluating the condition of ewes before lambing involves examining their pre-birth status, determining optimal feeding practices, assessing BCS, and considering health factors linked to dystocia resulting from the ewe herself (Jacobson *et al.*, 2020).

In ewes experiencing suboptimal conditions, there is an increased susceptibility to metabolic disorders, dystocia, and elevated mortality. The mortality risk for triplets in merinos rises when ewes have a low BCS compared to those with a high BCS. The late stages of pregnancy exacerbate the loss of condition, rendering them prone to metabolic disorders (Haslin *et al.*, 2023).

Conversely, overweight ewes accumulate fat around the rumen, restricting feed intake and predisposing them to pregnancy toxemia due to unmet energy requirements, thereby heightening the risk of ewe mortality. This condition, in turn, amplifies the likelihood of dystocia. Ewes carrying multiple lambs are more susceptible to malpresentation, and the overstretching of the myometrium leads to uterine inertia, significantly increasing the risk of dystocia, especially in overweight ewes with triplets.

Feeding practices exert a profound influence on the long-term growth of offspring. Flushing, a method to boost caloric intake before breeding, is employed by half of the farmers. The prevalent method involves monitoring BCS and employing diverse feed rations, including hay (95.8%), pasture (79.2%), concentrates, other haylage, and corn silage (37.5%) (Forbes, Rees and Boaz, 1967).

To address these challenges, recommendations are put forth for the feeding and management of ewes fed on silage. Specifically, a silage for pregnant ewes should possess at least 20% dry matter (DM) and 14% crude protein in the DM, while not exceeding 32% crude fiber in the DM (Forbes, Rees and Boaz, 1967).

Pregnancy toxemia in ewes is frequently triggered by negative energy balance, excessive lipid metabolism, ketosis, and hepatic lipidosis. Diets during late gestation should contain ample glucose precursors to provide essential materials for fetal tissues. Providing high-quality feed to

ewes in late gestation is crucial to prevent negative energy balance and mitigate the risk of pregnancy toxemia (Van Saun, 2000).

Table 1 outlines variations in nutrient content among different feeds for flocks.

	Current pellet	Previous pellet	Grass hay
Dry matter %	89.8	89.7	91.6
Crude protein %	15.0	14.6	7.1
Digestible energy (Mcal/kg)	3.07	3.11	2.55
Acid detergent fiber %	22.9	26.7	40.7
Neutral detergent fiber %	49.1	36.1	66.1
Crude fat %	3.7	3.6	N/A

(Van Saun, 2000)

The consumption of new pellets leveled off at 1.5-2 kg/head/day, falling short of the anticipated 2.7-3.6 kg/head/day. Ewes' intake of grass hay was 15-20% lower. The new pellet exhibited higher neutral detergent fiber and lower acid detergent fiber. Non-structural carbohydrates (NSC) decreased from 38.4 to 22.7%.

To enhance glucose availability for the fetus, the dam's body upregulates gluconeogenesis and minimizes its consumption.

The recommended intake for Neutral Detergent Fiber (NDF) is 1.1-1.3% of body weight. There is a growing trend in the practice of substituting low-cost by-product feeds in ruminant diets. Typically, these by-product feeds contain elevated levels of fermentable NDF and lower amounts of Non-Structural Carbohydrates (NSC). The structural carbohydrates present in the NDF fraction undergo fermentation by microbes, producing acetate or butyrate, which serves as an energy source for sheep. However, it's important to note that these components cannot contribute to net glucose production.

Despite the apparent equality in the energy density of the two pellet formulations based on digestible energy values (refer to the table above), these values do not consider fermentation and metabolic losses during the digestive and metabolic processes. In reality, the energy available to ewes for supporting maintenance and pregnancy needs was significantly lower for the new pellet formulation due to increased fermentation losses. The severity of the pregnancy toxemia outbreak and hypocalcemia observed in this flock seemed to result from a combination of limited glucose precursors, excessive dietary fiber limiting intake, and decreased availability of dietary energy. It is necessary to monitor feed quality and carefully evaluate feed substitutions, considering factors beyond cost considerations (Van Saun, 2000).

