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Major Reproductive Health Problems of Dairy Cattles in Gondar Town, Amhara, Ethiopia

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Abstract: Both cross sectional and prospective study were conducted to determine the major reproductive health problems and its possible risk factors of dairy cows from November 2016 to April 2017 in Gondar town, North West part of Ethiopia. A total of 384 dairy cows (311 cross and 74 local breed) were investigated. From the total animal assessed, 44.7% (n=172) were found to be affected with one or more of the reproductive health problems. Out of those animal affected with reproductive health problems, anoestrus (37%), repeat breeding (15.4%) and dystocia (7.5%), were found to be the major one. There was a significant association ($P<0.05$) in the prevalence of reproductive health problems with respect to age, breed, body condition score, method of insemination and production system. However, parity had no significant association on the occurrence of reproductive health problems. Poor management practice like unsatisfactory feeding, housing, health and reproduction practices and lack of regular clinical follow up by animal health professional in the farms are the main cause of reproductive health problems of dairy cows. Therefore, routine and period of examination, proper hygienic condition, feeding and housing, accurate heat detection and health management should be improved to minimize the occurrence of these problems and associated economic losses in the dairy farms of the study area.

Key words: Dairy Cow · Gondar · Risk Factors · Reproduction Health Problem

INTRODUCTION

Ethiopia is known for its high livestock population, being the first in Africa and tenth in the world. The country total cattle population is estimated to be about 56.71 million. Out of this the female cattle constitute about 55.45% and the remaining 44.55% are male cattle and 98.66% of the total cattle in the country are local breeds and remaining are hybrid and exotic breeds that accounted for about 1.19% and 0.14%, respectively [1]. The livestock subsector contributes about 16.5% of the national Gross Domestic Product (GDP) and 35.6% of the agricultural GDP [2]. It also contributes 15% of export earnings [3] and currently supports and sustains livelihoods for 80% of all rural population [2].

Despite the huge number of cattle in the country, productivity is low due to constraints of disease, nutrition, poor management and poor performance of endogenous breed. This constraint results in poor reproductive performance of dairy cattle and lower economic benefit from the sector [4].

Dairying is practiced almost all over Ethiopia involving a vast number of small, medium or large-sized, subsistence or market-oriented farms. Based on climate, land holdings and integration with crop production as criterion, dairy production systems are recognized in Ethiopia; namely the rural dairy system which is part of the subsistence farming system and includes pastoralists, agro-pastoralists and mixed crop–livestock producers; the peri-urban; and urban dairy systems [5]. The first system (Pastoralism, agro pastoralism and highland mixed smallholder production system) contributes to 98%, while the peri-urban and urban dairy farms produce only 2% of the total milk production of the country [6].

Reproductive performance is one key component of dairy production and the goal of reproductive management in dairy cattle is to have cows become pregnant in an efficient manner and at a profitable interval after calving [7]. So, high reproductive efficiency is necessary for a successful dairy operation and requires a calving interval that maximizes milk production within the herd [8]. Good estrus detection, good insemination technique, quality semen and a healthy uterine environment are critical components of high reproductive efficiency [9] whereas reproductive inefficiency is one of the most costly problems facing the dairy industry today.

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Reproductive problems occur frequently in dairy cows and can dramatically affect reproductive efficiency in a dairy herd [10].

Regular breeding depends upon the normal function of the reproductive system. In order to breed regularly, the cow has to have functional ovaries, display estrous behavior, mate, conceive, sustain the embryo through gestation, calve and resume estrous cyclicity and restore uterine function after calving. Each of these aspects of reproductive function can be affected by management, disease and the genetic make-up of the animal. When the function of the reproductive system is impaired, cows fail to produce a calf regularly. Among the major problem that has direct impact on reproductive performance of dairy cows are abortion, dystocia, retained fetal membrane (RFM), repeat breeding, uterine and vaginal prolapse. This could be classified as postpartum and prepartum [11].

