
Study on Prevalence and Risk Factors of Major Reproductive Health Problems in Dairy Cows of Bale and West Arsi Zones, South Eastern Ethiopia

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Abstract: Reproductive health problems are the most common disorders which occur frequently in lactating dairy cows and can dramatically affect reproductive potential of the dairy herd. A cross sectional study was conducted from November 2020 to June 2021 with the objectives of determining prevalence of major reproductive health problems of dairy cows and possible risk factors associated in selected major milk sheds areas of Bale and West Arsi zones. Purposive and simple random sampling was employed to select study sites and study animals/households. Data were collected by semi-structured questionnaire format and from farm records where available. The result of the study showed that out of total 370 dairy cows assessed, 48.11% (178) were found to be affected either with one or more clinical reproductive health problems. The most frequently encountered reproductive health problems were anoestrus (17.42%) followed by repeat breeding (15.73%), retained fetal membrane (15.17%), mixed problems (14.04%), abortion (13.48%), clinical metritis (11.24%), dystocia (8.43%), still birth/weak calf (1.69%), vaginal prolapse (1.69%), and uterine prolapse (1.12%) was the least recorded. A Chi-square analysis revealed that prevalence of reproductive health problems was significantly associated with the hypothesized risk factors investigated such as age groups, breed, parity, origin of the cows, body condition scores, herd size, herd density and farm hygienic status ($P < 0.001$). Moreover, culling due to reproductive disorders and access to veterinary extension services and training were the risk factors with the strong associations with occurrence of reproductive disorders ($p < 0.008$). The current finding revealed reproductive health problems are prevalent in the study areas. There is a need to design and implement appropriate prevention and control measures in the dairy farms of the areas.

Keywords: Reproductive Tract, Disorders, Prevalence, Risk Factors, Dairy Cows, Bale, West Arsi

1. Introduction

Reproductive inefficiency of dairy cattle causes great economic loss and frustration for dairy producers [1]. The high economic loss to the dairy industry occurs due to slower uterine involution during parturition, reduced reproductive rate, prolonged inter-conception and calving interval, negative effect on fertility, increased cost of medication, drop in milk production, reduced calf crop and early depreciation

of potentially useful cows [2]. Among the major reproductive disorders that have direct impact on reproductive performance of dairy cows include abortion, stillbirth, dystocia, retained placenta, pyometra, metritis, uterine and vaginal prolapse, anoestrus and repeat breeding and infertility in subsequent pregnancies in cattle [3].

The available information indicates that reproductive problems are one of the most frequently encountered diseases of dairy cows in Ethiopia. According to Haile *et al.* [3], of the major disease of cross breed cows in Addis Ababa milk

shed, reproductive disease was the most frequent disease. In addition, Gebrekidan *et al.* [4] recorded that reproductive problems are the major causes of slaughter of female cattle in Addis Ababa Abattoir enterprise.

Studies conducted so far in Ethiopia were limited to areas and farming systems which are mainly restricted to towns and their peri-urban areas of central highlands of the country [5, 6]. Hence, the exact picture of reproductive health problems and associated risk factors in the study areas is not well documented. Therefore, to the best of our knowledge there is paucity of information and no published data with regard to reproductive health problems and its associated exposing risk factors in intensive or semi-intensively managed dairy cows of Bale and West Arsi zones in general and in selected sites of the zones in particular. Hence, taking into consideration the gaps indicated above, a cross sectional study was conducted to determine prevalence of reproductive problems in the study areas as well as to assess possible potential risk factors contributing to the problems.

2. Materials and Methods

2.1. Description of the Study Areas

The study was conducted in and around 7 selected sites of Bale and West Arsi zones, namely: Gindhir, Agarfa, Robe, Goba, Adaba, Dodola and Shashemene. The eight study sites of the zones were selected based on population size and abundance of dairy farms that constituted the known milk shed areas. Agricultural production system of the study area is mixed farming. Mixed crop/livestock production system is the main form of agriculture in both study areas. Dairy farming using improved breeds is a common practice in the areas.