Efforts to augment litter size exhibit variable outcomes, resulting in either increased loss or diminished gain in body condition, even with the provision of concentrated feed. Manipulating the diet's energy intake in the final phase of gestation impacts body metabolism, influencing ewe body weight reduction, colostrum quality, birth weights, and overall lamb growth. Ensuring adequate nutrition and energy during lactation, coupled with higher protein content, proves pivotal for optimizing milk yield.

While mineral licks are commonly utilized, their prevalence is reduced due to cost and labour considerations. In indoor lambing scenarios, widespread practices such as navel treatment, tail-docking, castration of male lambs, and administering colostrum to weak or non-suckling lambs underscore the significance of hygiene in lambing pens, contributing to the mitigation of perinatal mortality risks (Binns *et al.*, 2002).

The use of coccidiostats is linked to an increased incidence of stillbirths, possibly indicative of poor ewe body condition. Ewes in good condition demonstrate a propensity to produce heavier lambs with higher survival rates.

Pregnancy toxemia, arising from negative energy balance and excess lipid metabolism, necessitates high-quality feed in late gestation to avert negative energy balance. Disparities in nutrient content among flock feeds exert a considerable impact on overall health and performance.

Lastly, a cautionary stance is advocated concerning the substitution of low-cost by-product feeds in ruminant diets. Emphasis is placed on the need to vigilantly monitor feed quality and judiciously consider feed substitutions based on cost considerations to forestall outbreaks of pregnancy toxemia and hypocalcemia, exacerbated by limited glucose precursors, excessive dietary fiber, and diminished energy availability.

5.8 Assess the effects on ewes due to dystocia. Examine factors such as mastitis, inadequate milk production, and suboptimal udder conformation.

The impact of dystocia on ewes encompasses trauma, hemorrhaging, and septicemia. Injuries may manifest as uterine rupture, tears in reproductive organs, or rectal damage. Dystocia increases the susceptibility to metritis, and the presence of Clostridium chauvoei post-parturient gangrene can escalate to necrotizing myositis, potentially leading to toxemia and death. Implementing good hygiene practices helps mitigate these risks (Menzies, 2007).

Ewe mortality or illness, distinct from lamb-related issues, and instances of dam rejecting the ewe are significant concerns. Factors contributing to these challenges include mastitis, inadequate milk production, and suboptimal udder conformation. Addressing these aspects is crucial for ensuring the overall well-being of ewes in the lambing process.

Dam rejection refers to the situation where a dam refuses to accept or care for one of her lambs. This can occur for various reasons, including but not limited to health issues in the ewe, problems with the lamb, or behavioral factors.

Mastitis, inflammation of the mammary gland, can affect milk quality and availability. Insufficient milk production may result in inadequate nutrition for the lamb. Suboptimal udder conformation, indicating structural issues, can hinder effective nursing and bonding between the ewe and lamb.

Maintaining good hygiene practices is crucial in minimizing the risk of infections and complications post-dystocia. Proper care, timely interventions, and vigilant monitoring can contribute to reducing the negative impact of dystocia on ewe mortality. Ewes often respond to antimicrobials, oxytocin, NSAIDS with no future effects on fertility, if rapidly identified and treated.

Ewes experiencing dystocia during their first lambing may face an elevated risk in subsequent lambings, emphasizing the long-term consequences of dystocia in ewe health and reproductive outcomes (Menzies, 2007).

5.9 Breed comparisons

The breed comparison study of 3252 lambs focused on dystocia and other factors related to birth difficulty, lamb vigor, and perinatal mortality in Suffolk and Texel sheep. The findings revealed notable differences among breeds, emphasizing the importance of considering genetic lines for optimal outcomes in terms of welfare, growth, and muscle development (Dwyer and Bünger, 2012).

Texels had the highest rates of assistance, with 55.7% requiring some form of intervention. Suffolk had a 30.7% rate of assistance. Scottish Blackface and Mules required the least assistance, with rates of 22.7% and 24.9%, respectively. Texel and Suffolk breeds were most likely to require veterinary assistance, particularly in the case of single heavy lambs. Malpresentations were equally likely in Texel and Suffolk breeds, both at 29%, while Scottish Blackface and Mules had a lower rate of 20%. Suffolk had the highest percentage at 56%, followed by Texel at 31.6%, Mule at 19.8%, and Scottish Blackface at 18.4%. Texels showed the highest weights and muscle development. Suffolk had lower weights but still exhibited considerable muscle development. The Charolais breed displayed the highest fat depth (Dwyer and Bünger, 2012).