The post-partum period is the most varied and vulnerable to problems and that incidentally coincides with the peak of milk production, uterine involution and resumption of ovarian activity, conception and greater risk to infection [12]. These result in considerable economic loss to the dairy industry due to slower uterine involution, 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 [11, 13]. But in dairy industry the reproductive goals that we need to follow are 12 months of calving interval, 85 days open, 1.6 services per conception rate and 85% of cows observed in estrus and recorded by 60 days fresh [14]. It is very difficult to diagnose those problems by one particular disorder or symptom because there is interrelation between predisposing factors such as management at calving, hygiene and parity, stage of gestation, nutrition and environment [14, 15].

The livestock production system, especially the dairy production, is the most important issue in Northern part of Amhara region. The demand of dairy and dairy products is coming greater and greater due to high population density and increased the trend of urbanization in the study area. There are so many dairy farms in Gondar in which their product serves as a source of food and income generation to the society. These farms are present in different production systems and herd size (Scale of production). Although there are many dairyfarms, the productivity of dairy cows in these farms is not as much as farmers expectations due to different reproductive health problems and poor management practices that greatly responsible for high economic losses in dairy industry. In addition, ample studies have not been conducted on the major reproductive health problems in dairy animals.

Therefore, the Objectives of this Study Were: Assess the major reproductive health problems of dairy farms and and to identify risk factors associated with reproductive disorder in the study area.

MATERIALS AND METHODS

Study Area: The study was conducted from November 12, 2016 to April 22, 2017 in Gondar town, North West part of Ethiopia. Gondar town, the capital city of North Gondar administrative zone, which is one of the eleven administrative zones located in Amhara regional state. The area is 740Km North West of Addis Ababa at latitude, longitude and altitude of 12.3- 13.8° N, 35.3-35.7°E and 2,200m.a.s.l respectively. The annual minimum and maximum temperature of the area vary between 12.3-17.7°C and 22-30°C respectively. The average rainfall is about 1419 mm. According to zonal agriculture office the livestock population of North Gondar is registered 1,936,514 cattle (Cross and local), 524, 083 sheep, 682, 264 goats, 36,828 horse, 12,473 mules, 223,116 donkey and 3,165,068 poultry.

Study Animals: The study was conducted on dairy cows that were under different age group, body condition score (BCS), parity number and kept in different management systems. Both local and cross breed cows were included in the study.

Sample Size and Sampling Method: The sample size required for this study was determined depending on the expected prevalence of reproductive problems and the desired absolute precision by the formula given by Thrusfield [16].

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

Where,
N= Number of sample; D= Desired absolute precision
P_{exp}= expected prevalence

$$N = \frac{(1.96)^2 \text{ X } 50\% \, (1 - 50\%)}{(5\%)^2} = \frac{3.8416 \text{X} 0.5 \text{X} 0.5)}{(0.05)^2}$$

$$= \frac{0.9604}{0.0025} = 384 \text{ dairy cows}$$

Therefore, using 95% confidence interval, 5% precision and 50% expected prevalence, the number of cows needed to demonstrate the prevalence of reproductive health problems in the study area was 384 dairy cows.

A sampling frame i.e. the list of the dairy farms was acquired from the urban agricultural development office at the beginning of the study. The number of farms sampled in the study was determined by $N=0.25/SE^2$, where N= number of sampled farms, SE=Standard error [17]. Standard error of 5% with 95% confidence interval were Considered. About 150 farms housing dairy animals were considered as the sampling frame. From this, 100 farms were selected. The number of cows selected from each farm was proportional to cow's number in each cluster (Farm) by simple random sampling method.

Study Design: A cross-sectional type of study was carried out on reproductive disorders and its associated risk factors which were under taken from November 2016 to April 2017. Moreover, longitudinal study was conducted on purposively selected dairy farms.