2.2. Study Population

The study population consisted of cattle that are managed under semi-intensive and intensive production systems in each study sites. The cattle under study comprise of the local and cross breeds (Holstein-Friesian/Jersey crosses with indigenous zebu) of dairy cows in the study settings (from urban and peri-urban farms).

2.3. Study Design

A cross sectional study design was employed using different approaches namely, questionnaire surveys, interviews, focus group discussions and direct observation to determine the prevalence of major reproductive health problems of the dairy cows and the associated risk factors. Epidemiological information regarding the selected animals and herds were collected by questionnaire surveys, interviews, focus group discussions and direct observation and farm records to determine the prevalence and associated risk factors of major reproductive disorders of dairy cows in the study sites.

2.4. Sample Size and Sampling Methods

The sample size for the study was calculated using a method recommended by Thrusfield [7]:

$$n = \frac{1.96^2 \times P_{exp} (1 - P_{exp})}{d^2}$$

Where: n = required sample size, P_{exp} = expected prevalence & d = desired absolute precision.

To maximize the sample size (in order to improve accuracy), the proportion (P) was taken as 50%; the sample size is calculated using a method recommended by Thrusfield [7], with 95% confidence interval, at 5% desired absolute precision and expected prevalence of 50%. Accordingly, the total numbers of sample required for this study will be 384 dairy cows. However, by the addition of 10% of the samples as non-participating rate, a total of 423 dairy cows were sampled for the investigation. Purposive sampling was employed to select the seven sites based on population size and dairying. Prior to commencement of the study, list of all households of those kebeles were obtained from respective livestock and fishery resource development office. Then, list of households possessing dairy cows were sorted with the help of agricultural development agents. Identification numbers were given for the sorted households/using their ear tag numbers from the farm list. Then, simple random sampling method was applied to select 423 households for the investigation.

2.5. Methods of Data Collection/Collection of Epidemiological Information

The data were collected using different tools to assess the prevalence of major reproductive health problems of the dairy cows and the associated risk factors. Both quantitative and qualitative data collections methods were used to collect both primary and secondary source of data with the objective of triangulating and checking the validity of information collected from different sources. The detailed questionnaires were pre-tested, checked for clarity prior the interview and adjusted by translating in to local language (Afan Oromo) and administered by the interviewer who speaks the same language with the participant respondents and finally translated into English. Herd and individual animal level data were collected by a semi-structured questionnaire.

2.6. Data Storage and Analysis

The data collected from the study sites were entered into computer using Microsoft Excel and transferred to STATA version 11.0 for Windows (Stata Corp. College Station, TX, USA) for statistical analyses. Both descriptive and analytical statistical methods were applied. Frequency and percentages were computed to describe the relevant variables. The prevalence of reproductive health problems was determined as the proportion of affected animals out of the total animals examined. The association between dependent and independent factors were analyzed using Chi-square (χ^2). A p-value < 0.05 was considered statistically significant.

3. Results

3.1. Prevalence of Major Reproductive Disorders in the Study Areas

The result of the study showed that out of total 370 dairy cows assessed, 48.11% (178) were found to be affected either with one or more clinical reproductive health problems. The

most frequently encountered reproductive health problems were anoestrus (17.42%) followed by repeat breeding (15.73%), retained fetal membrane (15.17%), mixed problems (14.04%), abortion (13.48%), clinical endometritis/ metritis/ pyometra (11.24%), dystocia (8.43%), still birth/weak calf (1.69%), vaginal prolapse (1.69%), and uterine prolapse (1.12%) was the least recorded as shown in Table 1.

Table 1. Prevalence of major reproductive problems in dairy cows of study sites (n=178).

