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Study on clinically manifested reproductive health problems of dairy cows managed under intensive and semi-intensive production systems in Wondo Genet district, Southern Ethiopia

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ABSTRACT

Reproductive disorders in cows are crucial as reproduction and fertility are the two key pillars of dairy production profitability. The study was conducted to identify and estimate the prevalence of clinically manifested postpartum reproductive disorders, to identify the associated risk factors and to estimate the sero-prevalence of brucellosis in dairy cows kept under intensive and semi-intensive dairy farms in Wondo Genet district from November 2019 to September 2020. Out of the total 205 cows examined, 90 cows (43.90%) had at least one of the reproductive problems identified by either questionnaire interview or regular follow up of individual cows. Out of 146 cows retrospectively and 59 cows prospectively assessed for the presence of any reproductive disorder, 62 (42.47%) and 28 (47.46%) cows had at least one reproductive disorders, respectively. Retained fetal membrane, abortion, uterine infections, anestrous and repeat breeding are the major reproductive disorders encountered followed by dystocia, milk fever and prolapses of the vagina and/or uterus. Among the considered host and management related risk factors, only presence of previous reproductive disorder had statistically significant association with the occurrence of reproductive disorder ($p<0.05$). This study also demonstrated that none of the serum samples collected from Wondo Genet and other towns (namely Hawassa, Wolaita Sodo and Arsi Negelle) and tested using Indirect Multi-species ELISA was positive for bovine brucellosis. Further studies, preferably laboratory based, should be conducted to identify the underlined causes of these problems in different parts of the country. Meanwhile, awareness should be created to farm owners/attendants to improve their farm management system.

INTRODUCTION

Dairying is one of the livestock productions practiced almost all over Ethiopia, involving a vast number of small, medium, or large-sized, subsistence or market-oriented farms (Abera, 2016). The dairy sector is dominated by traditional smallholder farmers who account for about 85% of the population and are responsible for 98% of the milk production (MoARD, 2007). Unfortunately, nearly 90% of the milk produced by the rural household is consumed

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within the producer households with the proportion marketed being not more than 10% (CSA, 2020)

Owing to the rapidly increasing population size, low productivity of the local breeds (1.32 liter/cow per day), a growing urbanization and the concomitant growing demand for dairy products, the country is already in a very high demand-supply variance (Seifu and Doluschitz, 2014). To partly fill this gap, the country expends over 10 million USD annually for the import of dairy products from different countries (Tegegne *et al*., 2016). For a sustainable economic growth, however, both the public and private sectors are engaging in urban and peri-urban dairy development (Seifu and Doluschitz, 2014; Edao et al., 2018).

Despite the progressive growth in the commercial (market oriented) dairy farming in urban and peri-urban settings, the dairy industry is still underutilized and challenged by several factors. In general the development of the dairy sector is hindered by poor management system, shortage of proper nutrition, absence of well-developed market infrastructures and widespread infectious and parasitic diseases (MOA, 1998). Among health related issues, reproductive disorders in cows are crucial as reproduction and fertility are the two key pillars of dairy production profitability (LeBlanc, 2008). These problems, caused by infectious and non-infectious causes, are responsible to reduce milk yield and subsequent reproductive performance of dairy cows (Rajala and Gröhn, 1998; LeBlanc *et al*., 2002; LeBlanc, 2008) and ultimately cause premature and forced culling of high producing dairy cows (Esslemont and Peeler, 1993).

Bovine brucellosis, a bacterial zoonotic disease, is one of the infectious diseases assumed to hamper productivity of cattle in the country (Ibrahim et al., 2010; Edao et al., 2018). The disease in cattle is characterized clinically by abortion at third trimester of first gestation, retained fetal membrane (RFM), metritis, orchitis and epididymitis (Radostits et al., 2006). Bovine brucellosis has been reported from several parts of the country, particularly in cows kept in intensive and extensive management systems. However, recent reports particularly from central and southern Ethiopia are revealing a very low to zero prevalence (Alem and Solomon, 2002; Belihu, 2002; Asmare et al., 2013; Bashitu et al,.2015, Edao et al., 2018).

