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Incidence risk of major reproductive disorders of dairy cows and cow-level risk factors in Wolaita Sodo town, southern Ethiopia

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Abstract

Reproductive health problems directly affect the reproductive performance of dairy cows and thus reduce the productivity of a dairy herd. A prospective longitudinal study was conducted in Wolaita Sodo town between to estimate the incidence risk of major reproductive disorders in dairy cows and identify potential risk factors. A total of 140 pregnant cows were monitored regularly every two weeks until birth and during the postpartum period. Of these, 74 (52.86%) had at least one of the reproductive problems identified during the study period. The most commonly observed reproductive disorders were dystocia (13.5%), retained fetal membrane (RFM) (12.9%), abortion (10%), stillbirth (7.1%), metritis (5.6%), uterine prolapse (2.4%), endometritis (1.6%), vaginal prolapse (1.6%), and pyometria (1.4%) in order of decreasing incidence risk. The risk of abortion was significantly higher in Jersey Local Crossbreed (RR = 3.5), in cows kept in the semi-intensive system, in large herds (RR = 4.4) and in cows with a poor body condition score (BCS) (RR = 7.3). The risk of dystocia was significantly higher in cows with poor BCS (RR = 9.1) and in cows that gave birth to a male calf (RR = 2.6). The risk of metritis was significantly higher in cows with poor BCS (RR = 11.9) and multiparous cows (RR = 6.4). The risk of developing RFM was 9.9 times higher in cows with a poor BCS than in cows with a good BCS. In general, the most common reproductive disorders, namely dystocia, RFM and abortion, can significantly affect the subsequent uterine health and thus prolong uterine involution time in affected cows. Therefore, raising awareness among farm owners and attendants on improving dairy farming management practices such as proper feeding, considering the size of sire and dam in artificial insemination and cow health management are recommended as practical measures to minimize the occurrence of these problems and the associated economic losses on the dairy farms.

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Introduction

With approximately 62 million cattle, Ethiopia is the African country with the largest livestock population (CSA 2020). Despite having a large population, the productivity and economic importance of cattle are low because of a number of factors, such as diseases, poor nutrition, poor management, a lack of marketing opportunities, inadequate animal health services, poorly coordinated development programs between various levels of governmental institutions and/or non-governmental organizations, and subpar performance of native breeds. These limitations result in poor reproductive performance in dairy cows. The dairy sector is not as established as that of other East African countries such as Kenya, Uganda, and Tanzania due to the aforementioned limitations (FAO 2019).

Currently, the number of dairy farms maintaining exotic breeds and their crossbreeds is increasing in urban and suburban areas of Ethiopia as a result of a number of factors, including population growth, urbanization, and growing knowledge of the nutritional benefits of milk. However these dairy systems, were unable to meet the country's increasing demand for milk and dairy products. This is due to a number of factors, the most significant of which is the prevalence of different types of reproductive disorders on dairy farms (Ibrahim 2017).

One of the key elements to the success of a dairy operation is reproductive efficiency. Reproductive health problems cause reproductive inefficiency in cows, resulting in significant economic losses in the dairy industry due to delayed uterine involution, reduced reproductive rate, prolonged inter-conception period and calving interval, high medication costs, decline in milk production, reduced calf-harvest, early depreciation of potentially useful cows and increased risk of culling (LeBlanc et al 2002; Sheldon et al 2009).

Over the years several studies on reproductive disorders in dairy cows of different breeds and management system have been conducted in Ethiopia. Ibrahim (2017) conducted a review of the studies on the subject and found that abortion, retention of fetal membrane (RFM), dystocia, vaginal and uterine prolapse, anoestrus, repeat breeding and endometritis are the most common reproductive disorders in Ethiopia. According to the review, abortion incidence ranges from 2.23 to 14.6%, RFM from 3.8 to 28.9%, dystocia from 2.9 to 9.7%, endometritis from 4.81 to 28.5%, vaginal prolapse from 1.24 to 1.95%, anestrous from 10.2 to 24%, and repeat breeding from 9.6 to 14%. Therefore, a deep understanding of the causes and risk factors of reproductive disorders is paramount to design a viable control measures to improve the profitability of the thriving dairy industry in Ethiopia.

