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Effect of calving course on fertility in an Irish dairy and beef farm

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1. Abstract

Reproductive performance in cattle herds is becoming an increasingly important factor. This includes dairy herds, where previously milk yield was a primary factor, but the financial impact of poor reproduction is becoming more evident. Uterine disease in particular has become a focus of study, but other factors such as calf gender, cause for culling, cow parity, dystocia's, services required, sire breed and perinatal mortality also play a role. These later factors will be the focus of this study, although the need for veterinary assistance in diagnosing uterine diseases is suggested also.

This study finds that female calves, higher parity, and Angus sires are associated with a lower calving difficulty score, whilst Simmental sires are associated with a shorter calving interval.

Primiparous cows and Angus sires are also found to be associated with increased occurrence of dystocia, while perinatal mortality increases with calving difficulty score.

However, the role of uterine disease is not signified to be any lesser in this study but instead perhaps the need for veterinary assistance in diagnosing such disease cases.

2. Table of Contents

3. Introduction

The dairy industry has changed considerably in the past 100 years with a change to larger herds, more selective breeding, and advances in the technology from housing, nutrition, milking, reproduction, and health monitoring. In this time, the primary breed selection has been targeted towards high milk production with the Holstein and Friesian or, most commonly the hybrid of the two, the Holstein Friesian becoming the iconic dairy cow. This selective breeding has led to cows setting new records for yearly and lifetime lactation production, with over 10,000 kg per lactation being achieved in some herds. However, with this high selection for the milk production, some other parameters have been given much lower importance. Factors such as reproduction performance, meat quality and life expectancy have all decreased in modern dairy herds. The negative energy balance which occurs in these breeds post-partum as a result of the rapid increase in milk production has a significant impact on all of these factors, but other aspects, such as metabolic disorders and uterine pathology, also have a role [1]. The reproductive performance, often measured using parameters such as time to conception, time to 1^{st} service, conception rate on 1^{st} service, is important as it determines the ability of a herd to produce its future stock and to get its producing animals into a new lactation. Calving interval is also of importance, especially in pasture-based herds where the yearly timing of calving should correspond to the grazing period and grass growth. Calving difficulty has importance not only for its effects on reproduction parameters but also for the increased work it can present for a farm, with large dairy farms wishing to decrease its incidence more so than smaller or beef farms [2]. This thesis will focus on the reproduction issues and parameters of a dual-purpose Irish beef and dairy farm

3.1. Objectives

In this thesis, the calving data of a dual-purpose Irish beef and dairy farm will be analysed, in particular any possible impact from calf gender, calving difficulty score, cow parity and sire breed.

4. Literature Review

4.1. Reproductive diseases

The most common reproductive issues of the dam's reproductive tract following calving are retained fetal membranes (RFM), clinical metritis, and clinical endometritis, both of varying degrees.

Retained fetal membranes, the failure to pass the placenta within 12 or 24 hours postpartum, depending on differing definitions by authors, is one of the primary risk factors for developing uterine disease.

Clinical metritis can also be defined using a grading from 1 to 3, with grade 1 having no systemic signs, having only enlarged uterus and purulent uterine discharge in the vagina within 21 days post-partum, grade 2 (puerperal metritis) having systemic signs such fever, enlarged uterus, fetid watery red-brown uterine discharge, systemic signs and depressed yield , and grade 3 having signs of toxemia [3, 4].

Clinical endometritis can be defined as either 21 days or more post-partum with purulent uterine discharge in the vagina or 26 days or more post-partum with mucopurulent uterine discharge in the vagina [3, 5]. This may not be the best definition however as evidence exists that purulent vaginal discharge can occur in the absence of endometrial inflammation [6]. Subclinical endometritis is seen in the absence of clinical endometritis with elevated neutrophils in uterine cytology, >18% days 21-33 post-partum or >10% days 34-47 post-partum, although the exact cut-off values are still debated in research, with a more recent studies suggesting a general threshold of >5% between days 21 and 62 postpartum [3, 7, 8]. The most effective method for evaluating this is the use of a cytobrush, rather than uterine lavage [9]. Pyometra is rare in cattle and defined by the accumulation of purulent material within the uterus, persistent corpus luteum and a closed cervix [3].

The prevalence of these conditions varies by herd. Metritis occurs in up to 40% of dairy cows, endometritis in 15-20% and subclinical metritis in up to 30% [4, 5, 10, 11].

4.2. Risk factors for uterine diseases

There are various risk factors for these diseases. Dystocia and RFM increase risk of metritis [6, 10, 12]. Twinning, dystocia, and metritis are risk factors for purulent vaginal discharge independent of endometritis [6]. For clinical endometritis, RFM, assisted calving, stillbirth, primiparity, vulval angle, and male offspring were all found to increase the risk to various degrees. Retained fetal membranes and stillbirth had the most significant impact while male offspring had the least, although the use of sexed semen makes male offspring one of the easiest targets for reduction [10, 13]. Female selection would also help to reduce dystocia as female calves are less likely to present with dystocia [14, 15].

The occurrence of RFM, which can range from 5-10%, is linked to risk factors such as twinning, dystocia, stillbirth, abortion, induced parturition, and milk fever [12, 14, 16–18]. Retained fetal membranes was also seen more in assisted dams then unassisted dams, and in unassisted dams in individual pens then group pens [19].

4.3. Consequences of Uterine Diseases

These diseases of the reproductive tract can have significant impact on the later reproductive performance of the dam. Clinical metritis was found to be linked to a 7-day increase in time to 1st service and 20% reduction in conception at 1st service leading to 19 more days to conception compared to unaffected dams [20]. Clinical metritis was also shown to reduce the milk production and increase the culling risk of multiparous but not primiparous cows [21]. In one study, clinical metritis was found to increase the time to pregnancy by a median of 32 days, or by 27% longer, and increase the culling rate by 1.7 compared to unaffected dams [5]. In a pasture based study, cows with purulent vaginal discharge had a 9 day longer calving to conception period and were 3 times more likely not to conceive at all [22]. Uterine disease alone may not have a direct impact on culling rate in some cases but the subsequent reduced fertility rate does increase the culling rate [23].

4.4. Bacterial Background of Uterine Diseases

The bacterial background of uterine diseases is complex. *Escherichia coli*, *Trueperella pyogenes* and several anaerobic species have been cultured from diseased cows, but their definitive role is complicated by the discovery of various other bacteria in the diseased uterine microbiome and how culturable and non-culturable bacteria may have varying roles. Regardless of the pathogenic background, the subsequent inflammation and tissue damage arise from the binding of Toll-like receptors to pathogen-associated molecular patterns [24–26]. Secreted cytolysin from *T. pyogenes*, pyolysin, when present, also plays a role in endometrial cell death by forming pores within the cells, although the cells do not sense damage-associated molecular patterns which would be released as a result of this damage. The damage leads to release of intracellular cytokine interleukin 1 alpha from the endometrium which increases the inflammatory response [27]. Bacterial contamination also impacts fertility by disrupting the follicular phase luteinizing hormone surge and ovulation when components are absorbed [28].

4.5. Dystocia and Calving Assistance Incidence and Consequences

Dystocia is calving difficulty from prolonged calving or severe or prolonged assistance in calving [29]. Of this, there are various forms of malpresentations, malpositions, and malpostures, along with oversized fetuses, which can be in relative or absolute terms. Relative oversized fetus occurs where the fetus is too large for the dam at her current size, mostly as a result of breeding the dam too early in their development such that the pelvic diameter is not yet sufficiently large and is much more common than absolute oversized [29]. Absolute oversized fetus is when the fetus is too large for the dam's normal pelvic diameter and can be a result of poor sire selection or overfeeding of the dam resulting in excessive fetal growth [30]. In both forms, the fetus is too large to pass naturally through the birth canal of the dam. If the fetus can pass through the bony section of the birth canal but not the soft tissue, the removal can be assisted by a cervical incision or episiotomy. If the fetus cannot pass through the bony section of the birth canal, a caesarean section or fetotomy can be performed, as appropriate. Dystocia requires assistance, which can range from some small assistance by farm workers to veterinarian assistance or pulling with strong force using a calf puller. These interventions pose a risk of increasing the bacterial load in the uterus postpartum and are also associated with a decrease in reproductive performance on their own, increasing days to 1st service by 2-3 and reducing conception rate by 4-10%, leading to increase in time to conception by 6-12 days. Similar effect on reproduction was found in the case of RFM [20]. Cows which, when calving, required veterinary assistance, had twins, or had male progeny all had an increased risk of mortality [31]. Previous calving difficulty and maternal calving difficulty predicted transmitting ability both serve as good predictors for level of assistance required in future calving's [15, 30, 32]. Pasture-based Holstein-Friesians in Ireland were found to have a calving assistance incidence of 31.1% and dystocia incidence of 6.8%, with primipara having higher prevalence rates for both cases [15]

4.6. Conclusion

The reproductive ability of a dairy herd is integral to its continued production, by providing the subsequent lactation and by generating new stock which will take the place of the current dams in the future. As such, maintaining strong performance in reproduction should be key in a dairy farms breeding and planning. The complex of diseases, particularly the inflammations of the uterus which were examined in this review, can have significant impact on this reproductive performance in herds. This is the basis on which the determination of the risk factors for these diseases should be established so that they may be mitigated in the hope of decreasing these diseases and increasing the reproductive ability of the cattle. Further study on the prevalence's of these diseases and the importance of the risk factors in other keeping methods and breeds may play a role in the future improvement of the reproductive performance across herds.

5. Materials and Methods

5.1. Farm information

All data was collected from the farm, and with the permission, of John Smith, Curraghtown House Farm, Navan, Meath, Ireland.

The farm consists of pastural grazing for approximately 6 months of the year, with indoor keeping for the remainder. The herd is kept for dual purpose of both beef and dairy, with an average milk production of 6,000 kg per animal per year, with most male calves raised to slaughter on the farm. The herd originates from a predominantly Holstein Friesian herd although over the past 10 years crossbreeding with Angus, Rotbunte and Simmental (primarily Fleckvieh) has been carried out. As such, all cows on the farm are crossbreeds of 2 or more breeds.