Although several studies have been conducted on the prevalence of bovine brucellosis (Asmare et al., 2013; Edao et al., 2018; Ataro e al., 2019; Dinknesh et al., 2019) and/or on the major reproductive disorders (Lobago et al., 2006; Hunduma, 2013; Wujira and Nibret, 2016; Yohannes and Alemu, 2019), majority are limited in the central highland, dairy farms of research centres and major towns/cities of the country. However, there is still paucity of information in some parts of the country including Wondo Genet district. Moreover, the scope of reproductive health in the dairy industry still demands more intensive investigation for better formulation of prevention strategies. Therefore, the present study is intended to identify and estimate the prevalence of the major clinically manifested postpartum reproductive disorders, to identify the associated risk factors and to estimate the sero-prevalence of brucellosis in dairy cows kept under intensive and semi-intensive dairy farms in Wondo Genet district.

MATERIALS AND METHODS

Study area

The study was conducted in Wondo Genet district, which is located 24km North East of Hawassa, the capital city of Sidama Regional state and 265.km to South of Addis Ababa, the capital of the country, Ethiopia. The district is classified administratively into 13 rural and 2 urban villages. It has temperature and altitude ranging from 7 to 26 °C and 1761 to 2695 m above sea level, respectively. The average rainfall is 1120 mm per annum and the main rainy season in the area is between July and early October (Bolka and Gebremedhin, 2019). In the area, animal husbandry is the main subsistent farming where cattle, sheep, goats and equines are the species of animals found (Jones et al., 2011). The town is known for its high potential in dairy production in Southern Ethiopia and major source of milk and other dairy products.

Study design

Study design and sample size

Both retrospective (questionnaire based) and prospective (follow-up and serological) studies were undertaken from November 2019 to September 2020 to estimate the prevalence of major reproductive problems in dairy cows. All female cattle with at least one calving history were purposively selected for the retrospective survey. For the prospective follow-up study, however, all pregnant cows and heifers (in their first pregnancy) which were at 4^{th} or more months of gestation were selected and registered according to their ear tag numbers /given name for follow-up.

The number of cattle required for serological survey was calculated based on the formula described by Thrusfield and Brown (2018), with 5% absolute precision with 95% confidence level. Moreover, a prevalence (2.7%) reported by Ataro et al. (2019) from Hawassa was used as expected prevalence as there is no previous report from Wondo Genet and its surroundings. As a result, the sample size computed was 40 for the study area. However, the sample size was increased by 5 fold and hence a total of 200 cows were randomly selected and examined. Moreover, equal numbers of animals were also sampled from the different farms found in Hawassa, Arsi Negelle and Wolaita Sodo for serological survey.

Study population and Study animals

The study population constituted all the dairy cows found in Wondo Genet district. The majority of dairy producers included in this study were market oriented small holder dairy farmers with average herd size of 10 cows. Although majority of the farms are small scale, there are also few governmental and private owned large (commercial) scale dairy farms with heard size of over 50. Most of these farms rear crossbred dairy cattle under semi-intensive management system. Hay and concentrate (wheat bran, molasses and oil and brewery by- products) were the common types of feed used in almost all farms. Majority of the management activities including heat detection (detection for the major oestrus sign of the cows) were done by the owners and attendants of the farm. Although both Artificial Insemination (AI) and natural method of breeding system were practiced in the study areas, most of the owners prefer natural mating because their cows repeat more than two times when inseminated by AI.

In all the farms, there was no regular vaccination and deworming practices for the common infectious and parasitic diseases, respectively.

Study Methodology

This research employed both retrospective and prospective (i.e. follow-up) studies to generate relevant data to attain the aforementioned specific objectives. Moreover, serological survey was also conducted to estimate the prevalence of Bovine Brucellosis.

Retrospective survey

Retrospective data was collected from the cow level record books kept by the farms (if any) and by using pretested semi-structured questionnaire (administered in the form of interview). Before the commencement of the interview, of course to get full co-operation of the dairy owners and hence obtain reliable data about their animals, thorough explanation was made to the respondent on the objectives of the study before the start of the interview and record exploration. During the interview, the actual questions on questionnaire were systematically and chronologically presented in Amharic (the national language). Accordingly, herd level information (housing, feeding, source of feed, herd size) and cow level information (parity, breed, service used, source of the cow, number of service per conception, and history of any reproductive disorder on the previous calving) were collected and recorded. All the cow level information was registered by their ear tag number and/ or given name for ease of identification. Moreover, the data collectors tried to make personal judgment and validation on the information given pertaining the management and husbandry. To avoid ambiguity, the major reproductive problems (Namely abortion, dystocia, retained fetal membrane (RFM), uterine infection, anoestrous, repeat breeder, vaginal prolapse and uterine prolapsed) were clearly defined according to the literature and explained to respondents.