In addition to estimating the incidence risk, the previous studies in Ethiopia have attempted to identify the risk factors for reproductive health problems. However, when analysing risk factors, practically all studies treated the numerous reproductive problems as if they were a single disease entity. Nonetheless, each reproductive problem has its own cause and contributing risk factors, and therefore screening for risk factors should be done independently for each disease.

Therefore, the present study was conducted with the aim of estimating the incidence risk of reproductive disorders and identifying the potential risk factor for each type of problem separately in Wolaita Sodo town, which is one of the potential dairy production areas in southern Ethiopia.

Materials and Methods

Description of the study area

The study was conducted on purposively selected dairy farms in the Wolaita Sodo town, an administrative capital for the Wolaita zonal administration in South Ethiopia. The town has a latitude and longitude of 6°54′N and 37°45′E with an elevation between 1,600 and 2,100 metres above sea level. It is approximately 390 km southwest of Addis Ababa and 160 km from Hawassa. The topography of the area is made up of plains (40%), valleys (25%) and mountains (35%). The town experiences an average yearly temperature of roughly 24°C. The rainfall regime over much of the area is typically bimodal, with the long rainy season extending from June to September and a small rainy season lasting from February to April. The annual rainfall ranges from 450 to 1446 mm.

Study population

The animal husbandry system, particularly milk production, is the most important issue in the Wolaita-Sodo zone, where dairy cows and their products are the main sources of income and food. The Wolaita sodo zone is a large, historical place in the country and the majority of the people live concentrated. As in all urban areas of the country, the demand for dairy and milk products is growing. The number of dairy farms in the town is growing accordingly due to newly established cooperatives, young entrepreneurs and university graduates.

All cows on dairy farms in the town of Wolaita Sodo constituted the target population for this study. According to the Wolaita Sodo Livestock and Fisheries Development office (2019), there are 85 dairy farms in the town. The management system used on the dairy farms ranged from semi-intensive, where the cows were provided with shelter, concentrates, and water by the owner and were allowed to graze on open forage, to intensive, where the cows were provided with shelter, concentrates and water by the owner, but were not allowed to graze on open forage. Forage widely available in the study area includes natural rangeland (cut-and-carry), grass hay, straw, flour mill by-products(‘frushka’), crop residues, some green grasses such as Alfa Alfa, elephant grass, and non-conventional forages such as False Banana (locally called “enset”) and residue of traditional alcoholic beverages (“atela”.). On all farms, the cows were milked by hand twice a day in the morning and in the evening.

Study design and sample size

A prospective, longitudinal study design was used to estimate the incidence risk of major reproductive disorders and to identify the associated risk factors. This was done by following up the cows at regular intervals throughout the study

period. Farm selection was based solely on herd size and owners' willingness to participate in the study. Accordingly, of the 85 dairy farms in the town, 20 farms that had 10 or more cows were specifically selected for the present study. In addition, questionnaire survey was carried out to collect cow and farm-level data that may help to assess the risk factors of the incidence of reproductive disorders.

Data collection

Questionnaire survey

A structured questionnaire was prepared and administered to the owners or managers of the selected 20 farms by face-to-face interview during the first farm visit to collect relevant information at farm and cow level. The questionnaire was pretested prior to administration and checked for clarity of the questions. Prior to the interview, respondents were briefed on the purpose of the study in Amharic (the preferred language for ease of communication). Then, the actual questions were presented step by step. The questionnaire survey aimed to collect relevant information about the age, breed, parity number, previous delivery status (normal/dystocia or assisted), lactation status, pregnancy status, feeding system, management system, herd size, mating system used, housing system, and history of morbidity and mortality of the cows.

Monitoring of cows

All pregnant cows on the selected dairy farms scheduled to calve during the study period, were enrolled in the study and assessed for reproductive health disorders every two weeks until the end of the study. During follow-up, study animals in each farm were identified by their tag number/ID or color or their owner-provided names. At each visit to the farm, data on each event of clinical reproductive health problems such as repeat breeding, stillbirth, abortion, dystocia, vaginal/uterine prolapse, retained fetal membranes (RFM), metritis, clinical endometritis and other reproductive health problems were recorded in a data recording format separately prepared for each farm. Emergency visits were conducted in response to calls from dairy farms about cow health problems that arose between visits. Although pregnant cows and heifers were followed up every 2 weeks, the frequency of observation was reduced to every other day after calving to monitor for the occurrence of metritis and clinical endometitis. During follow-up, the post-partum cows' body condition scores were assessed by palpation and visualization of the transverse and spinous processes of the lumbar vertebrae (loin) and tail head (Benti and Zewdie 2014) and recorded as poor, medium, or good. The total number of cows monitored during the study period was 140.