Genetic selection has played a crucial role in shaping the growth and carcass composition traits in sheep over the past 30 years in the UK. This extensive period of genetic selection has involved within-breed analyses to achieve high genetic gain. The evaluation focused on purebred lambs born in the UK, specifically Texel, Suffolk, and Charollais breeds.

Weights were recorded at two key stages: 40-85 days with a weight range of 12-45 kg, and 121 to 180 days with a weight range of 25 to 75 kg. The study, encompassing a vast population of 55,155 animals, revealed that body weight is under genetic control, and there is a high correlation between genetic factors and muscle depth.

Texels exhibited the highest weights and superior muscle development among the evaluated breeds. In contrast, Charolais, while still demonstrating robust growth, showed the highest fat depth. This study underscores the impact of genetic selection on key traits related to growth and carcass composition in different sheep breeds.

The study suggests that sires selected for greater productivity, muscle growth, and conformation may lead to increased birth difficulties and poorer lamb vigor. Balancing genetic traits is crucial, considering factors such as growth, muscle development, and fat depth (Fitzmaurice *et al.*, 2021)

5.10 Assessing the positive and negative of different pasture feeding regimes

Pasture feeding is a common and natural practice in sheep farming, where animals graze on open fields or pastures to meet their nutritional needs. This feeding method has both positive and negative aspects (Haslin *et al.*, 2023).

Positives can include implementing a well-designed feeding regime allowing for the optimization of ewe nutrition, ensuring that they receive the necessary nutrients for proper health, reproduction, and milk production. Adequate and balanced feeding positively influences lamb birth weight, vigor, and overall survival rates. Proper feeding contributes to maintaining optimal BCS in ewes, which is linked to their general health, reproductive performance, and resistance to diseases. Implementing feeding practices that prioritize the nutritional needs of ewes contributes to higher welfare standards, aligning with ethical and sustainable animal husbandry practices (Haslin *et al.*, 2023).

It is a careful balance between meeting nutritional needs, considering economic factors, and promoting the health and welfare of ewes and lambs, thus leading to reduced dystocia.

The optimal number of feeding places plays a crucial role in achieving maximum uptake. In a study involving pregnant animals housed indoors in Norway for 6-7 months during winter, the time spent feeding decreased for hay and silage. However, there was no significant difference in silage intake, and hay intake was lower by 6.8% when changing from a 1:1 to a 3:1 ratio of feeding places per animal. The recommended feeding space was 0.45m/ewe (Bøe and Andersen, 2010).

"The average daily feed intake of silage was 8.26 ± 1.25, 8.28 ± 0.66, and 8.60 ± 0.68 kg/ewe for the 1:1, 2:1, and 3:1 treatments, respectively, and there was no effect of reducing the feeding space on feed intake. For the groups on hay, daily consumption was reduced from 1.89 ± 0.18 to 1.82 ± 0.07 and further to 1.76 ± 0.12 kg/ewe for the 1:1, 2:1, and 3:1 treatments, respectively, and there was a difference between the 1:1 and 3:1 treatments ($F_{2,42} = 4.7$, $P < 0.05$)" (Bøe and Andersen, 2010). Additionally, ewes generally exhibit a preference for the more palatable hay.

There are negatives and implementing an optimal feeding regime may come with increased costs, especially if it involves high-quality feeds, supplements, or PLF technologies. Balancing nutritional needs with economic considerations is crucial.

Certain feeding regimes, such as PLF or individualized care, may require increased labour inputs. This can be a challenge, particularly for large-scale sheep farming operations.

Determining the right balance in feeding regimes is essential. Overfeeding can lead to obesity, metabolic disorders, and increased costs, while underfeeding can result in poor reproductive performance and compromised overall health.

The choice of feeding practices can have environmental implications, especially if it involves the use of resources like land, water, and energy. Sustainable feeding practices should consider minimizing environmental impact.

Introducing changes to feeding regimes may face resistance or challenges in adaptation, both from the sheep and the farmers. Gradual transitions and proper management are crucial to mitigate potential issues.