Data Collection

Questionnaires Study: A structured questionnaire was prepared and data collection were conducted on selected dairy farms to collect information from dairy farm owners; attendant/managers in one visit interview about the breed, feeding system, production system, health care and reproductive problems of their dairy cattle on individual level were studied. The questionnaire was checked for clarity of the questions prior to the interview and also respondent was briefed to the objective of the study by using local language. Following that, the actual questions were presented for the respondents.

Observational (Longitudinal) Study: The observational study which is specifically prospective was conducted through regular visit of the dairy farms at interval of once per three weeks throughout the study period. The study animals were identified by their tag number or identification card (ID). Those animals without ID were identified by their skin color, horn (Polled, hornless or other) and by identification mark. Pregnant animals suspected to give birth within the study period and heifers that has age of two years and above were included and follow up from the start to the end of study period. To do this observational study, data collection format was prepared and filled about the management, risk factors and any reproductive health problems occurred on each cows. On both types of techniques the knowledge of clinical diagnosis, history taking and response to previous treatment were essential tools to group the disease and problems in systematic and comparative manner.

Finally, those cows included in the study were judged as cows with and without reproductive health problems according to the following definitions.

Repeat Breeder: A cow that failed to conceive for three or more consecutive services is considered as repeat breeder [18].

Anoestrous: A state of complete sexual inactivity with no manifestation of estrus for more than two months [19].

Abortion: Is a loss of the fetus between the age of 42 days and approximately 260 days [20].

Stillbirth: Defined as a calf loss from day 260 until the end of normal gestation period [21].

Dystocia: A condition in which the first or especially the second stage of parturition was prolonged markedly for more than 6 hr and the cow required assistance [22].

Uterine Prolapse: The coming out of uterus through the vulva commonly shortly after parturition and hanged out with the inner surface outer most [23].

Vaginal Prolapse: The protrusion of the vagina and sometimes with the cervix through the vulva [24].

Retained Fetal Membranes (RFM): Is defined as the failure to pass all or part of the placenta from the uterus after 12 hours of calving [25].

Body Condition Scoring: Body condition was scored in order to assess the nutritional status of the animal and its association with the prevalence of reproductive problems. Animals were grouped into poor, medium and good BCS. The measurement was done through palpation and visualization of the transverse and spines processes for the lumbar vertebrae (Loin), the head of the tail.

Description of Variables: In this study, there were various risk factors for the occurrence of reproductive health problems which was regarded as independent variables and an outcome variable (Dependent variable), which was reproductive problems. The possible risk factors to be studied in this study were include age, parity, breed, BCS, method of insemination

and production system and the dependent variables were repeat breading, anoestrus, abortion, dystocia, still birth, RFM, uterine and vaginal prolapse.

Data Management and Analysis: Data from questionnaire and observational studies was entered in to Microsoft excel spreadsheet (MS Excel 2007) and analyzed using SPSS version 20. The prevalence of reproductive health problems was determined as a proportion of affected animals out of the total animal examined. The chi-square ($x^{2)}$ test was used to assess the association between risk factors and the occurrence of the reproductive problems. In all the analysis, confidence level was held at 95% statistical analysis by considering significant at $p<0.05$.

RESULTS

Out of the total 384 dairy cows examined based on questionnaire and regular follow up, 172 (44.7%) cows have suffered from at least one of the reproductive health problems. Accordingly, cows suffered from reproductive problems by questionnaire interview and on regular follow up were 46.3% (n=156/339) and 34.8% (n=16/46), respectively (Table 1).

Questionnaire Study

Animals' Management: From the total of 384 dairy cattle, cows under intensive and semi intensive management were 234 (60.8%), 150(39.2%), respectively and of which 310 (80.8%) were cross breed and the rest 74 (19.2%) were local breed. Most of the respondents bred their animals by using AI (68.6%) and only about 31.4% of respondent bred by natural mating.

