Original Research Article||

Prevalence of Retained Fetal Membranes and Associated Risk Factors in Cross Breed Holstein Friesian Dairy Cows Managed in Small and Large Scale Dairy Farms of Selected Districts of Sidama and Oromia Regional States

Tesfaye Belay[1], Sintayehu Yigrem[1*] and Desie Sheferaw[2]

[1]*School of Animal and Range Sciences, Hawassa University, Hawassa, Ethiopia*

[2]*Faculty of Veterinary Medicine, Hawassa University, Hawassa, Ethiopia*

Abstract

A retrospective study was carried out to analyze the prevalence and risk factors associated with retained fetal membranes (RFM) in HF crossbred dairy cows managed under various farm scales and farming systems in selected districts of Southern and Oromia regional states. A multi-stage sampling technique was employed to select farms and cows. A total of 120 farm households were selected for household survey. The perceptions of farmers on incidences of RFM, risk factors and possible mitigation practices were collected using the household survey. Prevalence of RFM was estimated by using data from: 1) monthly monitoring of smallholder dairy farms; where a total of 500 calvings were recorded between September 2019 and May 2020; 2) farm records on large scale dairy farms. The result shows that out of the total calving, 69 (13.8%) had RFM. RFM progressively and significantly increased with the advances in age of cows, showing 9.2%, 14.4%, 15.4% and 15.3% respectively, for age groups 2-4, 4-6, 6-8 and >8 years. With increased parities, prevalence of RFM also increased showing 6.9%, 13% and 74.3% respectively, for parity category 1-2, 3-6 and >7. The prevalence of RFM in cows was recorded for poor and medium body conditions as 18.6% and 4.3%, respectively. RFM was also associated with sex of calves born, 10.7% for female and 17.5% for male calves born. The prevalence of RFM was also affected by blood levels of HF crossbred cows where 50%, 75% and 87.5% crossbred had 32.1%, 12.1% and 13.3% RFM, respectively. In conclusion, the prevalence of RFM in the present study area was high, requiring special attention to be given by considering important predisposing factors. In this study, the impacts of other predisposing factors, such as nutritional status of cows, were not considered which might require further studies.

Key words: Ethiopia, reproductive problems, HF crossbred dairy cows, risk factors to retained placenta

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***Corresponding author's address:** Sintayehu Yigrem, Email: *Sintayehu@hu.edu.et*

Authors: Tesfaye Belay: tesfayebelay1616@gmail.com; Desie Shiferaw: *mereba480@gmail.com*

INTRODUCTION

The livestock sector in Ethiopia, with the largest population in Africa, has a considerable contribution to the economy of the country with 30-35% of GDP and more than 85% of cash income sources for smallholder farmers (Usman et al., 2013).. The total cattle population, which is estimated at 70 million herds, is mainly composed of local breeds (98.2%) (CSA, 2022). Even though there is a large number of cattle in the country their productivity is low due to constraints such as disease, poor nutrition, poor management and poor genetic performance of indigenous cattle breeds.

These constraints results in poor reproductive performance of dairy cattle and hence lower economic benefit from the sector (Bitew and Prased, 2011). Among the major reproductive health problems that have direct impacts on the reproductive performance of dairy cows are abortion, dystocia, retained fetal membrane, repeat

breeding and uterine prolapse. The problems could be classified as postpartum and prepartum (Forar, et al, 1995). Reproductive health problems causes considerable economic losses to the dairy industry due to slower uterine involution, prolonged inter-conception and calving interval, negative effect on fertility, a drop in milk production and early depreciation of potentially useful cows (Mukasa, 1989; Tekelye et al., 1991; Dinka, 2013; Aman, 2023). Diseases have numerous negative impacts on productivity of herds i.e. death of animals, loss of weights, slow down growth, results in poor fertility performance and decrease in physical power (CSA, 2022).

With increases in population size, the demand for milk also increases (Usman et al., 2013). Should the dairy sector improve and play its vital role at both the macro- and micro levels (rural families) those reproduction and production factors needs to be carefully studied and interventions implemented.