Follow-up survey

During postpartum period, cows were regularly examined for the presence of retained fetal membrane, any systemic signs, and abnormal vaginal discharge. During each visit, rectal temperature of cows with rough hair coat, depression and reduced appetite was measured by digital veterinary thermometers (Microlife VT1831; Measurement accuracy of ± 0.1°C). Each postpartum cow was visually inspected for the presence of any discharge on the vulva, perineum or tail. Moreover, after cleaning the vulva, a clean and sterile vaginal speculum was slowly inserted into the vagina of the cows and then the cervix and vagina were thoroughly inspected with illumination from a penlight. The type and nature of the vaginal discharge was differentiated from cows with normal delivery. The nature of discharge was classified as clear mucus, predominantly clear mucus with flecks of pus, mucopurulent (approximately 50% pus and 50% mucus), purulent (>50% pus) but not foul-smelling, or purulent or red-brown and foul smelling according to LeBlanc et al. (2002). Retained fetal membrane was defined as failure to pass the fetal membrane within 24 h postpartum (Kelton et al., 1998). Abortion was defined as the expulsion of a dead fetus of recognizable size at any stage of gestation (Robert, 1986; Ball and Peters, 2004). Anoestrus was defined as the failure of the cow to show clinical heat signs for 90 days or more

after parturition (Arthur et al., 1992; Bekana et al., 1994). Moreover, cows or heifers that cycle normally and have on clinical abnormality but failed to conceive by three or more consecutive services were considered as repeat breeder (Robert, 1986; Bonneville-Hébert et al., 2011).

Serological survey

Blood and serum sample collection

Approximately 10ml of blood samples were collected from the jugular vein of the randomly selected cows (800 in total) using plain vacationer tubes. Each tube was properly labelled with codes and allowed to clot over overnight at room temperature by placing inclined on a table. On the next morning, the sera were separated undisturbed, aliquated in to 1.8 ml cryo vials, properly labelled, transported and stored at -20^{0}C in FVM-HU lab. The sera were shipped with a cold chain to the National Animal Health Diagnostic and Investigation Centre NAHDIC), Sebeta, for a better and safe storage and serological tests.

During sample collection, the town, farm name, herd size, Cow ID / name, parity, breed, history of previous abortion/reproductive disorder and current physiological state (viz lactating, dry, pregnant) were recorded for all sampled animals on a format prepared for the same.

Serological examination

In the lab, the sera were exposed for Brucellosis serological tests (ID Screen ® Brucellosis Serum Indirect Multi-species ELISA) as per the kits' instruction (ID.Vet Innovative Diagnostic, rue Louis Pasture- Grables, France). Briefly, before performing the test, the sera and all reagents taken out of the refrigerator and left at room temperature for half an hour and homogenized by inversion and flicking with finger. The serum and controls (positive and negative controls), at a dilution rate of 1/20 were added to microwells coated with *Brucella abortus* LPS. The plates were incubated at 37°C in a humid incubator for 60 min and washed 3x with washing buffer. Then, 100 µL of the conjugate was added to each well and incubated again at 37°C and wet for 60 min. Again, washes were repeated, and 100 µL of TBM (substrate solution) were added, the wells were shaken, covered, and incubated at 18-26°C for 15 min. Finally, the reaction was stopped by adding 100 µL of the "stop" solution to each well and the results were read using an automated ELISA reader with a wavelength of 450 nm. The test were valid if the mean OD value of positive and ratio of positive to negative controls were calculated as ODPC > 0.350 and ODPC/ODNC > 3, respectively. The result was interpreted by Sero-positivity percentage (S/P %) of ≥120% as positive and ≤ 110% as negative.

Data management and analysis

The data obtained from questionnaire and follow-up surveys were carefully entered into farm and cow-level database Excel files. The data were coded and analyzed using Stata 14.2 window version (StataCorp, College Station, TX USA). The association of different risk-factors such as breed, management system, and methods of breeding with over all prevalence of reproductive problems were analysed by using χ^2 (Chi- square) test and value of $p<0.05$ considered as significant.