Nutritional imbalances from pasture feeding may contribute to dystocia if ewes are either undernourished or over-conditioned. Monitoring BCS scores is crucial to mitigate this risk. Achieving a careful balance between meeting nutritional needs, considering economic factors, and promoting the health and welfare of ewes and lambs can contribute to a reduction in dystocia.

5.11 Personal data analysis

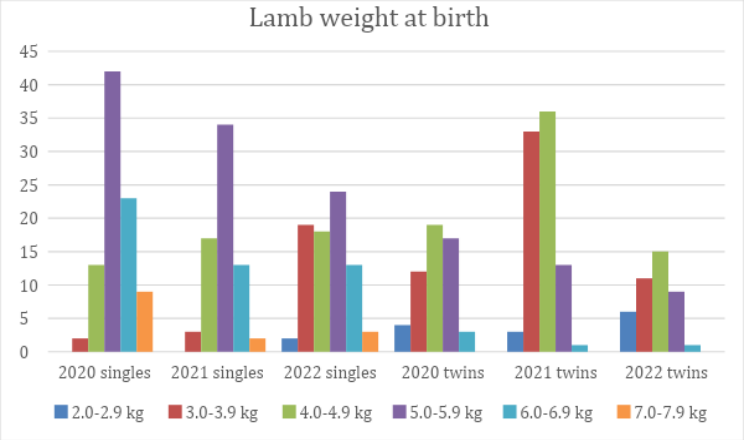
My study over 3 years between 2020-2022 on a sheep farm in the Isle of Man provides valuable insights into the lambing process and associated challenges. The rams were introduced to ewes on October 6th each year for a period of three weeks and three days, resulting in lambing generally starting on March 1st.

Lambing Events in 2023

- Two breech births observed, both involving the second lamb in twin births.
- Two instances of twins presenting simultaneously in the birthing canal, requiring assistance from the farmer
- Eight single lambs presented with one leg forward and one leg tucked back.
- Twenty-five ewes required assistance during lambing, with all interventions performed by the farmer; no veterinary assistance was needed.

For single Lambs the most common weight bracket was 5.0-5.9 kg. For twin lambs, the most common weight bracket: 4.0-4.9 kg, see figure 1. (Consistent with other studies, twin lambs tend to be slightly smaller in size.) No clear trend observed in the causes of lamb losses or specific trends related to lamb breeds, see figure 2.

Figure 1. Lamb weight at birth



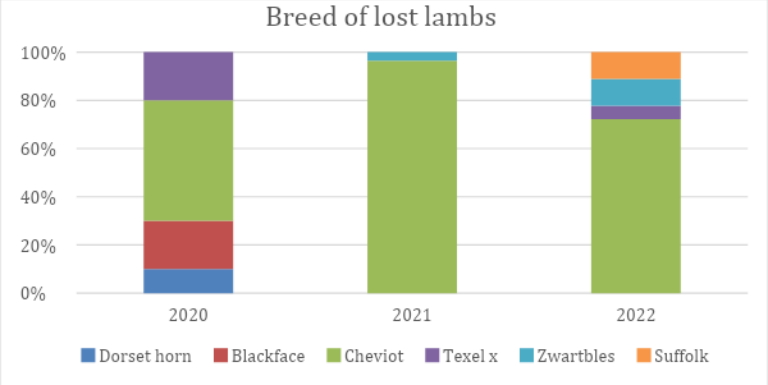
Conclusions

The study provides specific insights into lambing events, including presentation issues and assistance requirements. Weight distribution among single and twin lambs aligns with patterns observed in other studies. The absence of a clear trend in lamb loss causes and breed-related trends suggests the need for continued monitoring and research. The information gathered can guide future management practices during the lambing season. Highlighting the importance of farmer intervention, especially in cases requiring assistance.

Overall, the study contributed data to the understanding of lambing dynamics on the Isle of Man sheep farm, offering practical insights for improved management and care.

The farm keeps 70% Cheviots and the flock sizes of other breeds vary, it's logical to expect a higher number of lost lambs in the Cheviot flock simply due to its larger size. This is a normal outcome based on the proportional representation of each breed in the overall flock. The larger the flock, the higher the absolute numbers of various outcomes, including lamb losses. Therefore, when evaluating and comparing the number of lost lambs as seen in figure 2, it's important to consider the proportional representation of each breed in the total flock to make fair and accurate assessments.