Breeding is carried out exclusively using natural service with 2 Angus bulls and 3 Fleckvieh Simmentals, without the use of any marking paint or other forms of services recording. Services recorded are only from visual observation of the event, hence not all services are recorded.

Dry cows are housed together and fed a total mixed ration consisting of 1 kg soya, 2 kg straw, 18 kg grass silage and 150-200 g commercial dry cow mineral mix per cow daily. Visual checks are carried out for signs of coming near to calving, specifically enlargement of the udder and dropping of the pin bones. When these signs are seen, cows are moved from the slatted area to a straw bedded area, on average this is 3 days before they then calve. Once in this calving shed, the cows are regularly checked, either directly visually or with use of cameras installed in the shed, for calving. Cows are fed the TMR at night whilst in the calving shed to try and reduce the number of calving's that occur during the night.

The data had been recorded by John Smith using the Herdmaster© program from Irish Farm Computers LTD, between the years 2019 and 2022, with the calving's during the spring periods of 2019-2022 used in this study.

5.2. Data categorization

The data involved 462 calving's over the course of 3 years. In each incidence, the following data were recorded and used, where relevant, in the analysis in this thesis: breed of sire bull, calving date, calving score (scored from 0 to 2 as follows: CD 0 = calved spontaneously, CD 1 = assisted, CD 2 = calving jack or 2-man assistance required), calf gender, dystocia (includes exclusively all malpostures, malpresentations, malpositions or oversizing's noted) and perinatal mortalities (including death within the first 3 days of life, of which 2 were recorded).

For the dams, the following data were recorded and used, where relevant: calving interval, cull cows, cow parity (noted as primiparous for those which calved once, biparous for those which calved twice and multiparous for more) and number of observed services.

Some recorded events were not included due to their low number, which would lead to a low statistical power. These events are: abortion/premature (n=2), calving difficulty score of 3 requiring veterinary assistance (n=1), deformed calves (n=1), metritis (n=3), milk fever (n=3), retained fetal membranes (n=4), and twinning's (n=4).

5.3. Statistical analysis

The data were exported via CSV files to Microsoft® Excel®. KNIME© Analytics Platform was used in processing the data for removing unnecessary or empty entries and matching data entries across the years to given animal tag numbers.

Statistical analysis was carried out and graphs produced using Graphpad Prism©. A P value of less than 0.05 was deemed statistically significant.

6. Results

6.1. Variations in calving interval

6.1.1 Mean calving interval for each year

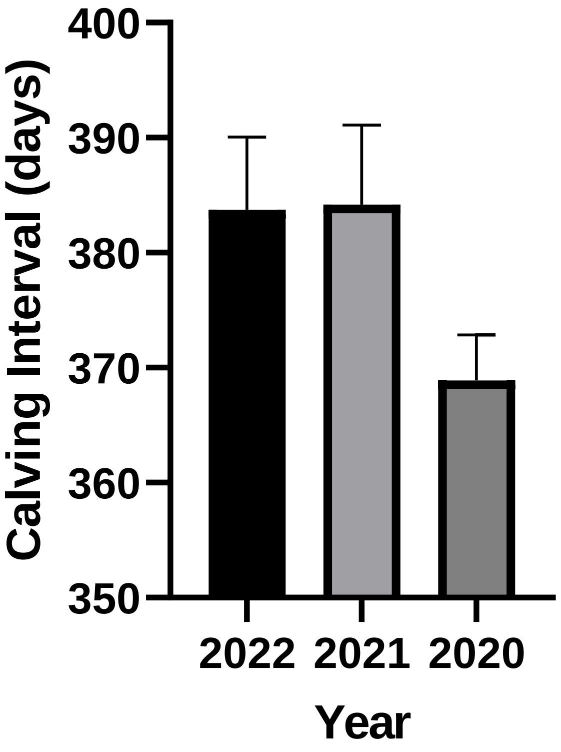

Figure 1. Calving Interval for all animals for the 3 years of the study. The calving interval was determined as the number of days between the date of calving of the given year and the date of calving of the previous year. Data expressed as mean ± SEM. N values for the different groups are: 2022=144, 2021=158, 2020=91.

6.1.2 Variations in calving interval by calving difficulty of previous year

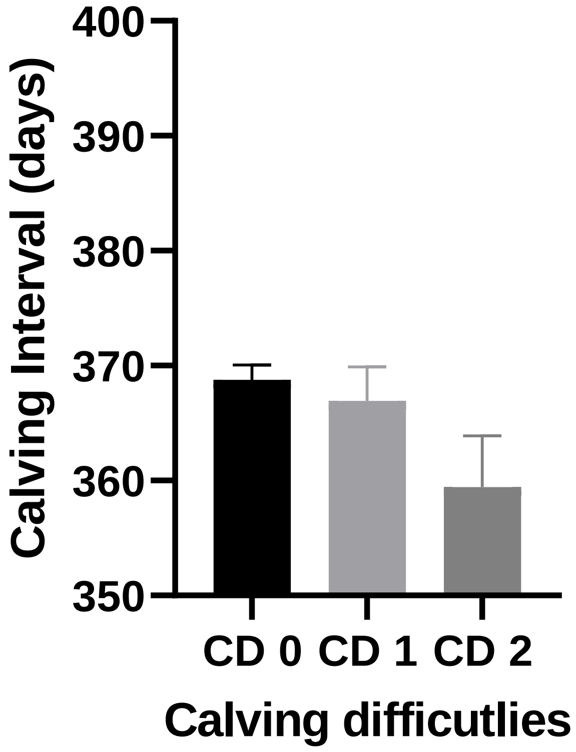

Figure 2. Change in calving interval according to calving difficulty score of previous calving. The calving interval was determined as the number of days between the date of calving of the given year and the date of calving of the previous year. The calving difficulty score was assigned according to the level of assistance required, CD 0 = calved spontaneously, CD 1 = assisted, CD 2 = calving jack or 2-man assistance required. Data expressed as mean ± SEM. N values for the different groups are: CD 0 = 305, CD 1 = 68, CD 2 = 18. No significant differences were found between the groups using a one-way ANOVA.

6.1.3 Variation in calving interval by gender of calf born

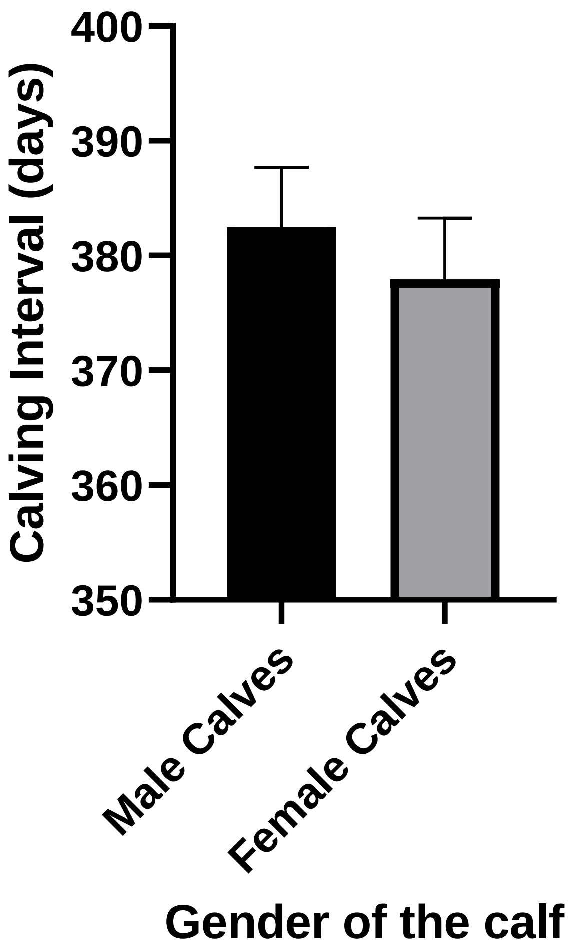

Figure 3. Comparison of the calving interval dependent on the gender of the calf born at the end of the given calving interval. Data expressed as mean ± SEM. N values for the different groups are: Male calves = 215, Female calves = 180. No significant differences were found between the groups using an unpaired t test.

6.1.4 Variation in calving interval by cow parity

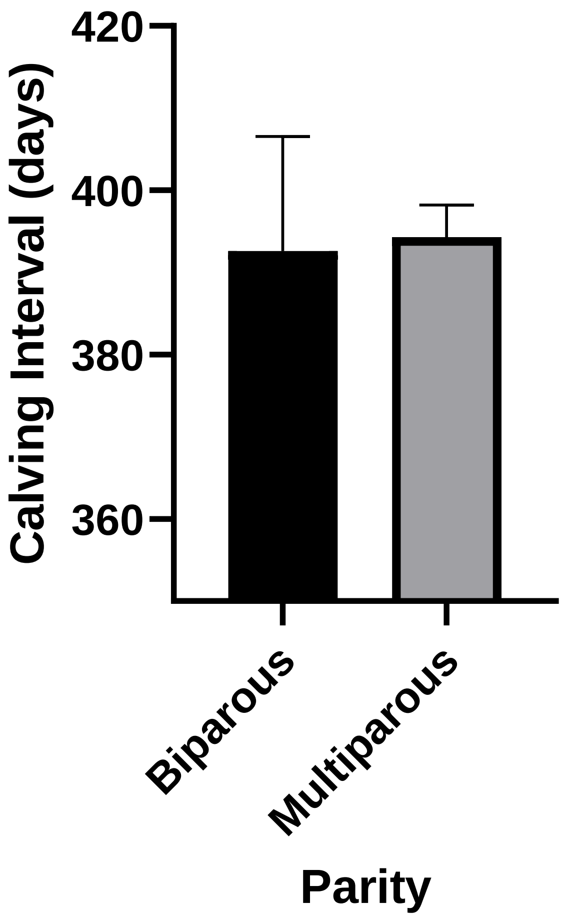

Figure 4. Comparison of calving interval based on parity of cows. Biparous cows are those having calved for their second time; multiparous cows having calved multiple times. Data expressed as mean $\pm$ SEM. N values for the different groups are: Biparous = 41, Multiparous = 406. No significant differences were found between the groups using an unpaired t test.