RESULTS

In general, out of the total 205 cows examined, 90 cows (43.90%) were having at least one of the reproductive disorders identified by either questionnaire interview or regular follow up of individual cows. Out of 146 cows retrospectively and 59 cows prospectively assessed for the presence of any reproductive disorder, 62 (42.47%) and 28 (47.46%) cows had at least one reproductive disorders, respectively. Based on questionnaire surrey and longitudinal study (follow-up), Retained Fetal Membrane, Abortion, Uterine infection, Anestrus, Repeat breeding, Dystocia, Hypocalcemia, Uterine prolapsed and Vaginal prolapsed were the major reproductive problems in dairy cows of Wondo Genet district (Table 1). On questionnaire survey, Retained Fetal Membrane and Abortion (12.33% each), anestrus (8.22%), and dystocia (4.79%) were the leading reproductive problems in dairy farms. Whereas, uterine infection (23.73%), Retained Fetal Membrane (18.64%), and repeat breeding (15.25%) were the leading problems encountered during the follow-up period (Table 1).

Table-1: Table 1: Major reproductive disorders of cows encountered in the study area

Type of reproductive Disorder	Follow-up (n=59)	Retrospective (n=146)	Overall (n=205)
	No (%) affected	No (%) affected	No (%) affected
Retained Fetal Membrane	11 (18.64)	18 (12.33)	29 (14.15)
Dystocia	3 (5.08)	7 (4.79)	10 (4.88)
Uterine infection	14 (23.73)	6 (4.11)	20 (9.76)
Abortion	6 (10.17)	18 (12.33)	24 (11.71)
Hypocalcaemia	3 (5.08)	4 (2.74)	7 (3.41)
Anestrous	5 (8.47)	12 (8.22)	17 (8.29)
Uterine prolapsed	2 (1.37)	1 (1.69)	3 (1.46)
Repeat breeder	9 (15.25)	3 (2.05)	12 (5.85)
Vaginal Prolapse	1 (1.69)	2 (1.37)	3 (1.46)
Overall (at least one Reproductive Disorder)	28 (47.46)	62 (42.47)	90 (43.90)

Although reproductive disorder is multi-factorial in nature and influenced by several host and environment (management) related factors, only the most important and widely accepted factors are considered in this study. Among the considered host related risk factors, only the presence of previous reproductive disorder had statistically significant association with the occurrence of reproductive disorder ($p<0.05$) (Table 2).

Table- 2. Host Factors associated with the occurrence of major reproductive problems

Factors		No cows examined	Cows affected, No (%)	$\chi 2$	p value
Body Condition Score	Poor	6	5 (83.3)	3.455	0.175
	Medium	28	12 (42.86)		
	Good	25	11 (44)		
Previous rep. performance	Poor	21	15 (71.43)	7.514	0.006
	Good	38	13 (34.21)		
NSC	One	33	15 (45.45)	0.12	0.73
	≥Two	26	13 (50)		
Parity	First	6	3 (50)	2.752	0.432
	Second	14	4 (28.57)		
	Third	14	8 (57.14)		
	≥Fourth	25	13 (52)		
Breed/Blood level	50%HF*	21	10 (47.62)	0.850	0.654
	75%HF	14	8 (57.14)		
	87.5%HF	24	10 (41.67)		

NSC=number of service per conception, HF=Holstein Friesian

On the other hand, among the considered management related risk factors (*vis-a-viz* source of the animal, management type, service used, floor type, presence of calving pen and contact with dogs) none of them had statistically significant association with the occurrence of reproductive disorders (Table 3).

Table -3. Management Factors associated with the occurrence of major reproductive problems

Factors		No cows examined	Cows affected, No (%)	$\chi 2$	p value
Source of the animal	Raised in the farm	36	17 (47.2)	0.002	0.964
	Purchased	23	11 (47.83)		
Management	Semi- intensive	41	18 (43.9)	0.68	0.41
	Intensive	18	10 (55.6)		
Contact with dogs	Yes	38	17 (44.7)	0.317	0.573
	No	21	11 (52.4)		
Floor type	Soil	13	9 (69.2)	3.17	0.075
	Concrete	46	19 (41.3)		
Graze Outside	Yes	33	13 (39.4)	1.95	0.162
	No	26	15 (57.7)		
Calving pen	Yes	31	12 (38.7)	2.005	0.157
	No	28	16 (57.1)		
Service Used	Natural	40	9 (47.5)	0.0001	0.992
	AI	19	9 (47.37)		

Among the different reproductive disorders, abortion and retained fetal membrane showed statistically significant association ($p<0.05$) with uterine infection that was expressed either in the form of endometritis or metritis (Table 4).

