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Evaluation of reproductive performance of smallholder dairy cows in mareka woreda of dawuro zone, Southern Ethiopia

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ABSTRACT

Aim: The study was aimed to determine the reproductive performance and identify the potential risk factors associated with reproductive performance of smallholder dairy cattle.
Method and Materials: This study was conducted in mareka woreda dawuro zone, southern ethiopia and about 90 cattle owners were interviewed and 384 dairy cattle of local and HF cross breed were included in the study.
Results: The results revealed that the mean age at first service in local breed was found to be 30.32±3.8 months and in HF cross breed 20.31± 2.56 months, whereas mean age at first calving was 40.42± 5.00 months in local breeds and 30.64± 3.53 in exotic breeds respectively. The mean days open was 69.62± 8.43 and 65.41± 12.06 days in local and exotic breeds respectively. Number of service per conception was 1.62± 0.87 in local and 1.40± 0.76 in exotic breeds. And also mean calving interval was found to be 16.86± 3.23 and 12.48± 1.68 months in local and exotic dairy cows respectively. The overall prevalence of reproductive performance disorders in current survey was indicated as abortion (27.6%), retained fetal membrane (38.3%) and repeated breeding (25.5%) and Anoestrus (8.6%).
Conclusion: It was concluded that decreased reproductive performance due to poor management as a result there is low economic gain to the owners. Therefore, improved management system should be practiced purposively to enhance the reproductive performance of dairy cattle breeds.

Keywords: Dairy cattle; Ethiopia; Mareka; Reproductive performance; Smallholder.

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Introduction

Reproductive traits are crucial factors determining the profitability of dairy production (Lobago *et al*., 2007). Reproductive traits describe the animal's to conceive calve down and suckle the calf to weaning successfully (Davis, 1993). These traits are important since they affect the herd size and off take. Reproductive performance is commonly evaluated by analyzing female reproductive traits. The traits regularly considered as including age at first service, age at first calving, days open, number of service per conception and calving interval. The major problem that have a direct impact on reproductive performance of dairy cows are classified as before gestation (infertility or anestrous and repeat breeder), during gestation (abortion, vaginal prolapsed and dystocia) and after gestation (retain fetal membrane and uterine prolapse) and the ultimate manifestation of infertility is failure to produce offspring (Hoojjer *et al.*, 1999).

Heat detection is the key to enhance reproductive performance and it is the most important problem which has faced the dairy industry as it is essential for the successful application of artificial insemination (AI) or natural service (NS) in dairy animals (Graves, 1999). Estrus period of receptivity may last for 6-30 hours and the interval between two heat periods may vary normally from 18-24 days (Bearden and Fuquay, 1992).

Reproductive health problems cause considerable economic losses to the dairy industry due to slower uterine involution, prolonged inter conception and calving interval negative effect on fertility, increased cost of medication, drop in milk production and early culling of potentially useful cows (Lobago *et al*., 2007). Factors such as a longer

time period for parturition to first estrus, poor estrus expression or detection improper timing of artificial insemination and reduce conception rate at first AI, have contributed to a longer inter calving period. In doing so, it has compromised profitability in dairy farming (Pelissier, 1972). The situation is further aggravated by the fact that high yielding early postpartum dairy cows often suffer from one or other ovarian disorder (Opsomer *et al*., 2000).

In either case (AI or NS) recording of cows in heat and data of service is necessary to predict future heat or calving data and to manage the cows (Hubble, 2007). Different finding indicated different result about reproductive performance in different parts of the country (Lobago *et al*., 2007; Mugerwa, 1989). Despite of different risk factors those can induce low reproductive performance in the area; Dawuro Zone of Mareka woreda has no previous study. Therefore, the objectives of this study were to determine the reproductive performance of smallholder dairy cattle and identify the potential risk factors associated with reproductive performance of the smallholder dairy cattle in the study area.

Materials and Methods

The study was carried out in Mareka woreda which is found Dawuro zone of Southern Nation Nationality and Peoples Regional State (SNNPRS), Southern Ethiopia. The area is located at about 544 km and 277 kms south west of Addis Ababa, the capital city of Ethiopia and Hawassa, the administrative town of SNNPRS respectively. The woreda is bordered on the south by Loma woreda; on west by Zaba gazo; Gena and Tarcha zuria woreda on the North by Mari Mansa woreda and on the East by Essera woreda. The total land coverage of the woreda is 44050 hectare of which 2000 hectare (4.5%) is covered by forest, 11500 hectare (26.1%) is grazing land, and 28140 hectare (63.9%) is cultivating land and the remaining 2410 hectare (5.5%) comprises bushes, savanna, rivers, springs, stagnant waters and hills. According to the agro-ecological classification criteria the woreda is divided into three agro-ecological zones. Namely high land (dega), midland (Woina dega), and lowland (kola) with their total land holds of 53%, 30% and 17% respectively. The study area's elevation ranges from 1000 to 2400 meters above sea level. The mean annual rainfall ranges from 650-1100mm and the rainfall distribution is bimodal with highest rainfall at wet season (April to September) and lowest rainfall at last half of dry season (February and march). The mean daily temperature ranges from 18^{o}C to 23^{o}C with the highest temperature share at dry season (November to March) and lowest temperature share at west season. The predominant farming system in the area was crop livestock production system. The woreda has a total human population of 126,022 of these 65,321 are men and 60,701 women. The livestock population consists of 122,084 cattle 47,438 sheep 18,854 goats 4,860 horses 2,759 mules 1,699 donkey and 63,042 poultry and 2,750 traditional and 863 modern bee hives (MWLFRDD, 2019).