Retained fetal membrane (RFM) is one of the most common conditions occurring in farm animals which occur following parturition. It is caused by multiple factors, which might even begin before parturition (Beagley et al., 2010). It is commonly observed in dairy cows, whereas it is less commonly reported in other domestic species. In physiological parturition, the afterbirth of the cow falls away within 3 to 8 hours following calving. The placenta is not said to be retained in cattle until 12 hours after parturition (Raheem et al., 2016)

Retained Fetal Membrane costs farmers in many ways, partly due to the veterinary costs, but mainly because of its effect on milk yield. Most importantly, RFM results in subsequent fertility problems. Studies have shown 5-10% prevalence rates of retained placenta in intensive dairy farms. Veterinary advice should be sought if the rate goes above this figure, especially if it goes above 10% (Laven, 2002). Detachment of the placenta in the cow is initiated by a progressive collogenolysis of the maternal and fetal connective tissues of the placentome during the last month of gestation. The successive weakening of the interface between the maternal and fetal tissue includes re-molding of the connective tissue and influx of leukocytes to the site (Gunnick, 1987).

RFM is a concern in dairy farms, because it can lead to further complications including Septic metritis (infection of the uterus), Septicaemia (infection of the blood), Endotoxemia (toxins in the blood), as well as Laminitis and death (Laven, 2002). In most of the animals affected with RFM, a slight to moderate loss of milk production and a slight to moderate delay in the involution the uterus and subsequent conception rates were reported (Stephen, 2002). With increased smallholder dairy intensifications and use of HF crossbred cows in dairy animals, it is important to asses associated reproductive problems such as RFM, where there is no sufficient data including from the present study area. Therefore, this study was intended to estimate the prevalence of retained fetal membranes and associated risk factors in cross-breed Holstein Friesian dairy cows in selected small and large-scale dairy farms. The specific objectives of the study were to quantify the prevalence of retained fetal membrane in smallholder and large-scale state farms (research and teaching dairy farms) in the study area, and to assess the possible risk factors.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted on dairy farms found in Hawassa (in Sidama regional state), Shashemene (in Oromia regional state) and Wondo Genet area (in both Sidma and Oromia regional states). Hawassa is situated on average altitude of 1750m above sea level and receives average annual rainfall of 955 mm and has mean annual temperature of 20°C. Shashemene is located at 1800m above sea level. The mean annual temperature of Shashemene ranges from 9.02ºC to 19.43ºC. Wondo Genet is situated at 1800- 2400m above sea level, and has mean annual rain fall of 1200 mm.

Household survey, on-farm monitoring as well as farm records were used. The farm monitoring was held between September 2019 to May 2020 on both smallholder and large dairy farms. Farm records from two large dairy farms, both owned by Hawassa University, and found at Hawassa University main campus and Wondo Genet College of Forestry and Natural Resources, were used for the study.

Study Design

Data obtained from farm household cross sectional survey and monthly monitoring were used to estimate the prevalence of retained fetal membranes and also to identify other dairy cows' reproductive problems that occurred in small and large scale dairy farms. The questionnaire was pretested before actual data collection was applied. A regular follow up was also held on purposively selected large scale dairy farms at Wondo Genet (College of Forestry and natural resource dairy farm), Hawassa University main campus dairy farms.

Sample Size, Study Animals and Data collection

Household survey was administered on 120 dairy animal owners to collect information about major reproductive problems they observed. The total number of respondents were computed based on the number of farms in the area and by using Cochran's formula for finite population (n_0 = 384 and N=174 farms in the study areas).

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where: n_0 = Initial sample size (i.e. already calculated), N = population size, and n = required sample size

From the total households 31 farms were from Hawassa, 41 from Shashemene and 48 Wondo Genet districts. The study animals were HF crossbred dairy cows managed under small- and large-scale production systems. For the farm monitoring, pregnant dairy cows were identified from the study dairy farms. Prior to monitoring of pregnancies and parturitions, the crossbred cows' history were recorded. The breed, blood level, age, body condition scores during parturition, as well as parity were recorded. During farm monitoring, clinical examination was held before confirming RFM. At the time of partition, the sex of claves born as well as the time period elapsed between calving and release of placenta were recorded. If it takes over 12 hrs until the placenta is released, it was recorded as retained placenta (Takagi et al., 2002). Any associated reproductive failures are also recorded. A monthly visit was carried out once a week on 35 dairy farms (7 farms in Hawassa, 12 farms in Shashemene and 16 farms were Wondo Genet area). A total of 253 dairy cows from small scale dairy farms and 247 dairy cows from large-scale dairy farms were monitored. Overall 500 dairy cows were fully monitored from small and large scale dairy farms.