6.1.5 Variation in calving interval by sire breed used in previous mating

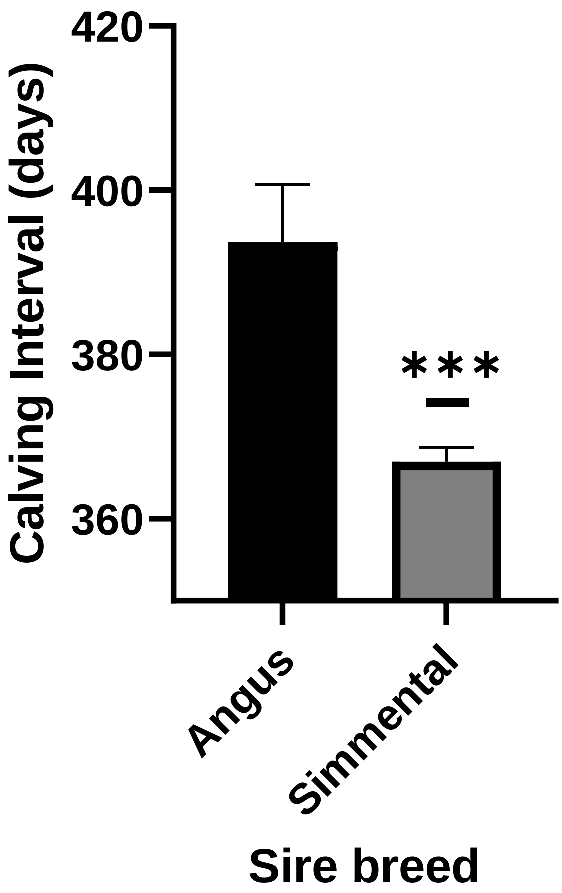

Figure 5. Comparison of calving interval based on the breed of the sire used in the latest mating. Cows in the Angus group were bred with an Angus bull. Cows in the Simmental group were bred with a Simmental breed bull, predominantly Fleckvieh. Data expressed as mean ± SEM. N values for the different groups are Angus = 199, Simmental = 194. Using a two-tailed unpaired t test, a significant difference was found. This signifies that cows bred with a Simmental bull tend to have a shorter calving interval, difference in the mean CI being -26.69 ± 7.378(SE) days. *** denotes a P value < 0.001.

6.1.6 Variation in calving interval by dystocia status

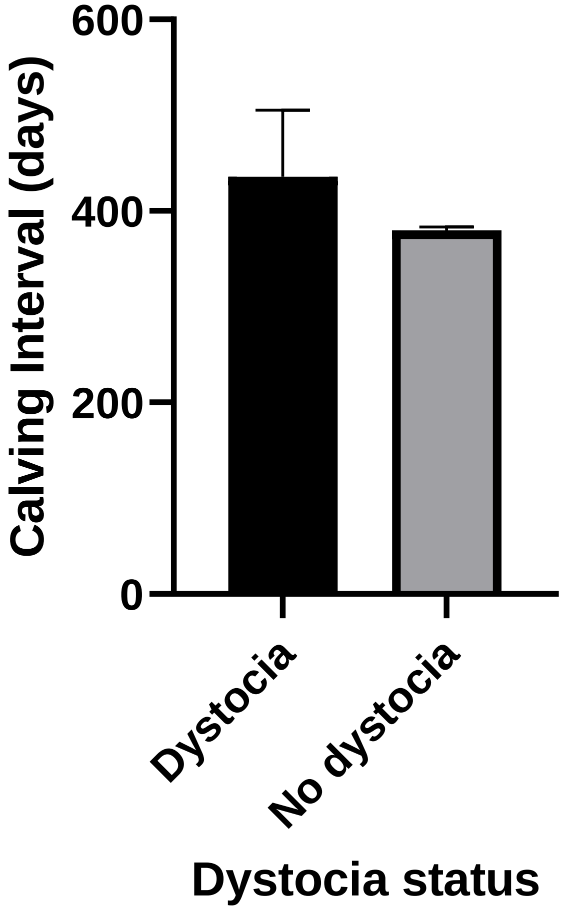

Figure 6. Comparison of calving interval based on dystocia occurrence at the end of given calving interval. Data expressed as mean ± SEM. N values for the different groups are: Dystocia = 5, No dystocia = 388. No significant difference was found between the groups using an unpaired t test.

6.2. Variations in calving difficulty

6.2.1 Mean calving difficulty of each year

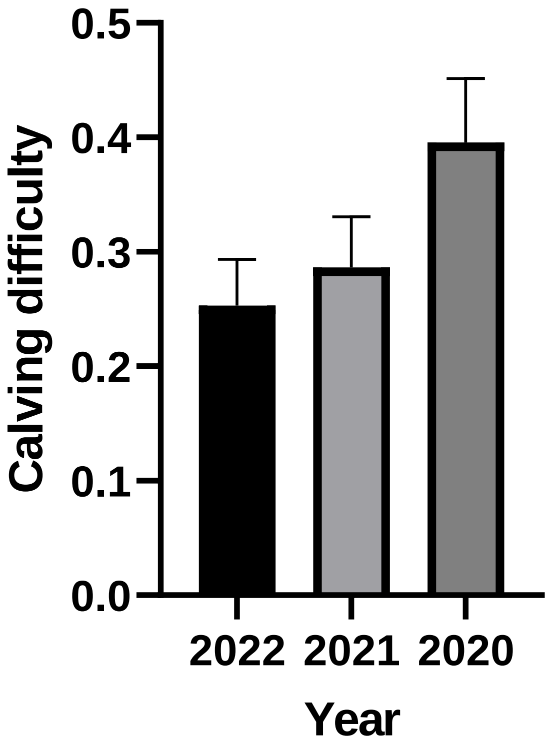

Figure 7. Comparison of the average calving difficulty score for each year of the study. Calving difficulty was scored use the following system: 0 = calved spontaneously, 1 = required some assistance from a single person, 2 = required use of calving jack or 2 people, 3 = required veterinary assistance. Data expressed as mean $\pm$ SEM. N values for the different groups are: 2022 = 162, 2021 = 164, 2020 = 134.

6.2.2 Variation in calving difficulty by gender of calf born

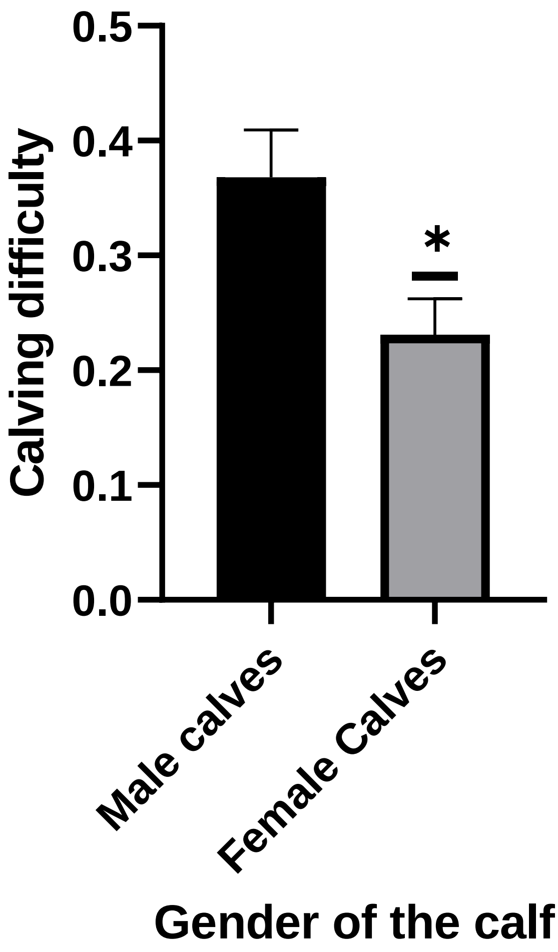

Figure 8. Comparison of the calving difficulty dependent on the gender of the calf. Data expressed as mean ± SEM. N values for the different groups are: Male calves = 250, Female calves = 212. Using a two-tailed unpaired t test, a significant difference was found. This signifies female calves tend to have lower calving difficulty scores. The difference between means is -0.1369 ± 0.05328. * denotes a P value < 0.05.

6.2.3 Variation in calving difficulty by cow parity

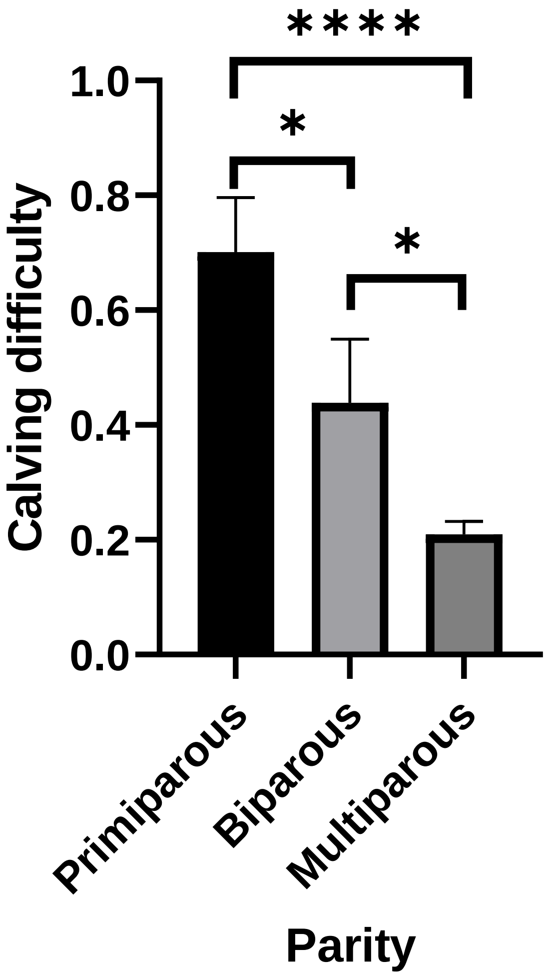

Figure 9. Comparison of calving difficulty based on parity of cows. Primiparous cows are those calving for their first time, biparous cows are those having calved for their second time; multiparous cows having calved multiple times. Data expressed as mean ± SEM. N values for the different groups are: Primiparous = 67, Biparous = 41, Multiparous = 406. Data was analysed by an ordinary one-way ANOVA with a post hoc Tukey's test. * denotes a P value < 0.05, **** denotes a P value < 0.0001. A test for linear trend was also carried out with a resulting P value of <0.0001, a slope of -0.2443± -0.034(SE) was determined. This signifies that higher parity tends to result in a lower calving difficulty score.