Figure 2. Breed of lost lambs



In 2020, the farm had 122 pregnant ewes and recorded 154 lambs, giving a lambing percentage of 126% per ewe. In 2021 there were 118 pregnant ewes, with 168 lambs born, giving a lambing percentage per ewe of 142%. In 2022, with 102 ewes and 123 lambs, the farm recorded a lambing percentage of 121%.

Figure 3. Lamb losses 2020

Total lamb losses in 2020: 10

Aborted: 1

Stillbirth: 5

Died before tagging: 1

Unknown: 3

Figure 4. Lamb losses 2021

Total lamb losses in 2021: 28

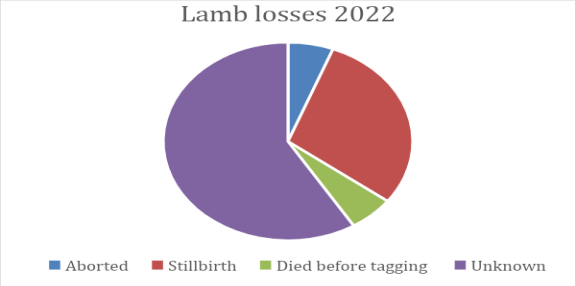
Aborted: 1

Stillbirth: 4

Died before tagging: 13

Unknown: 10

Figure 5. Lamb losses 2022



Total lamb losses in 2022: 18

Aborted: 1

Stillbirth: 3

Died before tagging: 11

Unknown: 3

The "unknown" category shown on figures 3, 4 and 5 encompasses lambs that died for various reasons, according to the farmer, including factors like mismothering, hypothermia, and starvation. Notably, in 2022, following the lambing season, the weather on the Isle of Man was harsher than usual, leading to a higher-than-expected lamb mortality rate. Extreme weather conditions can indeed have a significant impact on lamb survival, and such contextual factors are crucial for understanding fluctuations in lamb losses on the farm.

6.0 RESULTS

This comprehensive research explores multifaceted strategies to enhance lambing outcomes, addressing critical aspects such as genetic considerations, feeding practices, and maternal bonding. From recommending specific breeds with easy lambing traits to advocating for optimal ewe nutrition and implementing PLF, the study provides actionable insights. The findings underscore the interconnectedness of genetic selection, feeding protocols, and environmental factors in achieving the lowest rates of dystocia and stillbirth, ultimately contributing to the long-term welfare and sustainability of sheep farming operations.

Lambing Management Recommendations

- For outdoor lambing, provide adequate shelter and identify ewes needing extra care.
- Indoor lambing should ensure good ventilation and implement regular cleaning to prevent infections.
- If increased flock output is desired breeds such as Lleyn and Texel is recommended.
- Crossbreeds exhibit easier lambing and lower lamb mortality rates than purebreds.
- PLF offers benefits in efficiency, welfare, and disease prevention.
- Recommendations emphasize tailoring strategies to environmental conditions and selected breeds.

Strategic Breeding

- Opt for genetic lines known for easy lambing to reduce dystocia and stillbirth risks.
- Genetic selection impacts overall lambing experience, maternal instincts, and lamb vigor.

- Prioritize genetic traits associated with lower dystocia risk and overall reproductive success.
- Benefits include reduced veterinary interventions, lower mortality rates, and long-term sustainability.

Ewe Feeding for Optimal Lambing

- Provide a balanced diet meeting nutritional needs during pregnancy.
- Adjust energy content to meet increasing demands, especially in later gestation.
- Regularly monitor ewe body condition, ensuring a moderate BCS for better lambing experiences.
- Adequate protein intake supports fetal growth and colostrum quality.
- Proper mineral and vitamin supplementation, access to clean water, and fiber content are crucial.
- Plan for a smooth transition from pregnancy to lactation diet.
- Consider early weaning strategies if needed, and monitor and adjust feeding practices as necessary.