Study population

In Dawuro zone of Mareka woreda, the randomly selected 90 farmers were included in this study and were interviewed. The prepared questionnaires were mainly designed to collect information on reproductive performance of exotic and indigenous dairy cattle as well as associated risk factors. Accordingly, information about the risk factors such as age, means of breeding, parity, breed, health care and major reproductive problem such as abortion, retained fetal membrane (RFM), and repeated breeding were collected on individual cattle level. Structured questionnaires were used to record data on reproductive performance parameters like age at first service (AFS), age at first calving (AFC), calving interval (CI), number of service per conception (NSC) and days open (DO).

Study design and data collection procedure

A cross sectional study was conducted from November 2019 to June 2020 in purposively selected kebeles and randomly selected owners in Mareka woreda of Dawuro zone to determine the reproductive performance of dairy cattle. Data was collected from both primary and secondary sources. The primary sources were obtained through a semi-structured questionnaire. Before the actual data collection, the questionnaire was pretested. The interviews were conducted by trained research assistants under close supervision the researcher while the secondary data were collected from different sources such as books, research publications, journals, office reports of zonal and woreda Livestock and Fishery Resource Development Departments.

Sampling methodology and sample size determination

A total of 384 animals of consisting of 100 HF cross and 284 local dairy cattle owned by 90 smallholders

in the study area were sampled by using simple random sampling method. Since there is no previous study on case of reproductive performance of smallholder dairy cows in the study area, 5% level of confidence interval was used to calculate sample size using the following formula given by (Thrusfield, 2005).

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

Where, N= required sample size
Z= Student coefficient 1.96
Pexp= expected prevalence 50%
d= desired precision 5%

Accordingly, 384 animals were sampled for the study.

Data management and analysis

The raw data collected was entered into Microsoft Excel Spreadsheet and analyzed using SPSS version 23 software package. Data was statistically analyzed using Chi-square (X^2). The descriptive statistics was used to calculate the degree of risk factors and reproductive performance of smallholder dairy cows, in all case 95% confidence interval (CI) and the result was considered for statistically significant difference (P≤0.05).

Results and Discussion

This study revealed that the housing system in the study area were close and open housing systems for that 93.3% and 6.7% of the respondents kept their cattle under closed and open housing systems respectively. The common management systems were shown in (Table 1).

Of the total 284 local cattle 89.8% were bred by bull naturally where as the remaining 10.2% were artificially inseminated. On the other hand only 44% of the total 100 HF cross breeds were naturally mated by bull while 56% were statistically inseminated as demonstrated (Table 2).

The mean age at first service of local and HF-cross dairy heifers was 30.32±3.88 and 20.31± 2.56 months respectively and mean age at first calving of local and HF-cross breeds was found to be 40.42± 5.00 and 30.64± 3.532 respectively (Table 3).

The occurrence of abortion in both breed type was 27.6% of which local dairy cattle consists of 74.5% and HF-cross shares 25.5%. The total occurrence of abortion, RFM, anoestrus and repeated breeding consists of 27.6%, 38.3%, 8.6%, and 25.5% respectively in both breed types (Table 4).

Table 1. The common management systems in the study area

Management parameters	Variables	No of respondents	Percentage (%)
Housing system	Closed	84	93.3
	Open	6	6.7
Feeding system	Hay	8	9.1
	Pasture	51	56.8
	Crop residue	31	34.1
Water supply	Periodically	74	81.8
	Adlibitum	26	18.2
Vaccination	Regular	15	16.4
	During disease outbreak	69	77.1
	No	6	6.5
Treatment	Vet. Clinic	73	81
	Self administer	11	12.5
	Traditional healer	6	6.5
Data record	Yes	23	26
	No	69	74

Table 2. Breeding systems practiced among breed types

Breed types	No of sample	Bull (%)	AI (%)
Local	284	255 (89.8)	29 (10.2)
HF-cross	100	44 (44)	56 (56.0)
Total	**384**	**299 (77.9)**	**85 (22.1)**