S/n	Reproductive disorders	Number of dairy cows affected	Prevalence (%)
1.	Anoestrus	31	17.42
2.	Repeat breeding	28	15.73
3.	Retained fetal membrane (RFM)	27	15.17
4.	Mixed problems	25	14.04
5.	Abortion	24	13.48
6.	Clinical endometritis/metritis/pyometra	20	11.24
7.	Dystocia	15	8.43
8.	Still birth/weak calf	3	1.69
9.	Vaginal prolapse	3	1.69
10.	Uterine prolapse	2	1.12
Total		178	100%

3.2. Prevalence of Reproductive Disorders in Each Study Sites

The prevalence of reproductive health problems was highest in Shashemene (52.94%) followed by Robe (49.23%), Goba (48.33%), Dodola (46.94%), Adaba (46.67%), Agarfa (46.51%) and the lowest was recorded in Gindhir (42.50%). There was no significance difference ($P > 0.05$) in prevalence of reproductive problems among the study sites as depicted in Table 2.

Table 2. Seroprevalence of reproductive problems in dairy cows in the study sites.

Study sites	Samples tested	Samples positive	Seroprevalence (%)
Shashemene	68	36	52.94
Robe	65	32	49.23
Goba	60	29	48.33
Dodola	49	23	46.94
Adaba	45	21	46.67
Agarfa	43	20	46.51
Gindhir	40	17	42.50
Overall	370	178	48.11

Pearson χ^2 (2) = 1.282; Pr = 0.973; Pr = Precision value.

3.3. Association of Hypothesized Risk Factors with Prevalence of Reproductive Disorders

A Chi-square analysis revealed that prevalence of reproductive health problems was significantly associated with the hypothesized risk factors investigated such as age groups, breed, parity, origin of the cows, body condition

scores, herd size, herd density and farm hygienic status ($P < 0.001$). Moreover, culling due to reproductive disorders and access to veterinary extension services and training were the risk factors with the strong associations with occurrence of reproductive disorders ($p < 0.008$). However, its association with type of breeding service and grazing pattern was not statistically significant ($P > 0.05$) (Table 3).

Table 3. Association of hypothesized risk factors with prevalence of reproductive disorders.

Variables	Category	Number assessed	Prevalence of reproductive disorder (%)	χ^2 (p-value)
Age	Young (≤ 5 years)	83	17 (20.48)	32.713 (0.000)
	Adult (> 5 years)	287	161 (56.10)	
Breed	Local	69	12 (17.39)	32.057 (0.000)
	Cross	301	166 (55.15)	
Parity	Primiparous	85	18 (21.18)	32.061 (0.000)
	Multiparous	285	160 (56.14)	
Origin	Homebred	211	58 (27.49)	83.627 (0.000)
	Purchased	159	120 (75.47)	
Body condition score (BCS)	Poor	117	79 (67.52)	34.725 (0.000)
	Medium/good	139	43 (30.94)	
	Over-conditioned	114	56 (49.12)	

Variables	Category	Number assessed	Prevalence of reproductive disorder (%)	χ^2 (p-value)
Herd size	Small (≤ 5)	196	73 (37.24)	20.887 (0.000)
	Medium (<10)	115	66 (57.39)	
	Large (≥ 10)	59	39 (66.10)	
Herd density	Small ($<4\text{m}^2$)	178	67 (37.64)	15.056 (0.000)
	Large ($\geq 4\text{m}^2$)	192	111 (57.81)	
Farm hygiene	Poor	263	143 (54.37)	11.036 (0.001)
	Good	107	37 (34.58)	
Type of breeding service	AI	177	93 (52.54)	2.650 (0.266)
	AI & Bull	111	51 (45.94)	
	Bull	82	34 (41.46)	
Predominant culling reasons	Logistics	151	60 (39.74)	16.302 (0.000)
	Miscellaneous diseases	137	63 (45.99)	
	Breeding disorders	82	55 (67.07)	
Veterinary extension service & training	No	336	169 (50.30)	7.022 (0.008)
	Yes	34	9 (26.47)	
Grazing pattern	Zero grazing	203	105 (51.72)	3.198 (0.202)
	Partial grazing	91	43 (47.25)	
	Free range & supplemented	76	30 (39.47)	

