

## Research Article

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

Lachisa Hirpassa<sup>1</sup>, Berhanu Mekibib<sup>2</sup>, Rahmeto Abebe<sup>3</sup>

1. Independent researcher; 2. Faculty of Veterinary Medicine, Hawassa University, Ethiopia; 3. Hawassa University, Ethiopia

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 retained fetal membrane (RFM) (12.9%), dystocia (12.1%), abortion (10%), stillbirth (6.4%), metritis (5%), uterine prolapse (2.1%), endometritis (1.4%), vaginal prolapse (1.4%), 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 RFM, dystocia 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.

## 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%, anestrus 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. Regarding breed composition, most cows in the dairy farms studied were local Holstein-Friesian crosses (87%), while a smaller portion (13%) being local Jersey crosses. The average age of the cows included in the study was 5.5 years with a range from 2 to 13 and the parity number of the cows was between 0 (heifers) and 10.

### *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 on herd size and owners' willingness to participate, with 20 farms of 10 or more cows purposively selected from 85 dairy farms in the town. This aimed to increase the probability of following up with pregnant cows and reduce the burden on researchers. A total of 140 pregnant cows were recruited for the study on the selected farms. The number of cows selected per farm ranged from 3 to 20. In addition, a questionnaire survey was conducted to collect cow and farm-level data that may help for assessing risk factors 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, breeding 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 endometritis. 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 incidence risk was calculated as the number of new cases of a specific reproductive disorder divided by the number of cows at risk at the beginning of the study multiplied by 100%. The number of cows at risk were all pregnant cows recruited at the start of the study to monitor reproductive disorders. 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 reproductive health problems encountered, the highest incidence was recorded for RFM (12.9%), followed by dystocia (12.1%) and abortion (10%). The incidence risk of the other reproductive disorders identified during the study period is presented in Table 1 below.

Reproductive disorder	Cows at risk	No of new cases	Incidence risk (IR) (%)	95% CI for IR
Abortion	140	14	10	5.03, 14.97
Dystocia	140	17	12.1	6.73, 17.55
Endometritis	140	2	1.4	0.54, 3.39
Metritis	140	7	5	0.50, 6.65
Pyometra	140	2	1.4	0.54, 3.39
RFM	140	18	12.9	7.31, 18.40
Stillbirth	140	9	6.4	2.37, 10.49
Uterine prolapse	140	3	2.1	0.26, 4.54
Vaginal prolapse	140	2	1.4	0.54, 3.39
<b>Overall</b>	<b>140</b>	<b>74</b>	<b>52.86</b>	<b>44.59, 61.13</b>

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

### *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).

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)

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

\*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).

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 (0.6, 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)

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

\*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).

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

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

\*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).

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

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

\*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.

Retained fetal membrane (RFM) was the most frequent reproductive health problem encountered in the current study area, with an incidence risk of 12.9%. This falls within the reported range (3.8 - 28.9%) from earlier studies in Ethiopia (Ibrahim 2017) and other countries (2 to 15%) (Hooshmandabbasi et al., 2018; Manríquez et al., 2020). Risk factors for RFM vary by region, country, environment, and management practices, including dystocia, abortion, stillbirth, twinning, hormonal imbalances, immunosuppression, calving season, cow parity, nutritional deficiencies, management, and infectious diseases (LeBlanc et al., 2002; Roberts, 2022). In the current study, poor BCS was significantly ( $p < 0.05$ ) associated with RFM risk. 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 more likely to affect cows in poor condition because their ineffective defences increase the likelihood of infection, and the weak expulsive power of fetal membranes causes secondary problems (Haile et al., 2014). Dystocia, pluriparity, and abortion were considered important risk factors for RFM in crossbred cattle (Kumari et al., 2015). However, these were not shown in the current investigation. Further research is necessary to confirm these effects using various breeds in the Ethiopian environment.

Dystocia was the second most common reproductive disorder, with an incidence risk of 12.1%. This figure falls within the range (2.3 - 12.4%) found in 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 in Iran (14.7%) (Bahrami-Yekdangi et al., 2022) but higher than that in the US (7-8.8%) (Berry et al., 2007; Ribeiro et al., 2013; Manríquez et al., 2020). Dystocia incidence varies between cow populations from different studies or countries, influenced by calving management and

the case definition of dystocia (Bahrami-Yekdangi et al., 2022). Primary risk factors for dystocia include parity, nutritional status, previous history of dystocia, calf sex and higher birth weight, and maternal pelvic size (Berry et al., 2007; Mee, 2008). In this study poor BCS and calf sex were significant ( $p < 0.05$ ) risk factors. 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 can cause uterine fatigue, making fetal delivery difficult (Noakes et al., 2001). Male calves had 2.6 times higher risk of dystocia compared to female 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. Heifers are more prone to dystocia than older cows, according to numerous studies, with fetopelvic disproportion as the main cause (Berry et al., 2007; Purohit et al., 2012; Bahrami-Yekdangi et al., 2022). The current study also found a higher risk of dystocia in heifers compared to multiparous cows, although not statistically significant, possibility due to the small number of heifers in the study. Dystocia can lead to uterine infections, periparturient disorders, calf morbidity, higher veterinary costs, and reduced fertility, impacting farmers financially. Proper heifer rearing and peripartum management are crucial to mitigate dystocia's economic impact on dairy farms (Purohit et al., 2012).