Maternal Bonding

- Maternal bonding thrives with ewes in ideal BCS and an easy lambing process, free from dystocia and interventions.
- A clean and calm birthing environment, absence of stillbirths, and natural birth contribute to bonding.
- Natural births release bonding hormones, allowing ewes to engage in maternal behaviours.
- Vigilant monitoring, skilled intervention, and postnatal support enhance bonding.
- The best chances for bonding occur when ewes are in optimal physical condition, experience easy lambing, and give birth in a stress-free environment.

Effects on Ewes and Genetic Considerations

- Dystocia impacts ewes with trauma, hemorrhaging, and septicemia, necessitating good hygiene practices.
- Ewe mortality or illness and dam rejection are concerns, influenced by mastitis, inadequate milk, and udder conformation.
- Early experiences of dystocia may elevate risks in subsequent lambings.
- Genetic selection for easy lambing contributes to reduced dystocia, lower stillbirth rates, and improved overall reproductive performance.

Feeding Practices and Space

- Adequate feeding space, availability, and high-quality feed are crucial for ewe nutrition.
- Space per animal influences feeding behaviour and stress levels.
- Higher-quality feed supports optimal ewe health and reduces the risk of complications.
- Minimizing stress and competition during feeding contributes to overall flock welfare.
- Preventing nutritional stress through proper feed practices is essential for preventing stillbirth and dystocia.
- Long-term benefits include improved flock health, productivity, and lamb survival rates.

7.0 DISCUSSION

The comprehensive exploration of various factors impacting ewe and lamb health during the lambing process highlights the intricate interplay between management practices, feeding regimes, and genetic considerations. The data collected from different studies and farm observations shed light on critical aspects influencing dystocia, stillbirth, and overall survival rates.

Key Findings

Genetic Considerations**:** selecting genetic lines with low dystocia rates emerges as a fundamental strategy for promoting ewe and lamb well-being. The study comparing Suffolk and Texels emphasizes the importance of genetic choices in minimizing birthing difficulties.

Feeding Practices: adequate nutrition, characterized by both quality and accessibility of feed, plays a pivotal role in minimizing stillbirth and dystocia risks. The number of feeding places,

space per animal, and feed quality directly impact ewe health and, consequently, lambing outcomes.

Management practices: both indoor and outdoor lambing systems have their advantages, with indoor systems allowing for more rigorous monitoring. However, regardless of the system, attentive care and prompt intervention in case of complications are crucial for reducing mortality rates.

BCS: maintaining an ideal BCS emerges as a consistent theme throughout the discussion. Ewes with optimal BCS during pregnancy are associated with easier lambing processes, lower dystocia rates, and improved maternal bonding.

Risk Factors: factors such as maternal undernourishment, metabolic challenges, and birthing difficulties contribute to the complexity of dystocia and stillbirth. Recognizing these risk factors enables targeted interventions and management adjustments.

8.0 CONCLUSION

In conclusion, the data-driven exploration underscores the multifaceted nature of factors influencing lambing outcomes. Strategic breeding, informed feeding practices, and vigilant management collectively contribute to the mitigation of dystocia and stillbirth risks. The emphasis on achieving and maintaining ideal BCS emerges as a cornerstone for successful lambing.

As the agricultural landscape continues to evolve, the integration of PLF, genetic advancements, and evidence-based management approaches becomes imperative. This discussion provides valuable insights for farmers, researchers, and stakeholders to make informed decisions aimed at optimizing ewe and lamb health during the critical lambing period.

9.0 SUMMARY

My comprehensive examination of lambing-related factors reveals the intricate dynamics influencing ewe and lamb health. Key findings emphasize the significance of genetic choices, optimal feeding practices, and attentive management. Selecting genetic lines with low dystocia

rates is crucial, as highlighted in the Suffolk and Texels comparison. Feeding practices, including the number of feeding places and feed quality, directly impact stillbirth and dystocia risks. Both indoor and outdoor lambing systems offer advantages, with vigilant care being pivotal in reducing mortality rates.

Maintaining an ideal BCS emerges as a consistent theme, correlating with easier lambing, fewer stillbirths, lower dystocia, and improved maternal bonding. Understanding risk factors such as maternal undernourishment and metabolic challenges enables targeted interventions.

In conclusion, the synthesis of genetic advancements, PLF, and evidence-based management approaches is essential for optimizing ewe and lamb health during the lambing period. This discussion provides valuable insights for stakeholders navigating the evolving agricultural landscape.

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