Data management and analysis

The data collected via questionnaire survey, personal observation and clinical examination of cows were entered into Microsoft Excel spreadsheets, filtered and coded before statistical analysis. All statistical analysis of the data was performed using the STATA version 14 program (Stat Corporation Texas USA 2006). The strength of association between different risk factors (independent variables) and the incidence risk of major reproductive disorders (dependent variable) were determined by calculating the relative risk (RR) with the corresponding 95% confidence interval and p-values using

the “Tables for epidemiologists” command in STATA. Significance was determined at $p<0.05$. Incidence Risk (R) of disease is estimated as the number of new cases of a reproductive disorder during the follow up period over the population at risk (Dohoo et al 2009).

Result

Incidence risk of major reproductive disorders

During the observation period, 74 (52.86%) of the 140 cows monitored were affected by one or more reproductive health problems. Of the health problems (syndromes) encountered, the highest incidence risk was recorded for dystocia (13.5%), followed by RFM (12.9%), and abortion (10%). The incidence risk of the other reproductive disorders identified during the study period is presented in Table 1 below.

Table 1. Incidence risk of the reproductive disorders observed during the prospective study

Reproductive disorder	Cows at risk	No of new cases	Incidence risk (%)
Abortion	140	14	10
Dystocia	126	17	13.5
Endometritis	126	2	1.6
Metritis	126	7	5.6
Pyometra	140	2	1.4
RFM	140	18	12.9
Stillbirth	126	9	7.1
Uterine prolapse	126	3	2.4
Vaginal prolapse	126	2	1.6
Overall	**140**	**74**	**52.86**

Risk factors for reproductive disorders

In this study, various potential risk factors such as farm management system, herd size, breed, and body condition score, age, parity, average milk yield per day, breeding type used, and calf sex were assessed for their effect on the incidence risk of abortion, dystocia, metritis and RFM. The results of the statistical analysis are presented in Tables 2-5 below.

The incidence risk for dystocia was significantly ($p < 0.05$) associated with the BCS of the cows and calf sex. It was found that the risk of dystocia was 9.1 times higher in cows with poor BCS and 2.6 times higher in cows that calved male calves than their peers. Other variables such as breed, age, management system, herd size, milk yield, parity and breeding method were not associated with the risk of developing dystocia on the dairy farms studied ($p > 0.05$) (Table 2).

Table 2. Risk factors associated with the incidence risk of dystocia in dairy cows

Risk factors	Level	No examined	No cases	Incidence risk (%)	RR (95% CI)
Breed	HF local crosses	121	14	11.6	1
	Jersey local crosses	18	3	16.7	1.4 (0.5, 4.5)
Management system	Intensive	89	8	9.0	1
	Semi-intensive	50	9	18.0	2.0(0.8, 4.9)
Herd size	<30	89	8	9.0	1
	>30	51	9	17.7	2.0(0.8, 4.9)
BCS	Good/Medium	92	3	3.3	1
	Poor	47	14	29.8	9.1(2.86, 30.2)*
Calf sex	Male	67	12	17.9	2.6 (0.9, 6.9)*
	Female	72	5	6.9	
Age (in years)	<5	55	7	12.7	1
	>5	84	10	11.9	0.9 (0.4, 2.3)
Average milk yield /day	<10 L	77	7	9.1	1
	>10 L	39	6	15.4	1.7(0.6, 4.7)
Parity	≥1	115	13	11.3	
	Heifers	24	4	16.7	1.5 (0.5, 4.1)
Breeding method	AI	127	14	11.0	
	Natural	12	3	25.1	0.41(0.1, 1.3)

* *Significant difference ($p < 0.05$); BCS: Body condition score; AI: Artificial insemination*

Among the factors analyzed, the incidence risk of RFM was significantly ($p < 0.05$) associated with the cows' BCS. The risk of developing RFM was 9.9 times higher in cows with poor BCS than in cows with good or moderate BCS. Although the risk of developing RFM was higher in cows with dystocia compared to cows with normal parturition, the difference was not significant (Table 3).