Almost the entire respondent agreed that feeding practice depends on the availability of feed because of land and water that is important factors for cultivation of animal feed is limited in the farm area. The feed on which the animals are fed include green pasture, hay, straw, crop residues, alfalfa and brewery byproduct were among the common and mainly available feed types. As replied by the respondent, there was no regular vaccination and deworming practices but they took their animals for treatment whenever diseases occurred. The most common housing systems for dairy cattle in the study area were indoor (Closed barn) and outdoor (Tether) system, 88.1 and 11.9%, respectively. The sanitary condition varies from poor (65%) to good (35%).

Major Reproductive Disease Identified: Major reproductive health problems in the dairy cows include anoestrus (37%), repeat breeding (15.4%) and dystocia (8%). Other reproductive health problems in the study area include RFM, abortion, still birth, uterine prolapse and vaginal prolapse, (Fig. 1).

Observational Study: During the study period using regular follow up, a total of 46 cows were examined, from which 16 (34.8%) cows were affected at least by one of the major reproductive health problems. The prevalence of repeat breeding, anoestrus, abortion, still birth, dystocia, vaginal prolapse and RFM was found to be 10.9, 32.6, 4.3, 4.3, 4.3, 6.5 and 6.1%, respectively.

Association of Risk Factors with Reproductive Health Problems of Dairy Cattle

The overall prevalence of each reproductive health problems in both questionnaire and regular follow-up were 15.4%repeat breeding, 37%anoestrus, 4.7%abortion, 4.7%still birth, 7.5%dystocia, 1.8%vaginal prolapse, 1.3%uterine prolapse and 4.2%RFM.

Among risk factors of this study, age, breed, parity, method of insemination, BCS and production system were considered as a risk factors to assess its association with the overall occurrence of the reproductive health problems on both questioner and observational study. Age, breed and BCS were found significantly affected ($p<0.05$) the overall prevalence of the major reproductive health problems as shown in table 2.

Parity number have not statistically significant association ($p>0.05$) with the overall prevalence of the reproductive health problems, but method of insemination had statistically significant association ($p<0.05$), in which the prevalence were higher in cows bred by AI (66.8%) than those cows bred by natural service (33.7%).

On the other hand, the prevalence of reproductive health problems were higher in cows that were kept under semi-intensive production system (53.6%) than those were kept in intensive system (38.9%) with statistically significant associations ($p<0.05$). This could be due to lack of records, faulty heat detection, poor nutrition and management in the semi- intensive production system.

Table 1: Prevalence of reproductive health problems on different method of studies

Method of study	No. of cows examined	No. of cows with reproductive problems	Percent affected(%)
Questionnaire study	338	156	46.3
Regular follow- up	46	16	34.8
Total	384	172	44.7

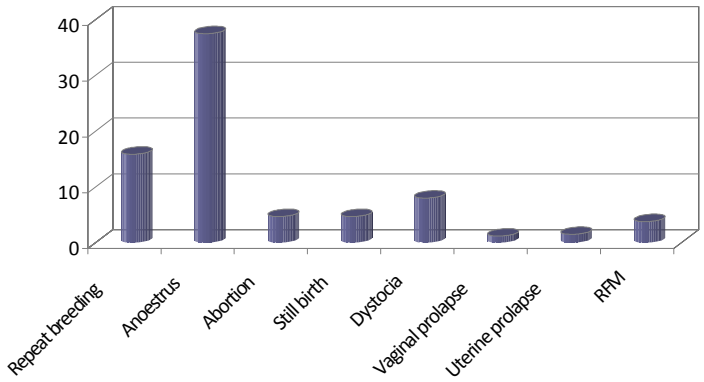

Fig. 1: Prevalence of major reproductive health problems on questionnaire study

Table 2: Percentage and association of major reproductive health problems with risk factors

Risk factors	Category	Total cow examined	Total cow affected	Percent (%)	X^2	P-value
Age	3-6 years	214	86	40.2	35.445	0.032
	7-10 years	138	55	39.9		
	> 10 years	33	21	63.6		
Breed	Local	74	29	39.5	17.198	0.0001
	Cross	311	206	66.2		
BCS	Poor	189	73	38.6	21.941	0.0001
	Medium	44	34	19.7		
	Good	152	65	42.8		
MI	Natural	264	89	33.7	40.848	0.001
	AI	121	83	68.6		
Parity	Primiparous	61	25	41	0.4	0.576
	Multiparous	324	147	45.4		
PS	Intensive	234	91	38.9	8.082	0.004
	SI	151	81	53.6		

NB: MI and PS stands for method of insemination and production system, respectively.