4. Discussion

The present assessment disclosed high prevalence of reproductive health problems of dairy cows in the study sites. Out of the total 370 dairy cows investigated, 178 (48.11%) cows were reported to have suffered at least with one reproductive disorder during their lifetime. The current finding concurs with the report by Melkamu [8] (50.9%) in Holleta. However, it was higher than the report recorded by Simeneh and Moges [9] (25%) from Gondar and Mathew *et al.* [10] (33%) from Tanzania. Nevertheless, the current report was lower than the seroprevalence rate of by Mitiku [11] (61.35%) from Durame. These differences in the results of the present study might be attributed to sample size, production system, study methodology and breed of animals, variation in management system and nutritional factor applied in different dairy farms [12].

The prevalence rate of anestrus/prolonged anoestrus observed in this study (17.42%) is higher than the report of Adane *et al.* [13] who recorded 10.26% in cross breed dairy cows in Hosanna, Southern Ethiopia. There are researchers who proposed that the high rate of anoestrus was due to genital infections [14] and crossbreeds were more affected than indigenous cattle [15]. That is because of Zebu cattle are adapted to tropical conditions of high temperature and humidity, diseases and low quality of feed than the European breeds [16].

The prevalence of repeat breeding (RB) in the present study (15.73%) is lower than the study conducted by Hunduma [17], who reported a prevalence of 26.8% from Central Ethiopia. This variation for repeated breeding might be due to various predisposing factors such as use of infertile bulls, malnutrition, reproductive tract infections and improper management practices [18].

The prevalence rate of retained fetal membrane (15.17%) in the study areas is in harmony with the finding of Haile *et al.* [3] who record 14.7% from Addis Ababa milk shed. Some other studies reported lower prevalence of RFM, which could be due to good management especially feeding and good sanitation [5]. The variation in the incidence of RFM may be

attributed to differences in predisposing factor in different site of study to which the animals are subjected to different condition, like; nutritional status and management [19].

The occurrence of mixed reproductive problems (14.04%) is higher than the result documented by Gashaw *et al.* [20] (5.6%). The relatively higher prevalence rates of mixed reproductive problems could be due to the inter-relationship of reproductive disorders as risk factors for each other. Mixed cases include abortion and RFM; RFM and anestrus; dystocia and RFM; metritis and RB and RFM and metritis were the most commonly occurred in the study area. This indicated that most reproductive disorders are interrelated and occurred in mixed form rather than individually [11].

The prevalence rate of abortion in the current assessment (13.48%) concurs with that of other researchers from different parts of the country, Bitew and Prasad [15] (13.9%) from Bedelle; Hunduma [21] (14.6%) from Assella; Benti and Zewdie [22] (12.2%) from Borena. However, it is higher than that of Mekonnin *et al.* [23] (6.4%) from Mekelle. The variation in the occurrence of abortion might reflect differences in the management systems, age and breed among dairy farms, creation of awareness to dairy farm owners, causative agents/etiology of abortion [24].

The present prevalence rate of clinical endometritis/metritis/pyometra (11.24%) is in contrary to the finding of Berihu and Abebaw [18] (3.21%) from Bako. The reason for this significant variation might be due to the difference in management system, environmental factors that are applied in different dairy farms as well as RFM, injury of the reproductive tract, injury at the time of breeding and uterine treatment and contamination of the reproductive tract during calving period [12].

The prevalence of dystocia obtained in this study (8.43%) was higher than previous report of 2.9% by Hadush *et al.* [5], 3.3% reported by Esheti and Moges [6], and Gashaw *et al.* [20] (3.8%). Nonetheless, it fairly agrees to the prevalence of 7.75% obtained by Dawit and Ahmed [25]. This variation in the occurrence of dystocia may be due to the fact that it is influenced by the factors such as age and parity of the dam, breed of the sire and size of the dam as well as nutritional

status. Inseminating cows with semen collected from large sized bulls without taking into account the size and age of cows is an important factor in precipitating dystocia [26].