Table 3. Risk factors associated with the incidence risk of RFM in dairy cows

Risk factors	Level	Number examined	No cases	Incidence risk (%)	RR (95% CI)
Breed	HF local crosses	122	16	13.1	1
	Jersey local crosses	18	2	11.1	0.8 (0.2, 3.4)
Herd size	<30	89	13	14.6	1
	> 30	51	5	9.8	0.7(0.3, 1.8)
Calf sex	Male	67	10	14.9	1.4 (06, 3.3)
	Female	73	8	11	1
BCS	Good/Medium	93	3	3.2	1
	Poor	47	15	31.9	9.9 (3.0, 2.5)*
Age	< 5	55	7	12.7	1
	> 5	85	11	12.9	1.0(0.4, 2.5)
Average milk yield /day	<10L	77	12	15.6	0.8(0.3, 2.1)
	> 10L	40	5	12.5	1
Parity	≥1	116	17	14.7	1
	Heifers	24	1	4.2	0.3 (0.04, 2.0)
Breeding method	AI	127	16	12.6	1
	Natural	13	2	15.4	0.8(0.2, 3.2)
Dystocia	No	122	14	11.5	1
	Yes	17	4	23.5	2.1 (0.8, 5.5)

* *Significant difference ($p < 0.05$) BCS: Body condition score; AI: Artificial insemination*

The incidence risk of abortion was significantly ($p < 0.05$) higher in Jersey local crossbreeds (27.8%) than in Holstein-Friesian local crossbreeds (7.4%). Jersey local crossbreeds were 3.5 times more likely to have an abortion than their peers. Based on the management system of dairy farms, the incidence risk of abortion was significantly ($p < 0.05$) higher in cows from semi-intensive dairy farms (19.6%) than in cows from intensive farms (4.5%). The abortion risk was 4.4 times higher in cows on semi-intensive farms than in cows on intensive farms. Similarly, herd size on dairy farms was significantly ($p < 0.05$) associated with the incidence risk of abortion in cows. The risk of abortion was 4.4 times higher on the large farms with more than 30 cattle than on the smaller farms with 30 or less herd size. In addition, the risk of abortion was significantly higher in cows with poor body condition score than in cows with moderate or good body condition status ($p < 0.05$). Cows in poor physical condition had a 7.3 times greater risk of abortion than cows in moderate or good physical condition. On the other hand, the incidence of abortion was not influenced by calf sex, cow age, parity, milk yield and breeding method used ($p > 0.05$) (Table 4).

Table 4. Risk factors associated with the incidence risk of abortion in dairy cows

Risk factors	Level	No cows examined	No cases	Incidence risk (%)	RR (95% CI)
Breed	HF local crosses	122	9	7.4	1
	Jersey local crosses	18	5	27.8	3.5(1.3, 9.4)*
Management system	Intensive	89	4	4.5	1
	Semi-intensive	51	10	19.6	4.4(1.4, 13.2)*
Herd size	<30	89	4	4.5	1
	> 30	51	10	19.6	4.4 (1.4, 13.2)*
BCS	Good/Medium	93	3	3.2	1
	Poor	47	11	23.4	7.3(2.1,24.8) *
Calf sex	Male	67	9	13.4	1.96 (0.7, 5.6)
	Female	73	5	6.8	1
Cow age (in years)	< 5	55	5	9.1	1
	> 5	85	9	10.6	1.2(0.4, 3.3)
Average milk yield /day	<10 L	77	4	5.2	1
	>10 L	40	5	12.5	2.4(0.7, 8.5)
Parity	≥1	116	9	7.8	1
	Heifers	24	5	20.8	2.7 (0.99, 7.3)
Breeding method	Natural	13	2	15.4	0.6(0.2, 2.5)
	AI	127	12	9.5	1

** Significant difference (p <0.05); BCS: Body condition score; AI: Artificial insemination*

The risk of incidence of metritis was significantly ($p < 0.05$) influenced by the body condition and parity of the cows, while other factors evaluated had no significant ($p > 0.05$) effect. It was found that cows in poor body condition had 11.9 times greater risk of developing metritis compared to cows in good or moderate condition. Likewise, the risk of metritis was 6.4 times higher in heifers than in single or multiple parity cows. The incidence of metritis was higher among cows with abortion and retained membranes, but the difference was not significant ($p > 0.05$) compared to cows without such disorders (Table 5).