6.2.4 Variation in calving difficulty by sire breed

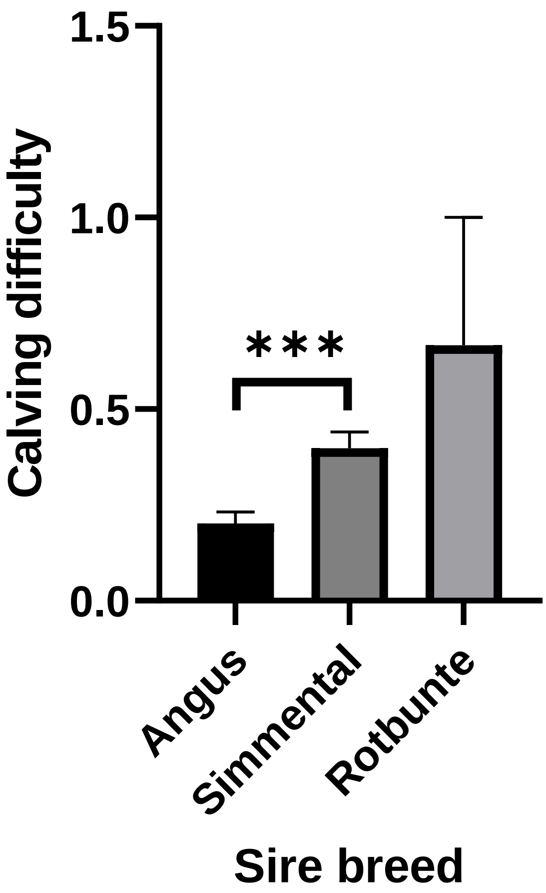

Figure 10. Comparison of calving difficulty based on the breed of the sire used in the latest mating. Cows in the Angus group were bred with an Angus bull. Cows in the Simmental group were bred with a Simmental breed bull, predominantly Fleckvieh. Cows in the Rotbunte group were bred with a Rotbunte bull. Data expressed as mean ± SEM. N values for the different groups are Angus = 223, Simmental = 231, Rotbunte = 6. Data was analysed by an ordinary one-way ANOVA with a post hoc Tukey's test. This signifies calves sired by Angus bulls tend to result in lower calving difficulty scores. Angus had a mean difference in CD of -0.1965± 0.05317(SE) compared to Simmental. *** denotes a P value < 0.001.

6.2.5 Variation in calving difficulty score with dystocia

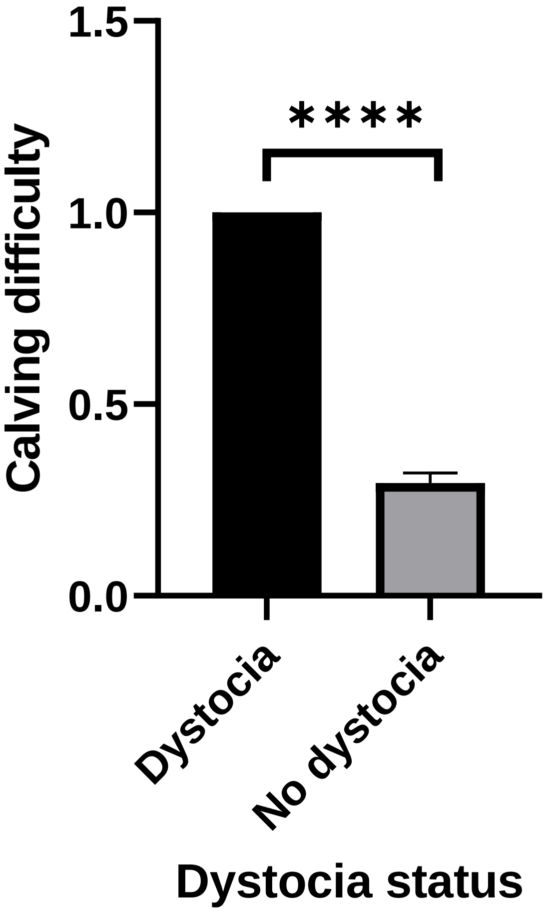

Figure 11. Comparison of calving difficulty based on dystocia. The calving difficulty score was assigned according to the level of assistance required, CD 0 = calved spontaneously, CD 1 = assisted, CD 2 = calving jack or 2-man assistance required. Data expressed as mean ± SEM. N values for the different groups are: Dystocia = 8, No dystocia = 452. A significant difference was found using a Mann-Whitney test, signifying a high calving difficulty score is associated with dystocia. The mean difference is -0.7058 ± 0.2027. **** denotes a P value < 0.0001

6.3. Variations in services required

6.3.1 Variation of observed services by parity

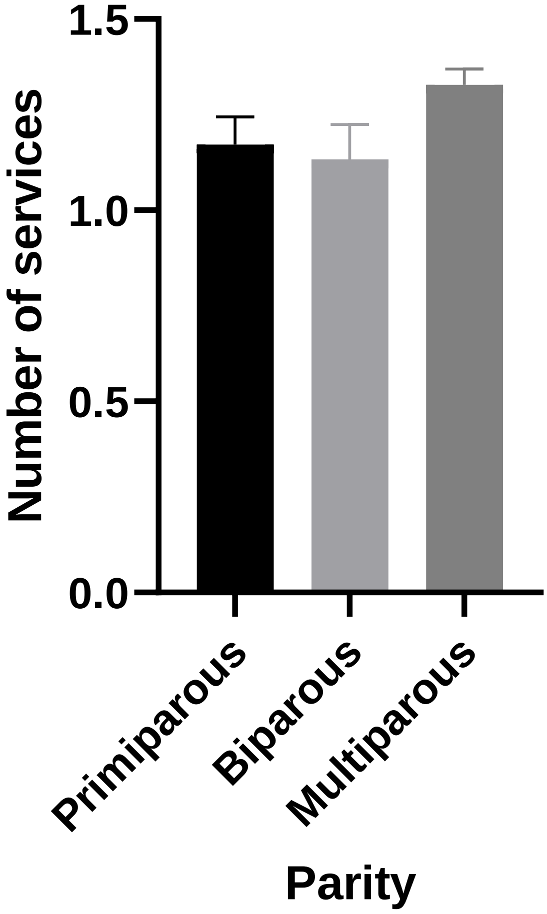

Figure 12. Comparison of number of recorded services based on parity of cows. Primiparous cows are those calving for their first time, biparous cows are those having calved for their second time; multiparous cows having calved multiple times. Data expressed as mean ± SEM. N values for the different groups are: Primiparous = 29, Biparous = 15, Multiparous = 198. No significant differences were found using an ordinary one-way ANOVA.

6.3.2 Variation of observed services by calving difficulty of the previous calving

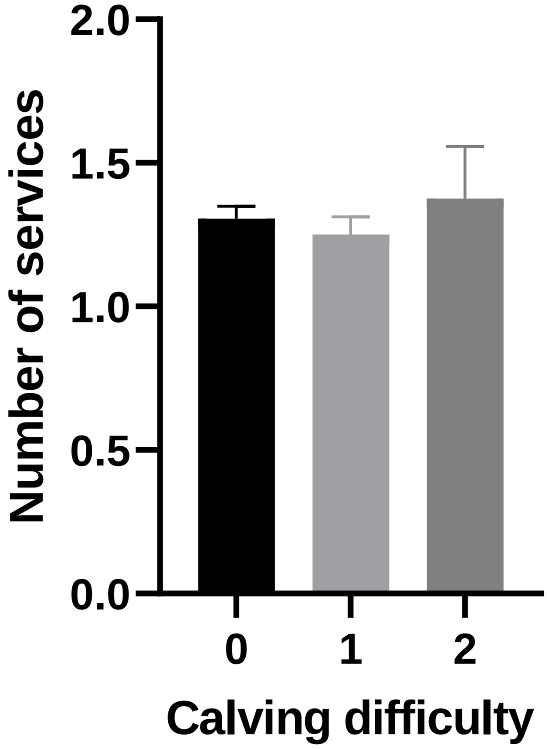

Figure 13. Comparison of number of recorded services based on calving difficulty of previous calving. The calving difficulty score was assigned according to the level of assistance required, CD 0 = calved spontaneously, CD 1 = assisted, CD 2 = calving jack or 2-man assistance required. Data expressed as mean $\pm$ SEM. N values for the different groups are: CD 0 = 186, CD 1 = 48, CD 2 = 8. No significant differences were found between the groups using a one-way ANOVA.

