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Major factors influencing the reproductive performance of dairy farms in Mekelle City, Tigray, Ethiopia

Abstract

The study was conducted from November 2011 to April 2012 with the objective of assessing major factors influencing the reproductive performance of dairy cattle in selected farms of Mekelle city. Thirty two dairy farms; 19 from private, 11 from cooperative and 2 from government were randomly selected. Total number of dairy cattle were 798; of which, 380 were from private farm, 373 were from cooperatives and 45 were from governmental. Data were collected by using questionnaire survey and observational study through regular visit during the study periods with the interval of once per week. According to the collected data from the respondents, 203(25.44%) Repeat breeder, anestrus, retained fetal membrane, abortion and dystocia were the major reproductive disorders with the prevalence rate of 27.2%, 18.2%, 15.8%, 13.3% and 8.7%, respectively; whereas metritis, uterine prolapse and vaginal prolapse prevalence rate were 6.9%, 5.9% and 3.9%, respectively. According to the data collected from respondents and observational study, there were variations in feeding, watering, housing, hygienic and reproductive management practices. Hence, in addition to reproductive disorders, managemental practices had an effect on the reproductive performance of dairy cattle.

Keywords: dairy cattle, management practices, reproductive disorders, reproductive performance

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Tilahun Regassa, Gebregiorgis Ashebir
Mekelle University, Ethiopia

Correspondence: Tilahun Regassa, Mekelle University, College of Veterinary Medicine, Mekelle, Tigray, Ethiopia, Email giorgisavet97@yahoo.com

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Introduction

Livestock production constitutes one of the principal means of achieving improved living standards in many regions of the developing world. In sub-Saharan African countries, livestock play a crucial role for both the national economies and the livelihood of rural communities.[1] The dominant economic future of the continent is the agricultural sector of which livestock; dairying in particular, is a very important and essential component.[2] To enhancing these positive aspects of livestock production is good management. It should also be noted that poor management, and especially over stocking, could cause degradation. Livestock production in most African countries has been an integral part of agricultural system and cattle production is the main component of livestock production in most farming systems in sub-Saharan Africa.[3]

Ethiopia is one of the largest countries in Africa both in terms of human population and land area with diverse demographic, socio-cultural and agro-ecological feature. It has an enormous livestock resource with total contribution of 15% gross domestic product and 33% of the agricultural output. The current estimates of the livestock population of the country comprises about 41.5million head of cattle, 24.3million sheep, 18million goats, 7million equines, 1.3million camels, 42million poultries and immense bee and fisheries. With cattle population endowment in Ethiopia, cows represent the largest population.[2] According to FAO,[4] 42% of the total cattle heads for the private holdings are milking cows. In contrast to huge livestock resource the livestock productivity is, however, found to be very low. The major biological and social-economic factor attributing to the low productivity including the low genetic potential and performance, poor nutrition, traditional way of husbandry system and prevailing of different disease.[5]

The presence of reproductive problems results poor reproductive performance which brings considerable economic losses to small holder dairy farms and the dairy industry.[6] Among the major problems that have a direct impact on reproductive performance of dairy cow, retained fetal membrane and the subsequent metritis and endometritis have been reported to be the most common clinical and economical problems.[7] Among the major factors that influencing the reproductive performance are infertility or anestrus and repeat breeding, abortion, dystocia, uterine infection (metritis, endometritis) and management practices. The ultimate manifestation of infertility is failure to produce offspring.[8] Female infertility may be due to failures to cycle, aberration to estrus cycle and failure to conceive.[9]

Anestrus and repeat breeding are two important reproductive problems leading to infertility in the dairy cows. It results into delay in puberty and lengthening of calving interval which squarely affect the economy by way of reducing the calf crops and life–time milk production. Anestrus is not disease but symptom of different conditions like period before puberty, period of pregnancy, incomplete uterine involution and symptoms of infertility.[10] The pathogenesis of repeat breeding involves either failure of fertilization or early embryonic death.[11] Abortion is expulsion of dead fetus or recognizable fetus after organogenesis and before full term of gestation period. Abortion can be caused by non-infectious agents like chemical poisoning, drug, hormones, nutritional disorders and genetics. Abortion also caused due to infectious agents like bacterial, viral, fungal and protozoa infections.[12] Dystocia is an abnormal and difficult birth in which the first and the second stage of parturition was markedly prolongs and subsequently impossible for dam to deliver without artificial aid. The incidence of dystocia is greater in pregnancies that terminate early due to uterine disease, fetal death, twining or that terminates after prolonged gestation period due to excessive size of the fetus.[13]