Variables and Working Definitions:

Body Condition Scoring (BCS)

For all of the animals under this study body condition was scored in order to assess the nutritional status of the animal and the prevalence of post parturient reproductive health problems. Therefore, animals were grouped in to 1, 2, 3, 4 and 5 body condition scores according to Richard (1993) and later on classified as poor (score 1 to 2), medium (score 3) and good (score 4 to 5) as referred in Benti and Zewdie (2014). As the proportion of BCS with 4 and 5 were too small the data were not used analysis. The measurement to estimate BCS was done through palpation and visualization of the transverse and spines processes for the lumbar vertebrae (loin) and tail head respectively (Ambaw et al., 2017).

Breed

In this study all study subjects were crosses local breeds (mostly Arsi breed) and HF. All the 500 dairy cows were HF breed, but were categorized into three by their HF blood level as above 87.5% (denoted in this work as 87.5%), between 75% to 87.5% (denoted as 75%), and between 50% and 75% (denoted as 50%).

Parity

The study was undertaken based on number of calvings. Cows were categorized as primiparous (1st calving) or pluriparous (animals with two or more subsequent calvings).

Age

The study also focuses on the age of the cows exhibiting RFM, which were obtained from the records of animals. Age was also used to assess its effect on the prevalence of the RFM. The data was analysed to assess the influence of age on the prevalence of RFM.

Calf Sex

The sex of delivered calves exhibiting RFM were obtained from the records of animals with RFM and the basis of their calf sex, which was used to identify the effect of the calf sex on the incidence or prevalence of RFM.

Data Management and Analysis

The data obtained from the questionnaire and regular farm monitoring were entered into Microsoft Excel spreadsheet, and prepared for descriptive and inferential statistics. The association of RFM and reproductive health problems (abortion, repeat breeding, stillbirth, dystocia and uterine prolapse) retained fetal membrane with various risk factors (age, breed, parity, calf sex and body condition) were analysed by using univariate logistic regression analysis. SPSS version 20 software used for the data analysis.

RESULTS AND DISCUSSION

Prevalence and Risk Factors of RFM

From the total of 500 calved cows, 69 (13.80%) had RFM problems. The current finding is in agreement with Mamo (2004) and Gashaw *et al*. (2011) who reported 14.2% and 19.2% RFM prevalence, respectively. However, it is higher than that of Nigussu *et al*. (2016) and Molalegn and Shiv (2011), who reported 10% and 8.6%, respectively. Higher proportion of RFM was observed in 50% of Holestein cross and poor body condition cows. The Univariable logistic regression analysis revealed that breed, age, parity, body condition score, and sex of calf influenced the prevalence of RFM (Table 1).

Table 1. Prevalence and associated risk factors of RFM in cows

Risk Factors	Categories	No. examined	No with RFM (%)	95% CI
Breed	87.5% HF-Cross	248	33 (13.3%)	9.6-18.2
	75% HF-Cross	224	27 (12.1%)	8.4-17.0
	50% HF-Cross	28	9 (32.1%)	17.4-51.6
Age	2-4	109	10 (9.2%)	5.0-16.3
	4-6	111	16 (14.4%)	9.0-22.3
	6-8	136	21 (15.4%)	10.3-22.6
	>8	144	22 (15.3%)	10.3-22.2
Parity	1-2	288	20 (6.9%)	4.5-10.5
	3-6	177	23 (13.0%)	8.8-18.8
	>7	35	26 (74.3%)	57.2-86.2
BCS	Poor	161	30 (18.6%)	13.3-25.4
	Medium	300	13 (4.3%)	2.5-7.3
Calf sex	Female	272	29 (10.7%)	7.5-14.9
	Male	228	40 (17.5%)	13.1-23.1
Total		500	69 (13.8%)	11.0-17.1

Where, No. of +ve= Number of positive.

The analysis shows that the influences of breed, age, parity, body condition score and calf sex in the occurrence of retained fetal membranes.

Breed

Among the risk factors breed of cows, influenced the occurrence of RFM (Table 2). The prevalence of RFM was significantly higher in 50% HF-cross cows (χ^2=6.77; P< 0.05) than in 87.5% and 75% HF-cross breeds. This might be associated with the variation in the concentration of cholesterol, glucose and total protein; and non-esterified fatty acid, β-hydroxy butyric acid among the crosses (Kumari et al., 2015).