Table 3. The mean reproductive performance of sampled animals

Parameters	Mean ± SD	
	Local cattle	HF-cross
age at first service (months)	30.32±3.88	20.31±2.56
age at first calving (months)	40.42±5.00	30.64±3.532
Days open (days)	69.62±8.56	65.4±12.06
Number of service per conception	1.62±0.87	1.62±0.76
Calving interval (months)	16.86±3.23	12.48±1.68

Table 4. Association of breed types with reproductive disorders

Variables	Local (%)	HF-cross (%)	Total (%)
Abortion	79 (74.5)	27 (25.5)	106 (27.6)
RFM	104 (70.8)	43 (29.2)	147 (38.3)
Anoestrus	24 (72.7)	9 (27.3)	33 (8.6)
Repeated breeding	77 (78.6)	21 (21.4)	98 (25.5)
Total	**284**	**100**	**384**

The present study revealed that 84out of 90 (93.3%) and 6 out of 90 (6.7%) of the respondents kept their animals under closed and open management systems respectively. Those animals which were kept under closed management system fed hay and crop residue Supplemented with oil-cake while in open management system entirely relied on grazing of natural pasture. In addition, 74 out of 90 (81.8%) of the owners watered their animals periodically and 16 out of 90 (18.2%) of watered adlibitum. Animals raised in 77.1% of the smallholder farms were vaccinated on disease outbreak. The 16.4% were vaccinated regularly; furthermore, 6.5% of sampled animals were not get vaccinated 81% of sick animals were getting treated in nearest veterinary clinic. The 89.8% of the local breed dams and 10.2% of the HF-cross breeds were bred natural mating. The possible explanation for reduced performance of study animals in survey area may be due to poor management system. Poor management contributed to reduced reproductive performance in dairy cows. 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 reason, supplement used and type of fed used by the farms (Lanyasunya *et al*., 2005).

The current overall mean estimates fall within the ranges reported from crossbreds and local zebu cattle in different management systems in Ethiopia (Shiferaw *et al*., 2003) and for crossbred cattle in the tropics (Masana *et al*., 2003). Age at first calving is the indicator of beginning of a cow's reproductive life and is closely related to the generation interval. The age at fist calving in local breeds of these study animals was 40.42±5.00 months. This result was in line with the age at first calving of 40.6 months (Yoseph *et al*., 2003). The reproductive life of HF-cross heifers in the study area begun at the mean age 30.64±3.52 months. The desirable age at first calving in local and Holstein Frisian breeds is 36 and 24 months respectively (Azage, 1989).

The prolongation of the AFC in the present study area was might be the result of poor farm management and inappropriate nutritional management practiced in the smallholder dairy farms. Different factors could cause due to delay age at first calving such as environmental factors like nutrition, health, routine management, climate; these are pre-determine for pre-pubertal growth rates, reproductive organ developments, and onset of poverty and subsequent fertility (Masana *et al*., 2003).

The mean days open in this study was found to be 69.62±8.53 days in local and 65.4±12.06 days in HF-cross breeds. The local breed days open was less than the result 85.6±5.6 noted by (Hunduma, 2012). This might be due to nutritional factors or other management problems in the present survey area. The mean number of service per conception in local breeds of the study animals was 1.62±0.87 times and in HF-cross breed 1.40±0.76 times. According to Rich and Turman (2009) number of service per conception greater than two is considered as poor. The results of this study were thus in the range of normal NSC.

The mean calving interval in local breed of the study animals was 16.86±3.23 and in HF-cross breed was a 12.48±1.68 month the calving interval of the HF-cross breed of the study animals is in agreement with the result of 13.4±5.1 months (Nibret, 2012). Although the present estimate is within range of previous reports, it is unfavorable and extended compared with the optimum CI (80-85 days) recommended to achieve the commonly accepted one year calving interval (Arbel *et al*., 2001). Feed shortage, silent estrus and lack of proper heat detection might be contributory factor for long CI reported in this study. The longer calving interval reduce yearly production cycle and the amount of milk that a cow likely to produce in a given period of time, which might be associated with environmental factors, poor nutrition, poor housing, lack of sufficient bull and AI service and poor health and reproductive management (Million *et al*., 2010).

Retained placenta was the highly prevalent reproductive disorder (38.3%) as compared to repeated breeding, abortion and anoestrus (27.6%,

25.5% and 8.6%) respectively. Retained placenta is one of the major calving related problems, which pose a great threat to reproduction efficiency of the dairy cows (Swai *et al*., 2005). This might be due to nutritional factors and other management problems.

Conclusions

The major factors affecting the reproductive 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; abortion, anoestrus, repeat breeding and retained fetal membrane. Thus, the management and reproductive problems might be the underlying causes of the delayed age at first service, age at first calving, days open, and calving intervals.

Based on the above conclusion the following recommendations were forwarded:

-Improved management system should be practiced

-Selection of cows should be focus on both productive and disease resistance

-Awareness should be created on the owners not to use the same bull to many cows and to encourage the practice of AI

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

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