Stillbirth in this study was occurred at the rate of 1.69% which is bit less than the findings of Haile *et al.* [3] who reported stillbirth rate of 2.8% in cross breed dairy cow under smallholding in Addis Ababa milk shed, and 3.01% reported by Dawite and Ahmed [25]. But the prevalence of stillbirth (1.69%) observed in this study is nearly in line with the finding of Tulu and Gebeyehu [27] who reported 1.0% prevalence of stillbirth in Boloso Sore, southern Ethiopia. Still births can occur due to forceful fetal extraction, hypocalcaemia and various pathogens [25].

The prevalence rate of vaginal prolapsed (1.69%) recorded in this study is comparable to the 1.24% and 1.95% reported by Dawite and Ahmed [25] and Hadush *et al.* [5], respectively. This variation might be due to management system, sample size, environment and breed of animals. In addition, the prevalence of uterine prolapse (1.12%) in this study is slightly higher than the previous report by Adane *et al.* [13], and Dawite and Ahmed [25] who recorded 0.76% and 0.56%, respectively. The possible factors attributed to uterine prolapse is forced traction of fetus at parturition, puerperal disease and nutritional deficiency [13].

Age and parity were significantly related ($P < 0.05$) with occurrence of reproductive disorders and the highest prevalence of reproductive problems was increased along increasing of age and parity which was lower than the finding by Dawit and Ahmed [25] from North Eastern Ethiopia. Increased reproductive problems along increased age and parity might be due to repeated exposure of aged and multiparous cows for different factors which contribute for reproductive problems (uterine infections) [13, 25].

The higher prevalence rate of reproductive problems in cross breed than that of local breed is in agreement with the reports of other researchers [16, 28]. The higher incidence of reproductive problems was in cross breed than in local cattle which might be due to the fact that cross breed/European breed is less adapted to tropical conditions of high temperature and humidity, disease and low feed quality than local breeds making them more susceptible. Beside this, cross breed requires more elaborated management, feeding, and better health care than the indigenous zebu to get better reproductive performance [16].

In the present study, BCS significantly influenced the occurrence of reproductive disorders in dairy cows of the study sites. The lowest occurrence of reproductive diseases in cows with medium BCS and the highest occurrence of reproductive diseases in cows with poor BCS followed by over-conditioned BCS were also reported by Hadush *et al.* [5] which agrees with the present finding. BCS has a good reflection on the reproduction as well as reproductive disorders [29]. Cows with good BCS conceived at a higher rate than did thin and over-conditioned ones. BCS at oestrus positively correlate with the conception rate. The authors reported that cows with lower BCS had longer intervals from calving to first ovulation and less detected estrus. Similar reports are available on

postpartum cows brought for first service [30].

Farms with higher herd density were significantly associated with prevalence of reproductive disorders. This finding is comparable with the report of Dubuc *et al.* [31]. Tightly packed cows create high humidity and are often under stress, and predisposed to reproductive health problems [31, 32]. Likewise, the significant association of occurrence of reproductive health problems ($p < 0.05$) accords with the reports of other investigators [32, 33]. Maintaining a clean and comfortable environment for cows is of major importance in control of reproductive disorders [34]. Moisture, mud and manure present in the environment of the animals are primary sources of exposure for reproductive health problems pathogens [32].

5. Conclusion and Recommendations

The investigation of the present study indicated considerably high prevalence of reproductive disorders recorded either singly or in combination (mixed problems). Age, breed, parity, origin of the cows, body condition scores, herd size, herd density and farm hygienic status are important potential risk factors identified for the occurrence of reproductive health problems. Reproductive disorders appear to be a highly prevalent and widely distributed in the study sites. Hence, further detailed research in specific aspects of breeding systems, regular health checkups, health care and management aspects would help to identify specific interventions that could be used to improve dairy cattle productivity.

Conflict of Interests

The authors declare that they have no competing interests.

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