The prevalence of RFM was higher in 50% than in 87.5% and 75% HF blood level. This may be due to the attention differences given by the owners especially in management. Whenever the exotic blood level of cows was increasing, then owners provided more attention to cows in feeding,

watering and health care to get better milk production (Personal observation of researchers).

Table 2. Univariate logistic regression (ULR) on the prevalence of RFM in the study areas.

Risk Factors	Categories (level of risk factors)	No. of cow examined	No affected (%)	Std. Er.	χ^2	P-value	95% CI
Breed	HF-Cross- 87.5%	248	33 (13.3%)	0.02	0.17	0.683	9.6-18.2
	HF-Cross- 75%	224	27 (12.1%)	0.02	Ref		8.4-17.0
	HF-Cross- 50%	28	9 (32.1%)	0.09	8.20	0.004	17.4-51.6
Age	2-4	109	10 (9.2%)	0.03	Ref	-	5.0-16.3
	4-6	111	16 (14.4%)	0.03	1.4	0.229	9.0-22.3
	6-8	136	21 (15.4%)	0.03	2.2	0.143	10.3-22.6
	>8	144	11 (15.3%)	0.03	2.1	0.148	10.3-22.2
Parity	1-2	288	20 (6.9%)	0.02	Ref	-	4.5-10.5
	3-6	177	23 (13%)	0.03	4.8	0.029	8.8-18.8
	>7	35	26 (74.3%)	0.75	7.4	0.000	57.2-86.2
BCS	Poor	161	30 (18.6%)	0.03	25.3	0.000	13.3-25.4
	Medium	300	13 (4.3%)	0.01	Ref		2.5-7.3
Calf sex	Female	272	29 (10.7%)	0.19	Ref	-	7.5-14.9
	Male	228	40 (17.5%)	0.25	4.9	0.029	13.1-23.1

Where, χ^2= Chi-Square, CI=Confidence Interval. BCS= body condition score

Parity

Parity was significantly affecting RFM ($p< 0.05$). As parity increased the occurrence of RFM also increased. Similar results were reported from various areas of the world (Sharma et al., 2017; Khan et al., 2016; Hossain et al., 2015; Gaafar et al., 2010 and Roberts, 1986). When parity increases the cow's milk production also increases and it may cause hypocalcaemia (Sheldon, 2019), and this has impact on the uterine atony (Sheldon, 2019, Qu et al., 2013; Eiler and Fecteau, 2007 and Roberts, 1986) that end up with retention of placenta.

Body Condition Score (BCS)

The occurrence of retained fetal membranes were significantly ($p< 0.05$) influenced by the body condition of the cows. The prevalence of retained fetal membrane was low in medium-body condition cows than in poor conditioned animals. This finding is in general agreement with the report of Hossain et al. (2015) and Benti and Zewdie (2014). Studies have shown that cows with poor body condition were facing a decreasing uterine inertia, and inadequate uterine contraction during the third stage of labour (Sheldon, 2019; Eiler and Fecteau, 2007); and hence, there was poor expulsive force (Robert, 1986). Over-conditioning of cows might also make cows to be more susceptible to metabolic problems and infections making them more likely to have difficulty to give birth, which leads to retained fetal membrane (Ishak et al., 1983). The animals with poor body conditions were more susceptible to RFM, which is due to the weak expulsive force exerted to expel out the fetal membranes leading to secondary complications (Robert, 1986). Induced parturitions, hormonal imbalance, dystocia as well as poor body defence mechanism have been reported to be important predisposing factors for RFM (Ishak et al., 1983; Beagley et al., 2010).

BCS significantly affected ($p<0.05$) the prevalence of RFM. There is evidence of a high incidence of retained fetal membrane when cows' diets are deficient in selenium and/or vitamin E. correction of dietary deficiencies or supplementary feeding of these substances is commonly associated with a reduction of the incidence of retention. The incidence of retained membranes is higher in genetically high-yielding dairy cows and cows on high nutritive planes at parturition which are more prone to RFM, as cows might have disorders with carbohydrate metabolism (fat cow syndrome, ketosis, displaced abomasum) around the time of caving (Noakes et al., 2009).

Calf sex

Retained fetal membrane was significantly ($p< 0.05$) higher in cows calving male calf. In a study by Gaafar et al. (2010), RFM was not associated with calf sex. Hormonal imbalance, nutritional differences among farms, and physiological status like gestation length between individual cows were found as important predisposing factors for RFM (Eiler and Fecteau, 2007; Beagley et al.,. 2010).