The current incidence of abortion (10%) is within the previous range (2.56 - 14.6%) found in Ethiopian studies over the past decade (Benti and Zewdie, 2014; Haile et al 2014; Tulu and Gebeyehu, 2018; Mitiku et al., 2022). The study showed that factors such as breed, herd size, management system, and BCS were significantly associated with abortion risk ( $p < 0.05$ ). According to this, Jersey local crossbred cows had a 3.5 times higher risk than Holstein-Friesian local crossbred cows. The probability of abortion was 4.4 times higher in large herds than in small farms. Similarly, semi-intensive farms showed a 4.4 times greater risk than intensive farms. Cows with poor BCS had a 7.2 times higher risk of abortion due to poor nutrition and weakened immune systems.

The higher risk of abortion in Jersey local crossbred cows may be due to differences in management, as all local-Jersey crossbred cows at the current study location were raised in semi-intensive systems, which may have increased the risk of abortion. However, it is challenging to offer conclusive proof of breed differences in 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.

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 in abortions (LeBlanc et al., 2002). Consistent with our finding, Keshavarzi et al (2017) and Rafati et al (2010) both found that herd size has a significant impact on the incidence of cattle abortions in Iran. Contrary to this, Lee and Kim (2007) from Korea and Haile et al (2014) from Ethiopia pointed out that the risk of abortion is independent of herd size.

The present study suggests that semi-intensive farms have a higher risk of abortion, potentially due to inadequate feeding, housing, and health management techniques, which is consistent with previous research (Khan et al., 2016). Additionally, cows with poor (BCS) were more likely to experience abortion, likely due to poor nutrition. It is well established that undernourished animals have weakened immune systems, making them more vulnerable to infections that could lead to abortion.

The metritis incidence risk (5%) in our study aligns with the 5.6% observed in Ethiopia (Hundie et al., 2013), but it is lower than the 6.6 to 16.63% range reported in other studies (Bitew and Shiv, 2011; Hadush et al., 2013). Conversely, our figure exceeds the 1.2 - 4.6% incidence risk reported by some researchers (Ayele et al., 2014; Esheti and Moges, 2014). In comparison to our findings, Manríquez et al (2020) noted a 4.9% incidence risk on organic farms in the US outside of Ethiopia. In our study, BCS and cow parity significantly ( $p < 0.05$ ) influenced metritis incidence, while other variables showed no significant effect. Cows with poor BCS had an 11.9 times higher risk of developing metritis compared to those with good BCS due to the influence of dietary management on uterine health. Heifers were 6.4 times more likely to develop metritis than older cows due to increased calving assistance, leading to higher bacterial contamination and uterine lesions (Giuliodori et al., 2013). Various risk factors for metritis exist, with parity, dystocia, and retained placenta being regularly documented (Giuliodori et al., 2013; Daros et al., 2017; Abunna et al., 2018). Although the incidence risk was higher in cows with RFM and abortion in our study, the difference between cows without these disorders was not statistically significant.

Stillbirth ranked as the fourth most common reproductive ailment among the cows studied, with an incidence risk of 6.4%. This rate surpasses the figures reported in other countries, such as the 4.3% from Iran (Bahrami-Yekdangi et al., 2022), but aligns closely with the 6% from the US (Berry et al., 2007). According to a study by Bahrami-Yekdangi et al (2022), various factors like calving year, calving season, parity, twin status, length of the dry period, calf birth weight, calf sex, and dystocia were strongly associated with the occurrence of stillbirths. In this study, cows with dystocia,

multiparous cows, and male calves experienced a higher percentage of stillbirths compared to other groups. However, due to the limited sample size, no statistical analysis was conducted. Nevertheless, preventing stillbirths is crucial for dairy farmers as it can lead to increased placental retention, reduced fertility, and a lower 305-day milk yield (Chassagne et al., 1999).

Clinical endometritis (1.4%), pyometra (1.4%), uterine prolapse (2.1%), and vaginal prolapse (1.4%) were also observed as less common reproductive health problems in the current study. As there were so few cases, we were unable to perform a risk factor analysis. However, these conditions should not be disregarded because of the enormous impact they have on ultimate reproductive success and production, and the necessary steps must be taken to prevent their occurrence.

Finally, it is important to note that the reproductive disorders observed in cows can have significant implications for dairy farmers in the study area. These disorders can lead to slower uterine involution, prolonged inter-conception periods and calving intervals, as well as high medication costs, reduced milk production, diminished calf crop, and early depreciation of potentially useful cows (Hossein-Zadeh, 2013). Therefore, it is important for dairy farmers to understand the causes of reproductive disorders, implement appropriate management practices, and work closely with veterinarians to minimize the impact on their herds.

### *Limitations of the study*

This study was limited by the fact that the cows were selected only from dairy farms with 10 or more cows, so it may not reflect the status of the reproductive disorders in farms with smaller herd sizes.

## **Conclusion**

The current longitudinal study uncovered that half of the cows examined displayed one or more clinical reproductive disorders during the follow-up period, indicating a high incidence of these issues among dairy cows in Wolaita Sodo town. The most common reproductive disorders observed were fetal membrane retention, dystocia, and abortion. The study also identified various risk factors—such as calf sex, cow breed, body condition score, parity, herd size, and management system—that contribute to the occurrence of reproductive disorders in the area. It is widely acknowledged that the reproductive disorders identified in this study can lead to significant economic losses for the dairy industry, as they impede uterine involution, reduce reproductive rate, prolong inter-conception and calving intervals, negatively impact fertility, increase veterinary costs, lower milk production,



decrease calf crop, and prematurely devalue potentially useful cows. Therefore, there is a need to raise awareness among farm owners and attendants so that they can enhance dairy farming management practices. This includes proper feeding of cows, considering the size of sire and dam during AI or natural mating, appropriate housing, closer monitoring of pregnancies in larger farms, observation of cows during the postpartum period, and prevention and treatment of infectious diseases.

## **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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## Declarations

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