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Uterine infection such as metritis and endometritis, generally they are called uterine infection. Metritis is the inflammation of the uterus whereas endometritis is inflammation of uterine wall.[14] In light of the above facts, it may be noted that, the reproductive efficiency of the dairy cows is affected by factors associated with management system like housing, nutrition, lack of knowledge for proper animal husbandry practices. Productivity of dairy cow is to a large extent dependent on how well it is fed. Dairy cows are highly sensitive to changes in feeding regimes, and production can fall dramatically with and small variations on a day-to-day basis. Feeding can be affected by cyclical weather effects on availability and quality of forages and even quality of concentrates or additives with manufacturer. Nutrient requirement vary with stage of lactation and gestation.[15] It is quite easy to understand that unless cattle are provide with good housing facilities, the animals will move to far in or out of the standing space, defecating all around and even causing trembling and wasting of feed by stepping into the mangers. The animals will be exposed to extreme weather conditions all leading to bad health and lower production. Dairy cattle may be successfully housed under a wide variety of conditions, ranging from close confinement to little restrictions except at milking time.[16] To some extent lack of knowledge of profitable animal husbandry practice resulted low reproductive performance of dairy cows. It has been observed that the knowledge and awareness of the owners regarding the proper animal husbandry practices and traditional misconception play an important role in lowering reproductive efficiency of dairy cows. Sometimes the owners may not aware of the fact that when their young animals should reach the puberty. The age of puberty which should have been attained at 2 to 2 1/2years of age reaches up to 4 to 5years or even more than it. In this way the owner misses at least one or two calf crops which they should have received by that time. Improper use of artificial insemination is also another factors which lowering the reproductive performance of dairy cows.[17]

Sanitation is necessary in the dairy farm houses for elimination of all microorganisms that are capable of causing disease in the animals. The easy and quick methods of cleaning animal house is with liberal use of tap water, proper lifting and dispose all of dung and used straw bedding, providing drainage, to the animal house for complete removal of liquid waste and urine. Periodical cleaning of water through eliminates the growth of bacterial and viral contamination and thus keeps the animal health.[18] Even though, the reproductive performance of dairy cows greatly influenced by multiple factors, research on major factors affecting reproductive performance of selected dairy farms in Tigray region specifically Mekelle city is scanty. Considering this, the present study was designed with the following objectives:

i. To assess the major factors that influences the reproductive performance of selected dairy farms.

ii. To determine the real status regarding to breeding, feeding, housing, and management practices.

Materials and methods

Description of the study area

The study was conducted from November 2011 to April 2012 in Mekelle city. Mekelle is a capital city of Tigray regional state, northern Ethiopia. Geographically, Mekelle city is located between 13° 23' north latitude and39° 29' east longitudes at altitudes of 2070 meter above sea level. The mean annual rain fall ranges from 250 to 300mm and the temperature ranges from 12°C to 27°C Mekelle enjoy a mild climate that can be described as "weynadega". The dominant farming system in the study area is subsistent mixed crop-livestock production system. Smallholder farmer that integrate crop and animal production maximize return from their limited land capital resource and maximize production risk. The farm animals provide draft power and manure for crop. Dried animal manure is used extensively as a source of household energy. Crop residues are used as feed for livestock. Output from livestock such as milk and meat are important source of food for the family. Cash from the sale of animal products, crop product and animals used to purchase farm input and cover expenditure for schooling, clothing and veterinary cost. Hence, livestock serves as capital asset in the form of already available source of cash and means of saving.[19]

Study animals

The study animals were dairy cattle kept in dairy farms found in Mekelle city. A total number of 32 dairy farms were selected in which 19 were private, 11 were cooperatives and 2 were governmental with a total number of 798 dairy cattle were observed from November 2011 to April 2012. Out of 798 dairy cattle 380 were from private, 373 were from cooperatives and 45 were from governmental farms. From 32 dairy farms, 27 farms were managed under intensive and 5 farms were managed under semi-intensive farming system. The herd structure in the study was consisted of 423 dairy cows, 193 heifers, 165 calves and 17 bulls.

Study protocol

Sampling procedure: Simple random sampling techniques were used to select 32 dairy farms in Mekelle city. Then the study was conducted by applying questionnaire survey to the farm attendants and managers of the farm, veterinarians, animal science technician and by observational study.

Questionnaire survey: Questionnaire survey was forwarded from November 2011 to April 2012 in selected dairy farms those found in Mekelle city. A detailed and organized questionnaire format (Annex) was designed to assess the major factors influencing the reproductive performance of dairy cattle in selected dairy farms. The questionnaire was framed in such a way that farm attendants, farm manager and veterinarians could give information that are recent and easy to recall and it was filled directly by face to face interviewing of the farms attendant, farm manager and veterinarians. In the survey, information on major factors influencing the reproductive performance of dairy cattle in selected farms was conducted. The data collected include reproductive disorders and husbandry practice of the farms.