6.3.3 Variation of observed services by gender of calf at previous calving

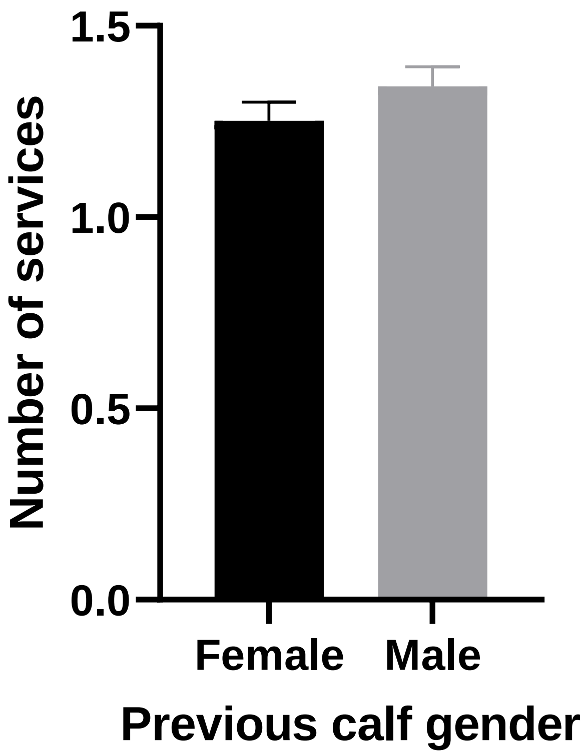

Figure 14. Comparison of number of recorded services based on previous calf gender. Data expressed as mean ± SEM. N values for the groups are: Female = 119, Male 123. No significant differences were found using a Mann-Whitney test

6.4. Variations in days from calving to last recorded service

6.4.1 Variations in days from calving to last recorded service by parity

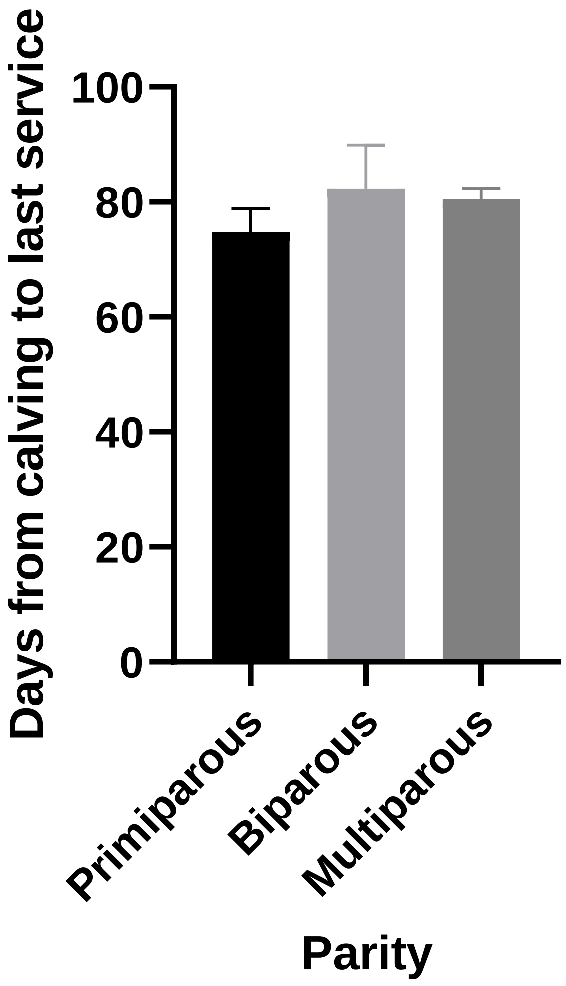

Figure 15. Comparison between the days from calving to last recorded service and cow parity. Primiparous cows are those calving for their first time, biparous cows are those having calved for their second time; multiparous cows having calved multiple times. Data expressed as mean ± SEM. N values for the different groups are: Primiparous = 29, Biparous = 15, Multiparous = 198. No significant differences were found using an ordinary one-way ANOVA

6.4.2 Variations in days from calving to last recorded service by previous calving difficulty

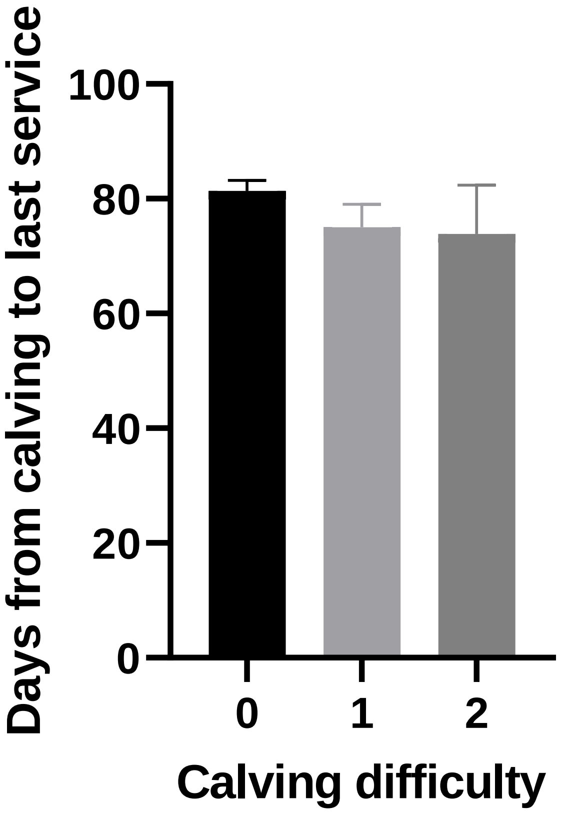

Figure 16. Comparison between the days from calving to last recorded service and calving difficulty. The calving difficulty score was assigned according to the level of assistance required, CD 0 = calved spontaneously, CD 1 = assisted, CD 2 = calving jack or 2-man assistance required. Data expressed as mean + SEM. N values for the different groups are: CD 0 = 186, CD 1 = 48, CD 2 = 8. No significant differences were found between the groups using a one-way ANOVA.

6.4.3 Variations in days from calving to last recorded service by gender of calf at previous calving

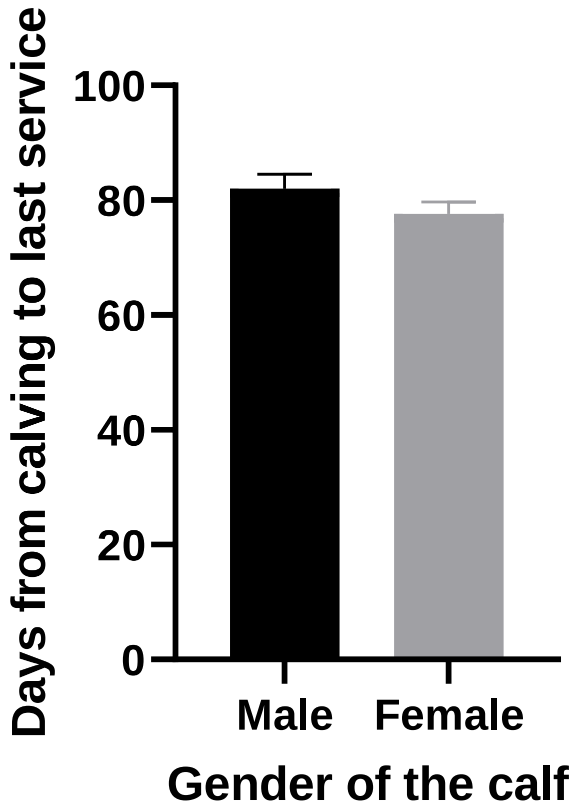

Figure 17. Comparison between the days from calving to last recorded service and calf gender. Data expressed as mean ± SEM. N values for the groups are: Female = 119, Male 123. No significant differences were found using an unpaired t test

6.5. Perinatal mortality

6.5.1 Variation in perinatal mortality by cow parity

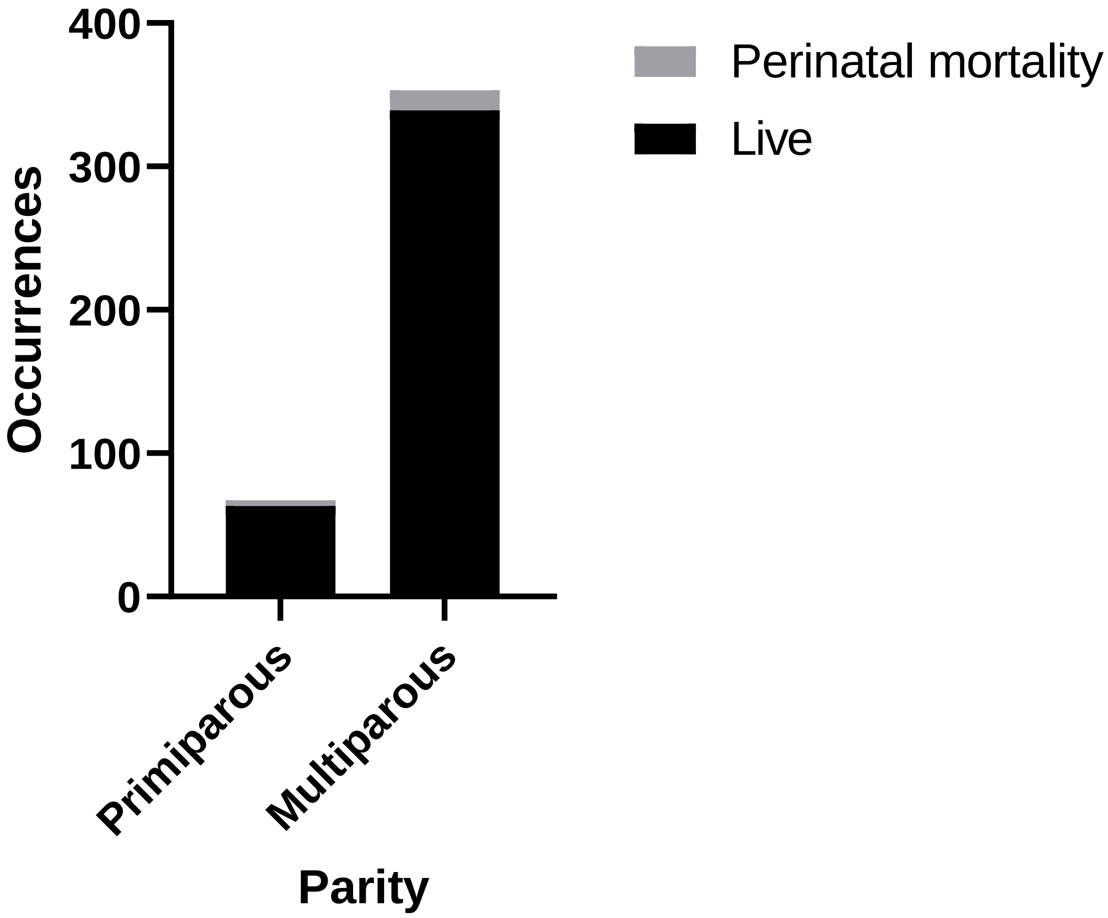

Figure 18. Analysis of the number of dead or live calves compared to parity. Perinatal mortality calves were those dead at birth or within 3 days of birth. Primiparous cows are those calving for their first time, biparous cows are those having calved for their second time; multiparous cows having calved multiple times. Data expressed as number of occurrences of each. Number in each group: Primiparous live = 63, Primiparous perinatal mortality = 4, Multiparous live = 339, Multiparous perinatal mortality = 14. No significant difference was found using Chi-square and Fisher’s exact test for odds ratio.