Table 5. Risk factors associated with the incidence risk of metritis in dairy cows

Risk factors	Level	Number examined	No cases	Incidence risk (%)	RR (95% CI)
Breed	HF local crosses	122	6	4.9	1
	Jersey local crosses	18	1	5.6	1.1(0.1, 8.8)
Herd size	<30	89	5	5.6	0.7(0.1, 3.5)
	> 30	51	2	3.9	1
Calf sex	Male	67	4	6.0	1.5 (0.3, 6.3)
	Female	73	3	4.1	
BCS	Good/Medium	93	1	1.1	1
	Poor	47	6	12.8	11.9(1.5, 95.8)*
Cow age	< 5	55	3	5.5	0.9(0.2, 3.7)
	> 5	85	4	4.7	1
Parity	≥1	116	3	2.6	1
	Heifers	24	4	16.7	6.4 (1.5, 27.0)*
RFM	No	122	5	4.1	2.7 (0.6, 13.0)
	Yes	18	2	11.1	
Abortion	No	126	5	4.0	3.6 (0.8, 16.9)
	Yes	14	2	14.3	

** Significant difference (p <0.05); BCS; Body condition score; RFM; Retained fetal membrane*

Discussion

The current prospective longitudinal study showed that more than half (52.86%) of the observed cows and heifers had one or more of the reproductive disorders during follow-up. Compared to previous studies in Ethiopia, the present finding is lower than the 67.7% incidence reported by Benti and Zewdie (2014), 66.15% by Tolosa et al (2021) and 61% by Mitiku et al (2022). In contrast, our result is higher than that of Haile *et al.* (2014) who reported incidence of 43.07%. The difference between these results could be related to the difference in management system, study design, sample size, animal breed, and environmental conditions prevailing in the study areas.

In our study, dystocia was the most frequently identified reproductive disorder with an incidence risk of 13.5%. This figure exceeds the incidences (2.3 – 12.4%) recorded by most other studies from different regions of Ethiopia (Hadush et al 2013; Haile et al 2014; Mitiku et al 2022). Compared to overseas studies, the current finding is lower than the incidence risk reported from Iran (14.7%) (Bahrami-Yekdangi et al 2022) but greater than the incidence risk reported from the US (7-8.8%) (Berry et al 2007; Ribeiro et al 2013; Manríquez et al 2020). The incidence of dystocia varies between cow populations from different studies or countries, these variations are strongly influenced by calving management and the case definition of dystocia (Bahrami-Yekdangi et al 2022). According to studies (Berry et al 2007; Mee 2008), the primary risk factors for dystocia are parity, nutritional status, previous history of dystocia, calf sex and higher birth weight, and maternal pelvic size. The two risk factors in the current study were cow BCS and calf sex ($p<0.05$). Dystocia was found to

be 9.1 times more likely to occur in cows with poor BCS than in cows with good BCS. Poor body condition may cause the uterine muscles to get fatigued and make fetal delivery difficult, increasing the likelihood of dystocia in cows (Noakes et al 2001). In comparison to cows that gave birth to female calves, the risk of dystocia was 2.6 times higher in male calves. A similar discovery has also been previously reported in Iran (Atashi et al 2012; Bahrami-Yekdangi et al 2022). According to Bahrami-Yekdangi et al (2022), male calves are heavier and greater in size than female calves, which may contribute to the higher risk of dystocia in cows that gave birth to male calves. However, other factors may also be at play. Heifers are more likely than older cows to experience dystocia, according to numerous studies, and fetopelvic disproportion has been proposed as the main culprit in heifers (Berry et al 2007; Purohit et al 2012; Bahrami-Yekdangi et al 2022). Although the difference was not statistically significant, the current study also found that heifers had a higher incidence risk of dystocia than multiparous cows. The lack of difference may be due to the small number of heifers (n = 24) in the study compared to the larger number of cows (n = 115) with one or more parities. Due to increased rates of uterine infections, periparturient disorders like retained placenta, metritis, and longer calving intervals, dystocia can have a significant financial impact on farmers. It can also cause calf morbidity and mortality, higher veterinary costs, decreased production, reduced fertility, and, in extreme cases, injury or death to the dam (Purohit et al 2012). Thus, heifer rearing targets must be met both before service and calving, as well as appropriate peripartum management decisions, in order to reduce dystocia and the associated economic impact on dairy farms.