Table-4. Association of uterine infection with the other reproductive disorders of cows as a predisposing factor

Predisposing factors	Number of cows	Cows with uterine infection	Cows without uterine infection	χ^2	p-value
RFM	11	7(63.6%)	4(36.4%)	11.9	0.001
Abortion	6	5(83.3%)	1(16.7%)	13.11	0.000
Dystocia	3	1(33.3%)	2(66.7%)	0.16	0.688
Hypocalcemia	3	1(33.3%)	2(66.7%)	0.16	0.688

RFM=Retained Fetal Membrane

The study further revealed that all the serum samples (800) collected from Wondo Genet, Hawassa, Wolaita Sodo and Arsi Negelle were negative for bovine brucellosis.

DISCUSSION

The prevalence of reproductive disorder recorded by the retrospective study (42.47%) is comparable with the studies of Dawit and Ahmed (2013) and Hadush et al (2013), who reported 40.3% and 44.3% from Kombolcha and central Ethiopia, respectively. Based on the existing published literatures, the prevalence of reproductive disorders in dairy cows, as reported by different researchers from different geographic locations in Ethiopia, range from 8.99% to 67.8% (Shiferaw et al., 2005; Abreham et al., 2010; Molalegne and Shiv, 2011; Ayele et al., 2013; Hunduma, 2013; Ambaw et al., 2017; Abunna et al., 2018; Abdeta and Hailu, 2020). However, the current report and of course most of the reports made earlier in the country, are quite higher than the reports made from abroad (Maruf et al., 2012; Elhassen et al., 2015; Khan et al., 2016). This variation in prevalence might be due to the difference in sample size, study methodology, farm management, environmental factors and breed of the animals kept in the different farms. However, variation in management system that is applied in different dairy farms including provision of veterinary service, proper feed and feeding, housing, hygiene, timely heat detection and insemination, implementation of farm biosecurity measures and record keeping.

Among the observed reproductive disorders, retained fetal membrane (RFM) was the leading problem accounted for a prevalence of 14.15%. Similar findings have been reported elsewhere by Abreham et al. (2010) from Addis Ababa milk shed, Ahmed and Naod (2019) from Jimma town and Ayele et al. (2013) from Wolaita Sodo town. Although RFM occurs more frequently in dairy farms of the developing countries, it is still an economically important disease of US dairy industry and affects approximately 7.8% (range: 1.3 to 39.2%) of the dairy cows (USDA, 2009; Qu et al., 2014). The presence of RFM greatly increases the risk of metritis and endometritis (LeBlanc, 2008) because of tissue decomposition, compromised immunity and

patent cervical canal with a concomitant ascending infection. In line with this, the current study also showed that cows with RFM developed uterine infection more significantly than those without RFM.

Abortion, the second most frequently encountered reproductive disorder in the current study (11.7%), was also reported as the second leading reproductive disorder in most parts of the country (Molalegne and Shiv, 2011; Abunna et al., 2018; Abdeta and Hailu, 2020). Based on the retrospective and/or follow-up studies conducted earlier, the prevalence of abortion in dairy cows in Ethiopia ranges from 0.63% in Wolaita Sodo (Ayele et al., 2013) to 28.9% in Adea Berga Dairy farm, West Shewa (Siyoum et al., 2016). Such variation in the prevalence of abortion among these studies could be partly explained by the difference in host and management related risk factors and the presence of different etiological factors for the occurrence of abortion. Regardless of the cause, most cases of abortions in cows are followed by uterine infection and hence connected with delayed uterine involution in the postpartum period (Getnet et al., 2018). The current study also showed that over 80% of the cows with abortion later developed uterine infection.