6.5.2 Variation in perinatal mortality by calving difficulty

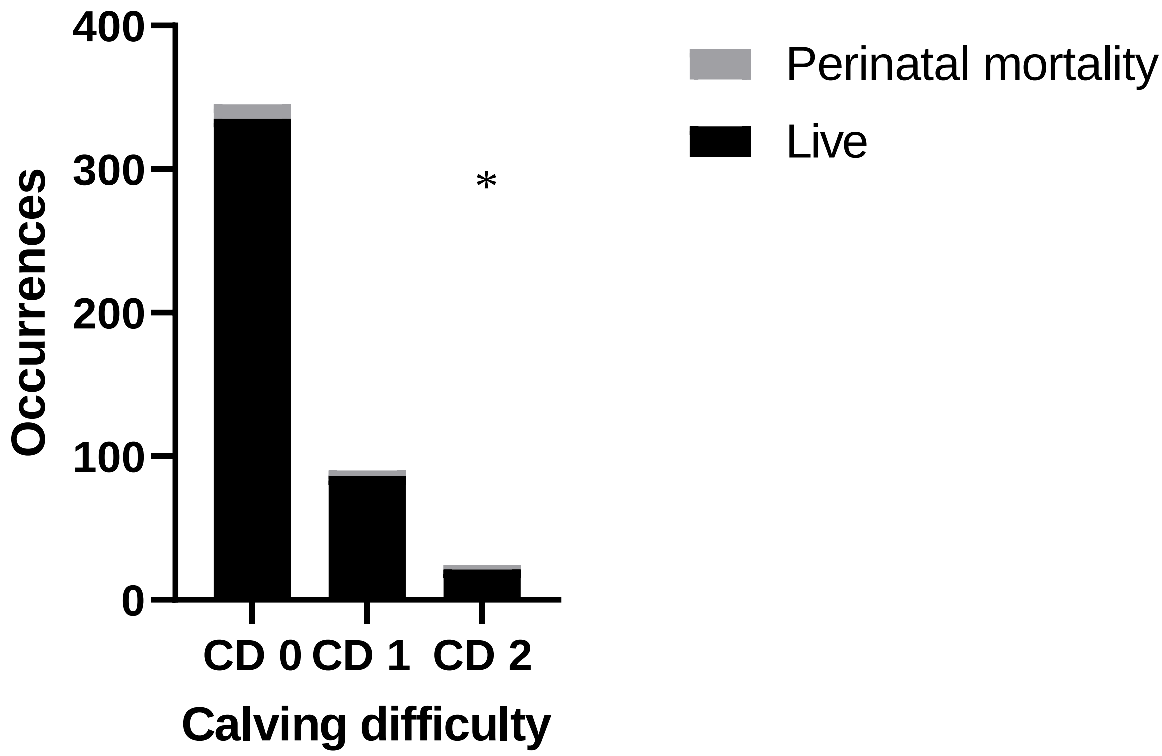

Figure 19. Analysis of the number of dead or live calves compared to calving difficulty. Perinatal mortality calves were those dead at birth or within 3 days of birth. The calving difficulty score was assigned according to the level of assistance required, CD 0 = calved on own, CD 1 = assisted, CD 2 = calving jack or 2-man assistance required. Data expressed as number of occurrences of each. Number in each group: CD 0: Live = 335, Perinatal mortality = 10, CD 1: Live = 86, Perinatal mortality = 4, CD 2: Live = 21, Perinatal mortality = 3. Using a Chi-square test for trend, a significant trend was found for an increased proportion of perinatal mortality with higher score of calving difficulty. The mean fraction of perinatal mortality for each: CD 0 = 2.9%, CD 1 = 4.4%, CD 2 = 12.5%. * denotes a P value <0.05.

6.5.3 Variation in perinatal mortality by calf sire breed

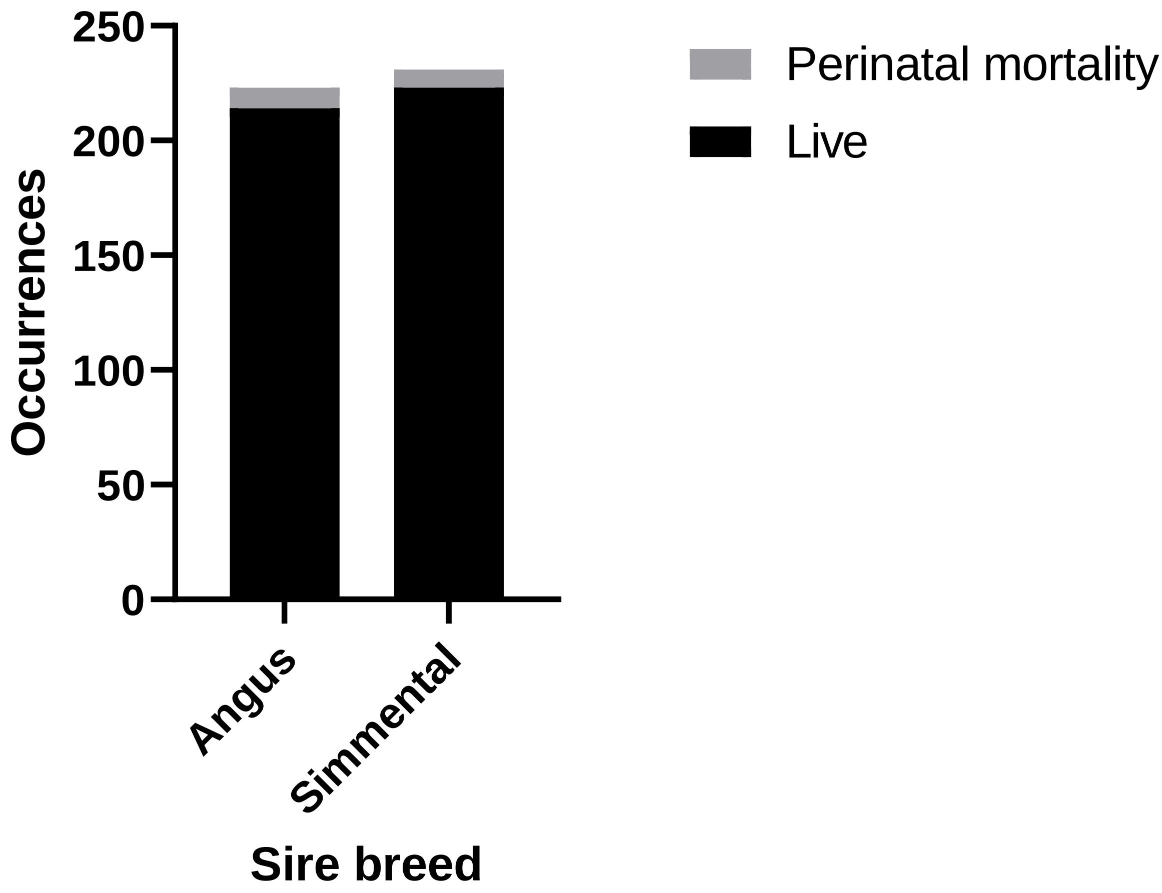

Figure 20. Analysis of the number of dead or live calves compared to calf sire breed. Perinatal mortality calves were those dead at birth or within 3 days of birth. Data expressed as number of occurrences of each. Number in each group: Angus live = 214, Angus perinatal mortality = 9, Simmental live = 223, Simmental perinatal mortality = 8. No significant difference was found using Chi-square and Fisher's exact test for odds ratio.

6.5.4 Variation in perinatal mortality by gender of the calf

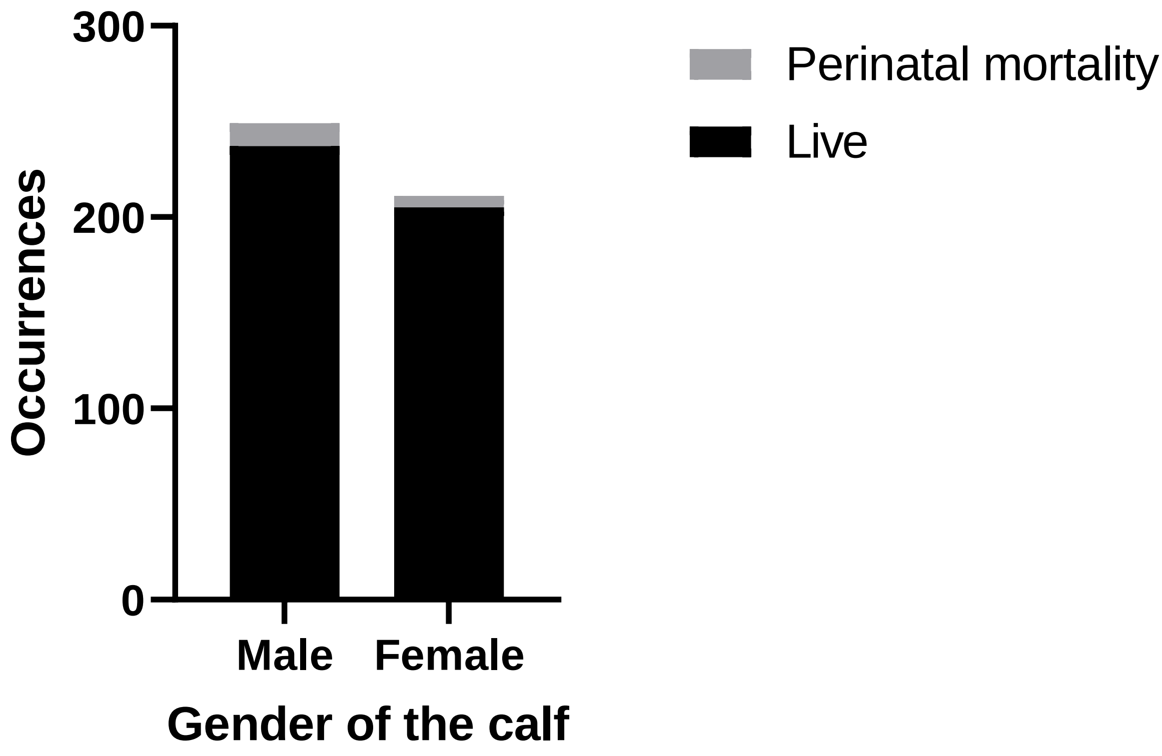

Figure 21. Analysis of the number of dead or live calves compared to calf gender. Perinatal mortality calves were those dead at birth or within 3 days of birth. Data expressed as number of occurrences of each. Number in each group: Male live = 237, Male perinatal mortality = 12, Female live = 205, Female perinatal mortality = 6. No significant difference was found using Chi-square and Fisher's exact test for odds ratio.