Observational study: The observational study was conducted through regular visit to selected dairy farms at an interval of once per week from the start to the end of the study periods. To do this observational format was prepared and filled to increase the reliability of information collected in questionnaire survey and see incidence of some disorders.

Data management and analysis: The data collated from respondents and record book of the farms were stored into Microsoft excel spread sheet (Ms-excel) and imputed to be analyzed by SPSS version 15 (SPSS, 2005).

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Results

Reproductive disorders

In the present study, of all the cows (n=203) found in the studied farms with the complaint of reproductive problems; the major reproductive disorders were repeat breeder, anestrus, retained fetal membrane, abortion, dystocia with percentage of 27.1%, 18.2%, 15.8%, 13.3% and 8.9%, respectively. Besides, metritis 6.9%, uterine prolapsed 5.9% and vaginal prolapse 3.9 % were recorded as minor reproductive problems in the study area (Table 1).

The result in Table 2 indicates that, repeat breeder and dystocia have high prevalence in the dairy cattle breed by artificial insemination while abortion, retained fetal membrane, metritis and uterine prolapse were high in dairy cattle breed by natural service. But, anestrus was not affected by type of service.

Table 1 Frequency of all the reproductive problems in the study area

	Reproductive disorders								
	Dystocia	**Abortion**	**Anestrus**	**RB**	**UP**	**VP**	**RFM**	**Metritis**	**Total**
Frequency	18	27	37	55	12	8	32	14	203
Percentage	8.90%	13.30%	18.20%	27.10%	5.90%	3.90%	15.80%	6.90%	100%

Table 2 The prevalence of reproductive problems associated with type of service

Service	Reproductive disorders								
		Dystocia	**Abortion**	**Anestrus**	**RB**	**UP**	**VP**	**RFM**	**Metritis**	**Total**
AI	Freq	10	10	25	41	4	2	11	4	107
	%	4.93	4.93	12.31	20.2	1.97	0.98	5.42	1.97	52.71
Natural	Freq	8	17	12	14	8	6	21	10	96
	%	3.94	8.37	5.91	6.89	3.94	2.96	10.34	4.98	47.29

Management practices

Feeding and watering: The response from respondents indicates that, the studied farms were mostly used feed types like straw, wheat bran (frusca), grass hay and alfalfa with percentage of 50%. Straw, grass hay and wheat bran were the only feed stuff used in some farms for feeding of dairy cows with a percentage of 34.4%. In small number of dairy farms straw, grass hay and "attela" were used for feeding of dairy cattle in study area (Table 3). Tap water 84.4% was used as a source of water for animals in the study area, where as some farms used river water 15.6% for watering of their animals. Most of studied farms watered their animals twice a day 65.6% and some of them were watered their animals once a day 15.6% but the others were provided water for their animals three times a day 18.7% (Table 4).

Table 3 Response of farm attendants and farm managers on feed types

Feed stuff	**No. of respondents**	**Proportion**
Grass Hay Wheat Bran(frusca) Alfalfa Straw	16	50%
Grass Hay Straw Wheat Bran(frusca)	11	34.40%
Grass Hay Straw Attela	5	15.60%
Total	**32**	**100%**

Table 4 Response of farm attendants and farm managers on water source and watering frequency

		Frequency	**Percentage**
Water source	River water	5	15.60%
	Tap water	27	84.40%
	Total	32	100%
Watering frequency	Once a day	5	15.60%
	Twice a day	21	65.60%
	Thrice a day	6	18.70%
	Total	32	100%

Housing and hygienic practice: The housing system of the study area was mostly closed type of house with concrete barn floor type except one farm which was rammed soil. The houses were constructed with ventilation which was graded as very good, good and poor and lighting system was found in majority of the study area but there were no lighting in some farms. Majority of housing system in the study area were good in hygienic practice but some houses were recorded as poor in hygienic in which animals were found with dirty things like feces. Housing system in majority of study area was not separate for animals of different age groups and they used one house having different partition. But some farms have separate house for calf unit and dry cow unit.

Reproductive management: In the study area most of the private farms used natural service (bull) and farms managed by cooperative and government were used mainly artificial insemination. Some farms owned by private and cooperative were used both types of service (AI and natural breeding), whereas farms owned by government were used only artificial insemination. According to the response obtained

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from respondents, the major factors for repeat breeding were lack of awareness 46.9%, improper time of insemination 28.1% and unskilled and low experienced technician 15.6%, whereas hygienic problem 6.3%and disease 3.1% were the minor one (Table 5).