RFM, which had an overall incidence risk of 12.9%, was the second most frequent reproductive health problem encountered in the current study area. The current incidence risk falls within the reported incidence range (3.8 - 28.9%) from the earlier studies (Ibrahim 2017). Also, the current figure is within the incidence range (2 to 15%) reported from other countries (Hooshmandabbasi et al 2018 Manríquez et al 2020). Risk factors for RFM differ by region, country, and environment and management practices. Some of the most commonly mentioned risk factors for RFM in cattle (LeBlanc et al 2002; Roberts 2022) include dystocia, abortion, stillbirth, twinning, hormonal imbalances, immunosuppression, calving season, cow parity, nutritional deficiencies, management, and infectious diseases. BCS was the only factor significantly ($p < 0.05$) associated with the risk of RFM occurring in the current study out of a number of factors that were examined. It was discovered that cows with poor BCS had a 9.9 times higher chance of placental retention than cows with good BCS. Problems with reproductive health, such as RFM, are especially likely to affect cows in poor condition. This is because the body's ineffective defences increase the likelihood of infection and the fetal membranes' weak expulsive power causes secondary problems (Haile et al 2014). Although dystocia, pluriparity, and abortion were said to be important risk factors for RFM in crossbred cattle (Kumari et al 2015), these were not shown in the current investigation. We also underline the necessity for further research to confirm these effects using various breeds in the Ethiopian environment.

The current incidence risk of abortion (10%) falls within the incidence range (2.56 to 14.6%) found in earlier studies in the nation over the previous ten years (Benti and Zewdie 2014; Haile et al 2014; Tulu and Gebeyehu 2018; Mitiku et al 2022). According to research (Waldner and García 2013; Waldner 2014), heifers, cows older than 10 years, feeding on communal pastures, lack of vaccination against diseases that cause abortions, hygiene, animal management and reproductive problems in the previous pregnancies all increase the risk of abortion in dairy cows. In our study, the factors

that were substantially ($p < 0.05$) connected with the incidence risk of abortion were breed, herd size, management system, and BCS. Compared to Holstein-Friesian local crossbred cows, Jersey local crossbred cows had a 3.5 times higher risk of abortion. The variation in abortion risk between the two breeds in the current study may perhaps be caused by management variations, even though it is challenging to offer conclusive proof of breed differences in abortion. It was discovered that all of the Jersey local crossbred cows in the current study locations were raised in semi-intensive systems, which may have raised their risk of abortion. Consistent with our findings, Yakubu et al (2015) from Nigeria found that breed was a significant factor influencing the incidence of abortion in cows. The probability of abortion was 4.4 times higher large herds than small farms. This may be because an increase in herd size is usually associated with an increase in stocking density, one of the determinants of exposure to a source of infection for abortions (LeBlanc et al 2002). Consistent with our finding, Keshavarzi et al (2017) and Rafati et al (2010) both noted that herd size has a considerable impact on the incidence of cattle abortion in Iran. While Lee and Kim (2007) from Korea and Haile et al (2014) from Ethiopia suggested that the risk of abortion was independent of herd size. Our research also revealed that the probability of abortion was 4.4 times greater in cows on semi-intensive farms than in cows on intensive farms, similar to herd size. In semi-intensive farms, poor feeding, housing, and health management techniques may be the primary contributors to abortion (Khan et al 2016). Additionally, it was discovered that cows with poor BCS had an abortion risk that was 7.2 times higher than that of cows with good BCS. Poor nutrition typically causes poor bodily condition, and it is well recognized that animals who are underfed have weak immune systems that make them more susceptible to infections that might cause abortion.