6.6. Variation in cull cows

6.6.1 Variation in proportion of cull cows by previous calving difficulty

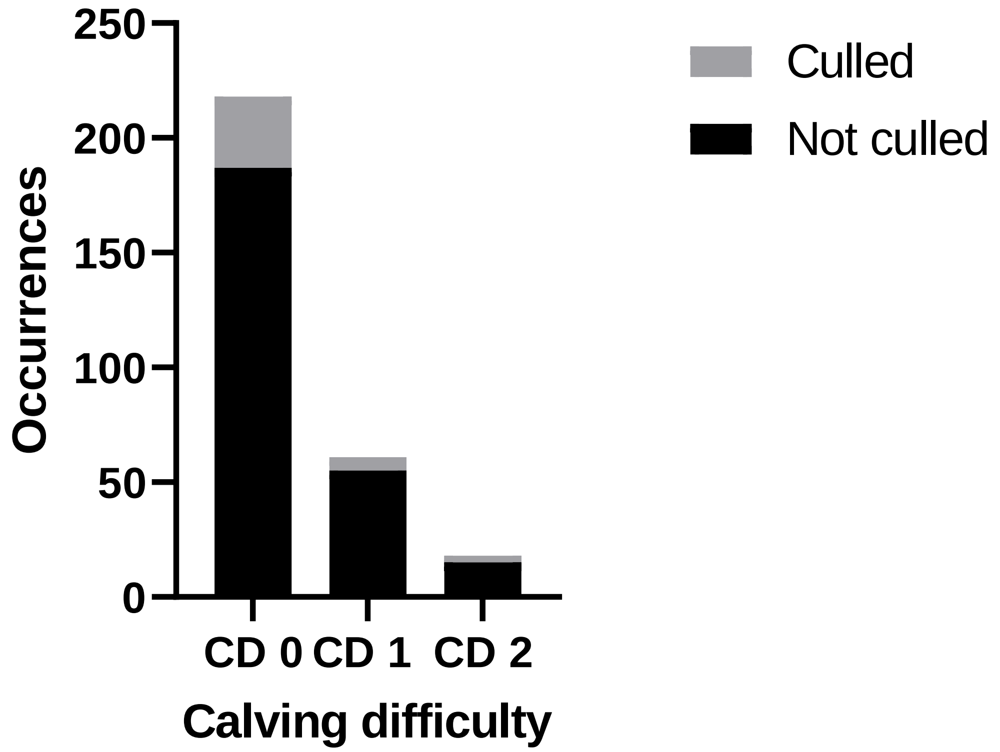

Figure 22. Analysis of the number of cows culled compared to previous calving difficulty. The calving difficulty score was assigned according to the level of assistance required, CD 0 = calved spontaneously, CD 1 = assisted, CD 2 = calving jack or 2-man assistance required. Data expressed as number of occurrences of each. Number in each group: CD 0: not culled = 187, culled = 31, CD 1: not culled = 55, culled = 6, CD 2: not culled = 15, culled = 3. No significant difference was found using a Chi-square test for trend.

6.6.2 Variation in proportion of cull cows by sire breed of previous calf

Figure 23. Analysis of the number of cows culled compared to previous calf sire breed. Data expressed as number of occurrences of each. Number in each group: Angus not culled = 145, Angus culled = 28, Simmental not culled = 108, Simmental culled = 11. No significant difference was found using Chi-square and Fisher's exact test for odds ratio.

6.6.3 Variation in proportion of cull cows by previous calf gender

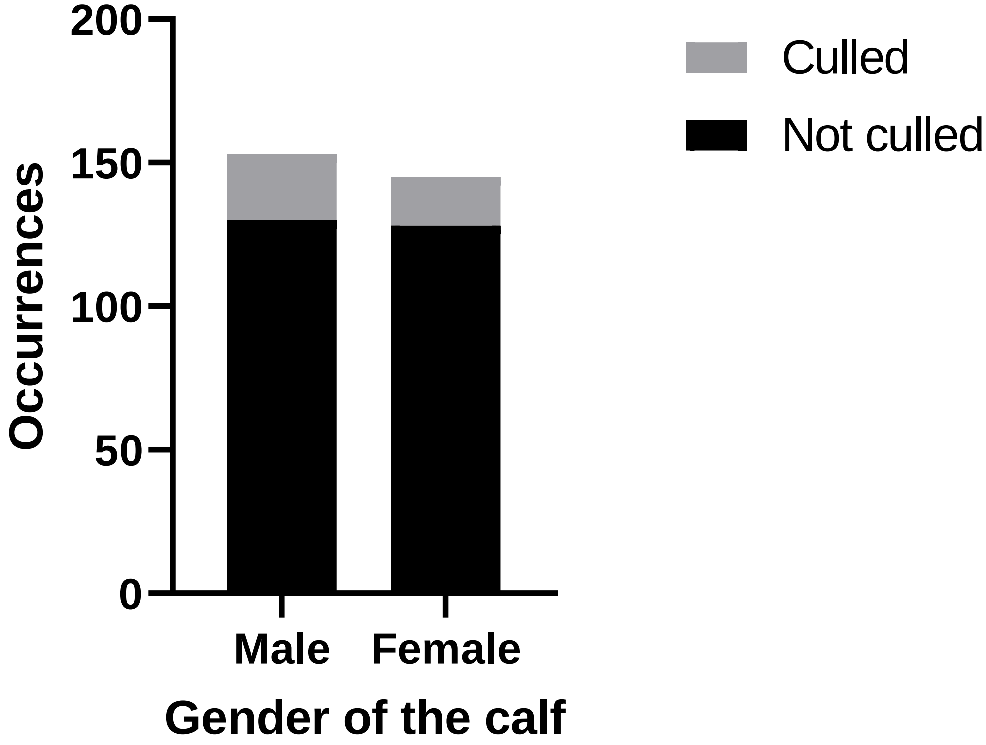

Figure 24. Analysis of the number of cows culled compared to previous calf gender. Data expressed as number of occurrences of each. Number in each group: Male not culled = 130, Male culled = 23, Female not culled = 128, Female culled = 17. No significant difference was found using Chi-square and Fisher's exact test for odds ratio.

6.6.4 Variation in proportion of cull cows by parity

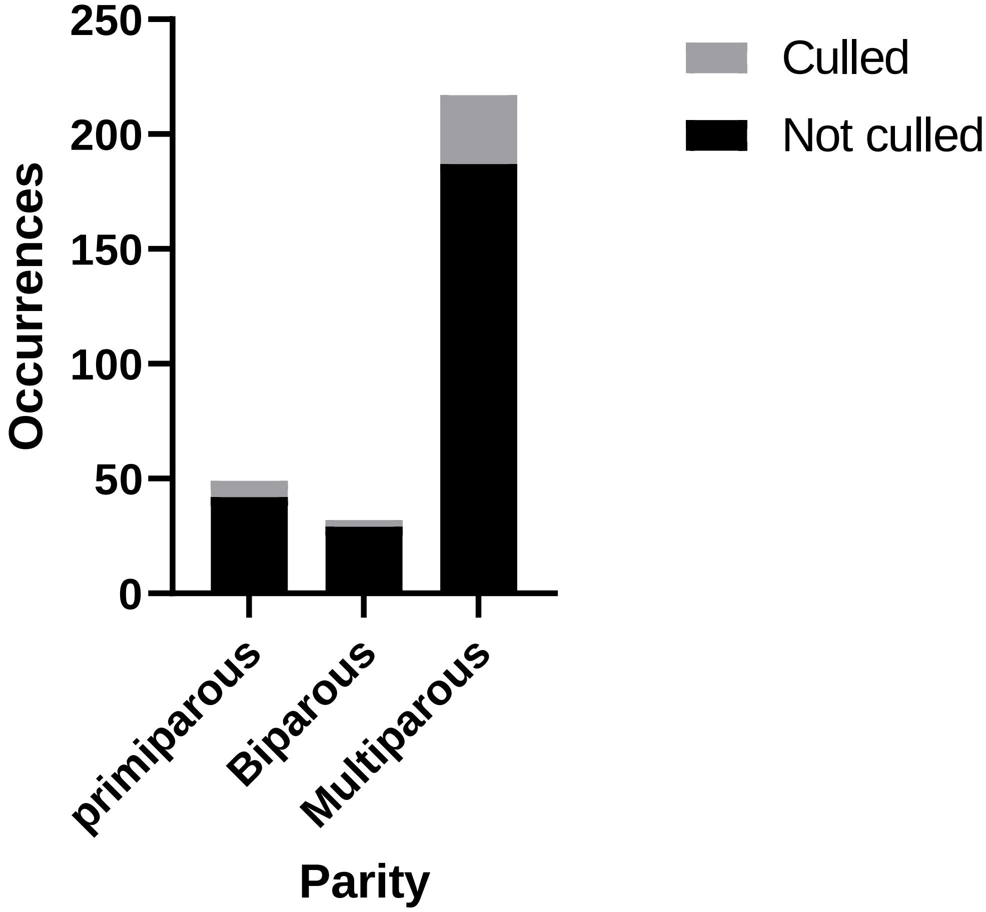

Figure 25. Analysis of the number of cows culled compared to cow parity. Primiparous cows are those calving for their first time, biparous cows are those having calved for their second time; multiparous cows having calved multiple times. Data expressed as number of occurrences of each. Number in each group: Primiparous not culled = 42, Primiparous culled = 7, Biparous not culled = 29, Biparous culled = 3, Multiparous not culled = 187, Multiparous culled = 30. No significant difference was found using a Chi-square test for trend.