DISCUSSIONS

In the present study a total of 384 animals were examined during the study period based on questionnaire study and regular follow up, from which 172 animals were positive for one or more reproductive health problems with overall prevalence of 44.7%.The prevalence of major reproductive problems reported in this study was higherthan that of a study conducted by Adane *et al*. [26] and Dawit and Ahmed [27] who reported an overall prevalenceof43.07% and 40.25%, respectively. This variation might be due to sample size, production system, study methodology and breed of animals as well as environmental factors. Differences in management systems and environmental conditions under which cattle are maintained could greatly affect the prevalence of reproductive health problems [28].

Older cows were more vulnerable than that of heifers with prevalence of 63.6% and 40.2%, respectively. An increased rate of reproductive health problems with increased age of cows was due to the fact that frequency of exposure to reproductive health problems with increased age, lack of uterine tone and slow involution of the uterus at high parity [29].

Cross breed cows were more susceptible to reproductive health problems at 66.2% than local breed (39.5%) cows. This variation in breed with the overall reproductive health problems could be due to less adaptive behavior of the cross breed cows to tropical condition such as high temperature, humidity and various diseases [29]. It is also reported that cross breeds require more intensive management, feeding and better health care than the indigenous zebu to attain better reproduction and production performances in the tropics [30].

The effect of BCS on the prevalence of the major reproductive health problems in good and poor condition animals were 42.8% and 38.6%, respectively. The higher

prevalence of reproductive health problems found in animals of poor and good body condition may be attributed to the fact that poor animals do have weak expulsive force to drop their placenta after birth or to give birth without assistance which is followed by secondary complication and poor defense mechanism that increase rate of infection and an obese/fat cow was more susceptible to metabolic problems and infections and is more likely to have difficult at calving and expulsion of placenta. Therefore, thinness or fatness could be a clue to underlying nutritional imbalance and health problems or improper herd management [31].

Reproductive health problems were seen increased from primiparous to multifarious with prevalence of 41% and 45.4%, respectively. A reproductive system of aging cows (Cow with higher parity) probably involves more complex and permanent uterine changes than those cows with lower parities. The effect of parity number on the occurrence of reproductive problems is probably due to repeated exposure of the genital tract to environmental factors which result in increased uterine infections. Longer recovery time from parturition, lactation stress and the low feed intake capacity of the older cows could also be other reasons for this variation [32].

The common cause of repeat breeding was a cystic ovarian disorder, anovulation, delayed ovulation, early embryonic mortality, improper timing of AI, lack of knowledge of proper heat detection, using old and infected bull, poor quality semen and inexperienced inseminator [33].The prevalence of repeated breeding (15.4%) found in the present study is line agreement to the 15.9%prevalence rate reported by Getachew and Nibret [34] from Ada'adistrict of East shoa, Ethiopia, but higher than the 13.08% prevalence rate reported by Adane *et al*. [26] from Hosanna, Southern Ethiopia. But this finding was lower than that of 21% prevalence rate reported by Alemselam *et al.* [35] from Mekelle, Tigray,Ethiopia. The variation between the values of the current study and previous reports could be due to the above factors.

The percentage of anoestrus (37%) in the present study is in line with Alemselam *et al.* [35] who reported a prevalence of 37.8%from Mekelle, Tigray, Ethiopia but higher than that of Khan [36] who reported a prevalence of 31.79% in North-Eastern India. This could be due to the differences in breed, nutritional status and other management system. Major reason for anestrus in dairy cattle is due to poor quality ration provided by the farmers, lack of round the year green fodder availability and poor managemental practices [33].