District and Farm Scale Level Prevalence of RFM

The observed prevalence of RFP is shown in Table 3 below.

Table 3. Prevalence of RFM disaggregated by farm scales and study districts

Categories	Farm scale			Prevalence (%)
	Total Observed	Negative	Positive	
By farm scale				
Small scale	253	222	31	13.9%
Large scale	247	209	38	15.4%
Overall	500		69	13.8%
By district				
Wondo Genet	221	-	42	19.0%
Shashemene	150	-	15	10%
Hawassa	129	-	12	9.3%
Overall	500			

Prevalence of RFM at District Level

From the three study areas, the effect and prevalence of retained fetal membranes were highly observed around Wondo Genet area which is n=42 (19%), then n=15 (10%) in Shashemene and least in Hawassa n=12 (9.3%).

Perceptions of Farmers on Reproductive Problems

From the total 120 farm households surveyed, 80.8% revealed RFM as the top reproductive problems in the study area (Table 4). This result agree with Abunna et al. (2018) and Tolosa et al. (2021) who reported the highest prevalence of RFM. The proportion of RFM recorded during this study is in agreement with Yohannes and Alemu (2019) and Gashaw et al. (2011). A total of seven different types of reproductive problems were reported from the study areas. According to farmers RFM, abortion and repeated breeding were the top three major reproductive problems. Such reproductive problems were frequently reported from various parts of the country (Tolosa et al., 2021; Yohannes and Alemu, 2019; Abunna et al., 2018; Tigabneh et al., 2017). Such high rates of reproductive problems on dairy cows might heavily contribute to the low productivity of dairy cows in the study areas.

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Table 4. Reproductive disease identified in the study area

Reproductive Problems	Response Categories	District (n=120)			n	Proportion (%)
		Wondo Genet (n=52)	Shashemene (n=37)	Hawassa (n=31)		
Dystocia	Yes	5	5	2	12	10%
	No	47	32	29	108	90%
Stillbirth	Yes	5	3	3	11	9.2%
	No	47	34	28	109	90.8%
Uterine prolapse	Yes	6	4	1	11	9.2%
	No	46	33	30	109	90.8%
Milk fever	Yes	11	8	8	27	22.5%
	No	41	29	23	93	77.5%
Abortion	Yes	19	8	11	38	31.7%
	No	33	31	20	82	68.3%
RFM	Yes	42	32	23	97	80.8%
	No	10	5	8	23	19.2%
Repeat breeding	Yes	15	8	6	29	24.2%
	No	37	29	25	91	75.8%

From a total of 120 respondents about 22.5% of them reported that milk fever was the fourth problem in the study areas. Milk fever was reported from various areas of the country with different prevalence rates (Anteneh et al., 2012; Tolosa et al., 2021; Fasil et al., 2016). It mainly occurs due to deficiency of metabolizable Calcium ions in good milk-yielding cows, and weak management.

Relatively high prevalence of repeated breeding (24.2%) has been reported in this study. This problem was also reported from various scholars studied in different parts of the country (Haile et al., 2014; Hadush et al., 2013; Michael, 2003). The main reason of repeated breeding in healthy cows is related to poor management practices such as faulty heat detection, incorrect insemination time, inappropriate semen handling and technical problems or skill of technician (Arthur et al., 2016). Dystocia that accounted for 10% of the farms is an important predisposing factor for the occurrence of RFM. However, the current finding is higher than the prevalence of 5.9% reported by Fasil et al. (2016), 5.79% reported by Mamo (2004, 7.7% reported by Tesfaye and Shamble (2013), and 3.8% by Gashaw et al. (2011). Age and parity of the dam as well as breed of the sire were found as important factors. Inseminating cows with semen collected from large-sized bulls without taking into account the size and age of cows is an important factor in predisposing cows to dystocia (Noekes 1986).

CONCLUSIONS

From the results, it can be concluded that breed, parity, BCS and sex of calves had pronounced effects on the prevalence of RFM. This study revealed that RFM, abortion, repeated breeding and milk fever were the major reproductive problems in the area. Considering the higher prevalence and distribution of the problems in the area animal health extension work shall be strengthen to aware animal owners the impact of such reproductive problems on cows' productivity. Further epidemiological study to identify the main causes of each problems is very important; and this will play a key role in the designing of control options.

CONFLICTS OF INTEREST

Authors declare that they have no conflicts of interest.

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