6.7. Variations with dystocia

6.7.1 Variation in proportion of dystocia by cow parity

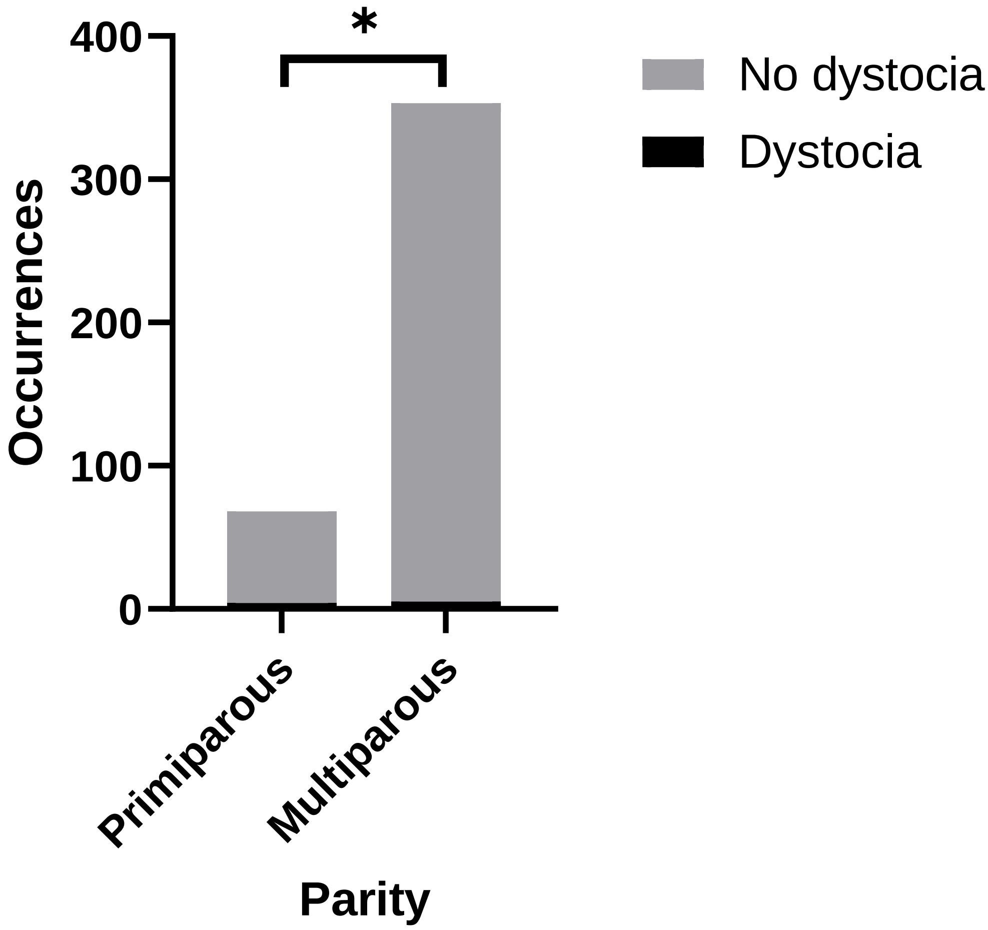

Figure 26. Analysis of the number of cows with dystocia compared to parity. Data expressed as number of occurrences of each. Number in each group: Primiparous dystocia = 4, Primiparous no dystocia = 64, Multiparous dystocia = 5, Multiparous no dystocia = 348. A significant difference was found using Chi-square and Fisher's exact test for odds ratio, signifying dystocia to be more common in primiparous cows. The mean fraction of dystocia in primiparous is 5.9% and in multiparous is 1.4%. * denotes a P value <0.05.

6.7.2 Variation in proportion of dystocia by calf sire breed

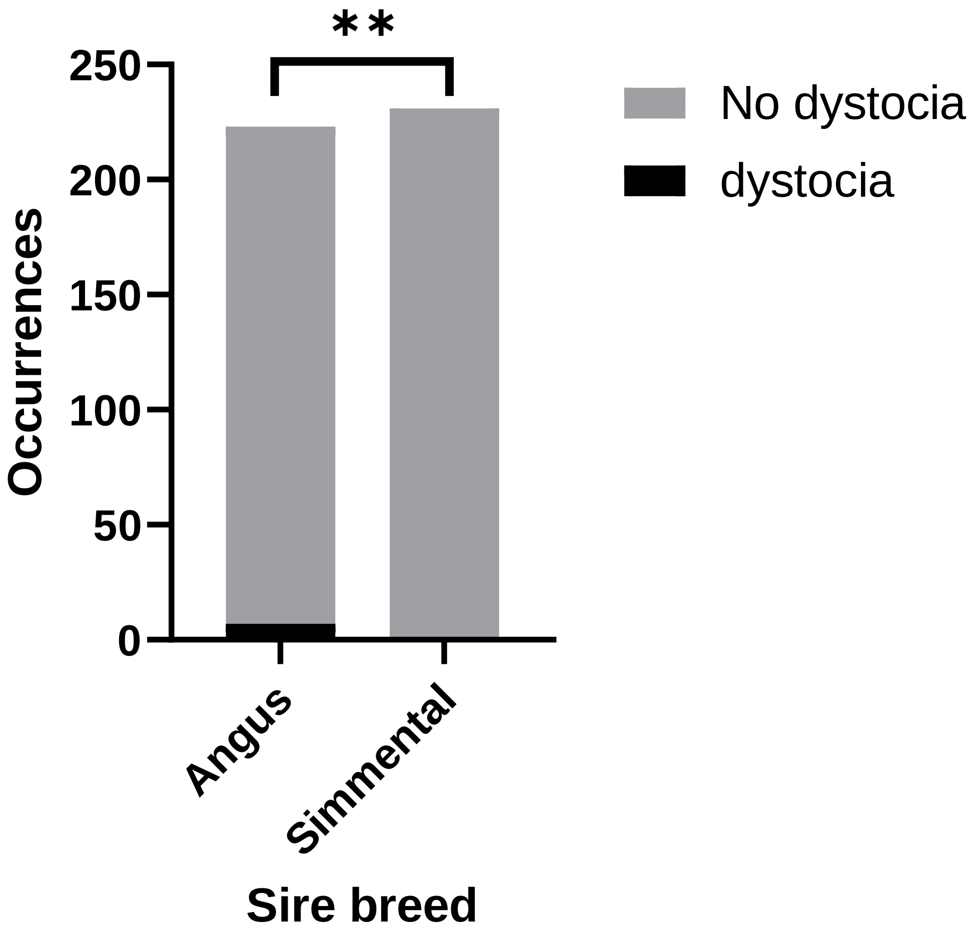

Figure 27. Analysis of the number of cows with dystocia compared to calf sire breed. Data expressed as number of occurrences of each. Number in each group: Angus dystocia = 7, Angus no dystocia = 216, Simmental dystocia = 0, Simmental no dystocia = 231. A significant difference was found using Chi-square and Fisher's exact test for odds ratio, signifying dystocia is more common in cows bred with Angus bulls. The mean fraction of dystocia for angus sires is 3.2% and for Simmental is 0%, as no dystocia births were sired by Simmentals. ** denotes a P value <0.01

7. Discussion

As mentioned in the materials and methods section, the prevalence of clinical metritis and RFM on the farm was very low. From the literature review, it is evident that these are two of the most significant issues, in relation to calving, having an impact on the reproductive performance of cows and generally have high occurrences [4, 5, 10, 11]. Although the low occurrence of clinical cases prevents the study of them in this thesis, it does allow other factors to be more evenly compared, in particular calf gender, parity and sire breed.

For variation in calving interval, the only significant variation occurred when the breed of bull used for mating was examined. Simmental bulls resulted in a considerably shorter CI, with a mean difference of almost 27 days shorter than Angus bulls. With a mean CI of 367 days, this places them near the ideal CI of 365 days. This is especially desirable considering this is using natural service, have a reduced labour need compared to artificial insemination.

Calving difficulty (CD) was found to vary based on multiple factors. Higher CD ~~with dystocia~~ is to be expected, and the lower CD with female calves and higher parity agrees with findings from other studies [14, 15]. The finding of lower CD with Angus calf sires' contrasts with the finding of lower CI with Simmentals, resulting in a trade-off between the two breeds in terms of the reproductive features of each and their impact on the farm.

No variation in the recorded service data was found in relation to the other parameters, although this may be partly attributable to the fact only visually observed services were recorded.

Perinatal mortality was found to have a higher prevalence in calving's with a higher calving difficulty score, but no link was found with sire or calf gender, despite these both impacting calving difficulty. This may partially be due to low statistical power due to the low number of perinatal mortalities and warrant further study with a larger sample size.

No significant variation in proportion of cull cows was found with any of the examined parameters. Over half (22 of 40) of the cows were culled due to recorded infertility. This could warrant a need for veterinary investigation into the cause of this infertility, in particular uterine diseases as they are known to have an impact on reproductive performance and a high incidence in herds [1, 4, 5, 10, 11].

Dystocia was found to be higher in primiparous cows, agreeing with previous findings [15] and also with the findings in this study of higher CD score with primiparous cows and dystocia cases. In contrast to the findings of CD score, dystocia was found to have higher prevalence with calves sired by Angus compared to Simmental.

8. Summary

Overall, the findings of this study suggest that although the more common practice of artificial insemination may not help with the already good calving interval, improvement in calving difficulty scoring, and hence possibly perinatal mortality, may be gained from the use of sexed semen to favour female calves.

The possible benefits of such a change however would have to be weighed against other factors, such as the increased labour need for the artificial insemination (AI) and associated costs, and the reduction in male calves suitable for the beef production element of the farm.

The keeping of older, multiparous animals is favourable when considering the reduced calving difficulty score but if a change to AI was made, it may become less favourable. This would also have to be factored in terms of cost of rearing animals and a possible reduction in the time animals would be kept for, although milk yield in later lactations, which is not examined in this study, would also play and important role.

Also, the low recorded number of uterine diseases but high proportion of cows being culled due to infertility warrant veterinary investigation to detect possible subclinical cases or clinical cases missed by the farmer.

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