The incidence risk of metritis (5.6%) found in the current study is comparable to the 5.6% observed in Ethiopia (Hundie et al 2013). However it falls short of the 6.6 to16.63% incidence risk range that other studies have described (Bitew and Shiv 2011; Hadush et al 2013). In contrast, the current figure is higher than the incidence risk 1.2 - 4.6% reported by some researchers (Ayele et al 2014; Esheti and Moges 2014). In contrast to our findings, Manríquez et al (2020) observed an incidence risk of 4.9% on organic farms in the US outside of Ethiopia. BCS and cow parity had a significant ($p < 0.05$) influence on the incidence of metritis in our study, while other variables had no significant effect. In contrast to cows with good BCS, cows with poor BCS had an 11.9-times increased risk of developing metritis. This is due to the fact that the health of the uterine environment is influenced by dietary management of the cows. Heifers were 6.4 times more likely to develop metritis than older cows. This is because heifers require more assistance with calving, which increases the risk of bacterial contamination and uterine lesions, both of which result in the development of metritis (Giuliodori et al 2013). Studies show many risk factors for metritis, although parity, dystocia, and retained placenta are the ones that are regularly documented (Giuliodori et al 2013; Daros et al 2017; Abunna et al 2018). Despite the fact that in our investigation, the incidence risk was higher in cows with RFM and abortion, the difference from cows without these disorders was not statistically significant.

Stillbirth was the fourth most common reproductive ailment observed in the study cows, with an overall incidence risk of 7.1%. This figure is higher than the incidence risk reported from other nations, such as 4.3% from Iran (Bahrami-Yekdangi et al 2022) and 6% from the US (Berry et al 2007). According to a study by Bahrami-Yekdangi et al (2022), the risk factors that were strongly linked to the incidence of stillbirths were the calving year, calving season, parity, twin status, length of

the dry period, calf birth weight, calf sex, and dystocia. In the current study, cows with dystocia, multiparous cows, and born male calves all had a higher percentage of stillbirths than other groups. However, no statistical analysis was carried out because of the limited sample size. However, preventing stillbirths is of utmost importance to the dairy farmers as it can lead to a higher incidence of placental retention, lower fertility and a lower 305-d milk yield (Chassagne et al 1999).

Clinical endometritis (1.6%), pyometra (1.4%), uterine prolapse (2.4%), and vaginal prolapse (1.6%) were also observed as less common reproductive health problems in the current study. As there were so few cases, we were unable to conduct a risk factor analysis (each including 2-3 cases). However, these conditions should not be disregarded because of the enormous influence they have on ultimate reproductive success and production, and necessary steps must be made to prevent their occurrence.

Finally, it is important to note that some of the cows recruited for the study were bred naturally, and the likelihood of experiencing any reproductive disorders was higher in these cows. However, the difference is not statistically significant due to the small number of cows, so it is important to note this fact. This finding demonstrates the importance of paying close attention while employing bull service as a breeding technique for dairy farmers.

Conclusion

The current prospective longitudinal study revealed that half of the cows examined exhibited one or more clinical reproductive disorders during the follow-up period, indicating a high incidence of these disorders among dairy cows in Wolaita Sodo town. The most frequent reproductive disorders were dystocia, fetal membrane retention and abortion. The study also identified various risk factors such as calf sex, cow breed, body condition score, parity, herd size, and management system for the occurrence of reproductive disorders mentioned in the study area. It is well known that the reproductive disorders identified in the current study can cause significant economic losses for the dairy industry because they slow uterine involution, lower reproductive rate, prolonged inter-conception and calving interval, negative impact on fertility, increased veterinary costs, a decline in milk production, reduced calf crop and early depreciation of potentially useful cows. Therefore, awareness should be raised among farm owners and attendants so that they can improve dairy farming management practices, such as proper feeding of cows, considering the size of sire and dam while using AI or natural mating, closer monitoring of pregnancies in larger farms and observing cows during the postpartum period.

Statements and Declarations

Conflict of interest

The authors declare that there are no conflicts for the publication of this work.

Ethical statement

This research was approved by the Hawassa University Institutional Research Ethics Committee. All methods are carried out in accordance with the relevant guidelines and regulations. Prior to conducting the study, the objectives, expected outcomes and benefits of the study were explained to the dairy farm owners or managers involved in the study and written informed consent was obtained from all dairy farms.

Author contributions

R.A. designed the study, performed the data analysis and interpretation, and prepared the final manuscript for publication. L.H. involved in data collection and writing draft manuscript. B.M participated in data analysis and critically reviewed the manuscript. The final manuscript was read and approved by all authors.

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