Another important reproductive disorder found in the present study was dystocia, accounted for 7.5% which is in close to Dawit and Ahmed [27] reported as 7.75%. Because definitions of dystocia vary in the literatures, there is variation in the international prevalence of calving difficulty. Internationally, reported prevalence in dairy cattle of severe or considerable difficulty in calving varies from just below 2% to over 22%. Improper cervical dilation, failure of uterine expulsive forces (Uterine inertia) and neoplasm of vagina, vulva and uterus could be the maternal causes of dystocia in cows [37]. According to Anderson *et al*. [38] dystocia primary occurs among first calf heifers as a result of feto- pelvic disproportion *i.e*., because of calf size or pelvic dimension of dam. 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 [23].

The prevalence of both abortion and still birth in the present study were 4.7%, which is less than the findings of Dawit and Ahmed [27] in Kombolcha, Northeast Ethiopia, who reported 9.05% and 3.01%, but higher than that of Alemselam *et al.* [35] from Mekelle, Tigray, Ethiopia, who have reported a prevalence rate of4.0% and 0.1%, respectively. The difference in prevalence of abortion may be due to variation in practice of AI, genetic, nutritional status, infection, level of toxicities and husbandry management system in different areas. Abortion can occur due to metabolic or hormonal abnormalities, nutritional deficiencies, trauma, toxicities, or infectious agents [32].

The prevalence of RFM in this study was 4.2%, which is higher than previous reports of Hadush [39] who reported that 3.5% from central Ethiopia. In contrast to this finding, higher prevalence of RFM were reported from different part of Ethiopia (7.32, 7.18, 11.5, 8.3 and 7.6,) reported by Adane *et al.* [26], Dawit and Ahmed [27], Alemselam *et al.* [35], Temesgen and Tegegn[40] and Ararsa and Wubishet [41].The difference may be due to different predisposing factors to which the animals are subjected to. Among which, abortion, dystocia, fetal presentation, parity of dam, infection, nutritional status and management problems have all been shown to affect the prevalence of RFM. The low prevalence of RFM in this study might be linked to the low prevalence of abortion (4.7%), a known predisposing factor for RFM [42].

The prevalence rate of vaginal prolapse (1.8%) recorded in this study was lower to the prevalence of 2.9% and 2.7% reported by Adane *et al.* [26] and Alemselam *et al.* [35], respectively. This variation might

be due to management system and breed of animals. On the other hand, the prevalence rate of uterine prolapse (1.3%) was higher than that of Adane *et al.* [26] and Dawit and Ahmed [27] reported 0.43% and 0.76% in Kombolcha, Northeast Ethiopia and in urban and per urban area of Hosanna, Southern Ethiopia, respectively. But lower than that of Ararsa and Wubishet [41] who reported 2.7% in Borena, Ethiopia. Uterine prolapsed is usually associated with hypocalcaemia or milk fever, poor uterine tone, increased straining, weight of the retained fetal membrane and excessive estrogen content in the feed [43].

CONCLUSION

This study revealed higher prevalence of reproductive health problems in the study area. Anoestrus, repeat breading and dystocia were found the most frequently encountered reproductive health problems of dairy cows. Cross breed cows were found more susceptible to reproductive health problems than local breed cows. These reproductive health problems could be due to the poor management practice like unsatisfactory feeding, housing, health and reproduction management practices, poor farm hygienic practices and lack of regular clinical follow up by animal health professional in the farms. The possible risk factors responsible for the occurrence of reproductive health problems identified were age, breed, BCS, method of insemination and production system.

Based on the above conclusion, the following recommendations are forwarded.

Improvement of hygienic condition of the farms and proper management and handling of cows should be practiced.

- Routine and periodicexamination of cows should be practiced by animal health professionals. ows with high exotic blood level need to be handled with sound care and management.
- Community awareness on the early control and prevention activities of reproductive disorder should be done.
- Further study should be conducted to identify risk factors, to assess the status of the animals and design control strategy.

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