Studies suggest that although the causes of abortion are both infectious and non-infectious in origin, in most cases where a diagnosis is reached, the cause is infectious (Cabell, 2007). The attempt made in the current study to estimate the prevalence of bovine brucellosis in 4 selected towns including Wondo Genet revealed that brucellosis is not prevalent in the area and hence could not be blamed for abortion cases at least in the study areas. The current finding is concordant with the previous studies conducted by Belihu (2002) and Asmare et al (2013) who couldn't find positive reactors in dairy farms of the Addis Ababa area and from central Ethiopia (Adama) and northern Ethiopia (Mekele and Gondar), respectively. These findings strongly suggest the presence of infectious and/or noninfectious causes other than bovine brucellosis that should be considered the moment other similar serological surveys are planned in the future.

Uterine infection, in the form of clinical endometritis / metritis, was the third commonly encountered reproductive disorder in the area (9.76%). This problem is also reported by other researchers from different parts of the country with prevalence ranging from 1.2% in Bedelle (Esheti and Moges, 2014) to 16.9% in Ada'a district (Molalegne and Shiv, 2011). According to Lewis (1997), as large as 40% of the postpartum cows in some herds abroad may be diagnosed with, and treated for, uterine infections. Variation among studies in the prevalence of uterine infection could be emanated from the difference in the diagnostic methods used, the classification of the uterine infections, the postpartum period during which the infections were detected, the parity of the cows, the general characteristics of the cows, or the herd management practices at large. Although the risk factors for uterine infections are well established (LeBlanc et al., 2002), prevention of uterine infections is usually difficult because of the presence of nonspecific bacteria on the lower genitalia and all over the cow's environment (Lewis, 1997). However, most researchers argue that attention to sanitation and periparturent hygiene, particularly during calving, may be the best and wise attempt

Anoestrus (8.3%) and repeat breeding (5.85%) were the other reproductive disorders encountered in the study area quite frequently. Unlike the current findings, these reproductive disorders, particularly anoestrus, are the leading problem in most parts of the country including Borena zone (Benti and Zewdie, 2014), Desie and Kombolcha (Ambaw et al., 2017), Hosanna town (Adane et al., 2014), Nekemte town (Abdeta and Hailu, 2020), Ada'a district (Esheti and Moges, 2014) and Dawro zone (Bizuayehu and Wale, 2016). Some studies from abroad including Khan et al. (2016) from India, Elhassan et al. (2015) from Sudan and Maruf et al. (2012) from Bangladish also indicated that these problems are the leading among other reproductive disorders. Although the causes and pathogenesis of anoestrus and repeat breeding are multifactorial and beyond the scope of this research article to discuss, both problems can partly be the aftermath of other interrelated reproductive disorders mainly dystocia, abortion, retained fetal membrane and uterine infections. Most of the owners mentioned that anoestrus and repeat breeding are the major reason for the culling of cows followed by lack of space and feed. In line with this, Agarwal et al. (2005) and Hadley et al. (2006) also conclude that failure to resume to cyclicity and timely conceive are the major reasons for economic losses and why cows are culled in most dairy farms of the globe.

The effort made to assess the association of different host and management related risk factors with the occurrence of the reproductive disorders revealed that only previous history of reproductive performance showed statistically significant association ($p<0.05$). This clearly showed that cows with poor reproductive performance in their previous reproductive cycle are more likely to develop at least one of the reproductive disorders in their subsequent pregnancies. This could be partly explained by the likelihood of development of permanent changes (functional and/or mechanical damages like scaring and stenosis) on the uterus and ovaries following most reproductive disorders (Bonneville-Hébert et al., 2011). The absence of association with the other considered risk factors need to be proved further with a larger sample size preferably on a wider geographic area.

CONCLUSION

This study revealed the presence of a serious reproductive disorders in cows of the study areas, Retained Fetal Membrane, Abortion, Uterine infection and Anestrus were the leading reproductive disorders followed by others. Among the considered host and management related risk factors, only the presence of previous reproductive disorder had statistically significant association with the occurrence of the problem. The serological survey demonstrate that brucellosis was not a problem in area including Hawassa, Wolaita Sodo and Arsi Negelle towns.

Since the causes of reproductive disorders are multifactorial, laboratory based studies should be conducted to identify the underlined causes of these problems in different parts of the country. Meanwhile, awareness creation to farm owners/attendants to improve their farm management system through proper housing and feeding, accurate and timely heat detection and insemination, regular consultation with animal health and production professionals, selection of feasible breeding method, maintaining hygiene of the cow and its environment and strict farm

biosecurity can significantly minimize the occurrence of these problems and associated economic losses in the dairy farms of the area.

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