Table 5 Response on repeat breeding problem

Constraints	No. of respondents (N=32)	Proportion
Lack of Awareness	15	46.90%
Unskilled and Low Experienced Technician	5	15.60%
Improper time of Insemination	9	28.10%
Hygienic Problem	2	6.30%
Disease	1	3.10%
Total	32	100%

Discussion

The prevalence of reproductive disorders in the present study doesn't agree with the study of Tsegay B.[20] This might be due to differences in the sampling methodology. Of all reproductive disorders, repeat breeding was the most prevalent one. Moreover, the repeat breeding prevalence was higher in those dairy cattle bred by artificial insemination rather than natural service and this might be due to lack of awareness, improper time of insemination, unskilled and low experienced technician and improper handling of semen. Occasionally repeat breeding was occurred in cows bred by natural service and this might be due to use of infected or diseased bulls. High incidence of abortion occurs in natural service than AI and this might be due to the presence of sexually transmitted diseases and great concentration of lethal genes. The prevalence of RFM was high in natural service than AI and this could be attributed to the transmissions of disease during service from infected bull to female which in turn infects the genital tract. Dystocia was found to be high in AI than natural service and this might be due to insemination of small sized animal which results difficult to calving large fetus through the small pelvic size. Anestrus prevalence was varied by using different type of service (natural and AI) and this could be due to feeding of animals with low concentrates of energy and proteins. When energy intake in the adult animal is low, follicles fail to develop to maturity and follicular atresia result, along with a loss of sexual desire and anestrus.[21]

The finding of present study on metritis prevalence was higher with the report of Worku T.[22] This might be due to deficiency of vitamin A which brings changes in the epithelial tissues, such as keratinization and degeneration of the placenta and result metritis. On the other hand, metritis prevalence was high in naturally serviced animals over AI and this might be due to the naturally serviced animals get high incidence of abortion, fetal death and retain fetal membranes which are the main cause for infection of uterus. The prevalence of uterine prolapse in the present study was higher in natural serviced animals than AI. The reason for high prevalence of UP in natural service might be due to transmission of disease from infected bull to female during service. In addition, the prevalence of vaginal prolapse was higher in naturally serviced animals than AI. This might be due to transmission of disease from infected bull to female during service.

The overall management and husbandry system come among the prevailing factors. Differences in dietary factors and plane of nutrition in the farm were assumed to be the main causes. Feeding varies from farm to farm based on season, supplement used and type of feed used by the farms. This is in agreement with the idea described by Lanyasunya.[23] The commonly available and frequently applied feed stuffs in the medium and large scale dairy farms include straw, grass hay wheat bran and other green grasses like alfalfa and elephant grass, where as in small scale dairy farm the commonly available and frequently applied feed stuffs were straw, grass hay and "attela". This is because of insufficient land for cultivation of green fodder like alfalfa and elephant grass.

Majority of the houses were constructed with good ventilation system and there were some house with poor ventilation and this affects the health of animals due to suffocation which in turns affect the reproductive performance. In the study area the absence of lighting in some farms affects the detection of estrus signs during night and it is difficult to attend the animals at night. In the present study, there were unhygienic house especially dirty barn floors predispose the occurrence of postpartum disease. Majority of the housing system in study area were not separated for animals of different age groups and they used one house having different partition. But some farms have separate house for calf unit and dry cows unit. The reasons for absence of separate house in majority of the farms were lack of sufficient land, and economical problems. In majority of the study area there was no separate house for cows at advanced pregnancy. They calved in the stall barn on concrete floor which could affect both the newborn and the dam. As indicated by Owen[24] the heat detection in the study area was done by farm attendants by observing the sign of heat: excitement, restlessness, reduced feed intake, clear mucus discharge via vulva, mounting other animals and ready to be mounted by other animals.

Conclusion and recommendations

The result of present survey would seem to suggest that reproductive performance of dairy cattle is governed by multiple factors. The major factors affecting the reproductive performance of dairy cattle in the study area were reproductive disorders and factors related with management and husbandry practices like housing, feeding, watering, breeding and hygienic practice. More potential risk factors responsible for affecting reproductive performance in dairy cattle were identified: reproductive disorders that includes; dystocia, abortion, anestrus, repeat breeding, uterine prolapse, vaginal prolapse, retained fetal membrane and metritis.

Based on the above conclusion the following recommendations are forwarded

i. Reproductive disorders like abortion, metritis and retained fetal membrane were mostly present in dairy cattle breed by natural service may be due to venereal disease, so awareness should be created on the owners not to use the same bull to many cows and to encourage the practice of artificial insemination.

ii. Artificial inseminators should be well trained and get annually refreshment courses.

iii. The farm attendant should know the signs of heat and attend the animals always for the signs heat, at least twice a day.

iv. The veterinarians should create awareness on the animal owners about managemental practices and animal health.

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v. The surrounding veterinary clinic should be well equipped to treat the animals observed with reproductive disorders.

vi. Provision of proper semen quality and quantity is important.

vii. Management system like feeding, watering, housing, hygienic and breeding management should be improved.

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Conflict of interest

Author declares that there is no conflict of interest.

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