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Survey on Reproductive Performance of Smallholder Dairy Cows in Hawassa City, Ethiopia

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Abstract: Cross sectional study in selected kebeles of Hawassasub city using questionnaire survey was conducted from November, 2011 to March, 2012 in Hawassa city with the objective of assessing the reproductive performance of small holder dairy cows. In this study 490 dairy cows and 249 small holder dairy owners were interviewed. The result, revealed that age at first calving of Arsi zebu, cross less than 50%, greater than or equal 50%, boran and Jersey was 3.39, 2.78, 2.29, 1.88 and 2.54 years, respectively. Calving interval recorded in different breed such that Arsi zebu, cross less than 50%, greater than or equal 50%, Boran and Jersey was 14.2, 12.4, 11.3, 11.8 and 12.4 months, respectively. Number of service preconception recorded in the breeds of Arsi zebu, cross less than 50%, greater than or equal 50%, Boran and Jersey was 1.18, 1.50, 1.72, 2.17 and 2.29, respectively. The age at first calving, calving interval and number of service preconception in the deferent breeds were statistically significant ($P<0.05$) in which calving interval was shortest in crossbreed cows ≥50%, while it was longest in Arsi Zebu breed than other. However, age at first calving was shortest in Boran breed than others. On the other hand, the major factors that were found to influence the reproductive performance of cattle in the study area were feeding system, breeding type (AI or natural) and daily milk yield. Besides, this study showed that the most commonly encountered health problem with their prevalence rate were retained fetal membrane 21(8.4%), milk fever 10 (4%), uterine prolapsed 2 (1%).

Key words: AI · Cattle Breed · Reproductive Performance

INTRODUCTION

Rapidly growing demand for livestock products due to human population pressure, in come growth and urbanization put the livestock production one of the feasible business sector. Land use and human population pressure are leading to intensification and expansion in many livestock production system including dairy cattle [1]. The major functions of animal production including dairy animals are to provide protein, energy; mineral and vitamins for supplement the cereal grains and pulse in the diet [2] The agricultural sector in Ethiopia engaging 85% of the population, contribute 52% of the gross domestic products (GDP) and 90% of the foreign exchange [3]. Cattle production plays an important role in the economics of smallholder farmers and pastoralist in the country at large.

Though Ethiopia has an estimated 50.8 million heads of cattle population [4], almost all of them (99.19%) are local indigenous breeds that are known to have poor reproductive and productive performance perhaps due to inadequate nutrition, poor genetic potential, inadequate animal health services, lack of appropriate breeding policy and lack of efforts to use latest and appropriate application of reproductive and productive technologies to improve their performances [5-8]. Zebu (*Bosindicus*) cattle are multipurpose animals with low potential for meat and milk production which is estimated to meet only 35% of the requirements [9, 10]. The dairy industry is a large dynamic segment of agricultural economy of many nations. Animal breeding is only one of the steps in the process of animal production but, as it is the first step, it is a fundamental to a sound animal husbandry [11]. Livestock productivity remains marginal in Ethiopia,

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despite the large livestock resource in the country, due to various reasons among which is the low genetic potential of indigenous cattle for milk and meat production [12, 13].

Among the major problem that have direct impact on reproductive performance of dairy cow, retained fetal membrane and subsequent endometrities and payometra have been reported to be the most common clinical and economical problem [14]. Reproductive problem in farm animal cause great economic loss to the dairy industry due to slower uterine involution reduced reproductive rate, prolonged interconnection period and calving interval, high cost of medication, drop in milk production, reduce calf and early depreciation of potentially useful cow [15]. Basic effects of poor or sub optimal reproductive performance are reduction in milk yield and in calf crop per unit of time [16].

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 prolapse and dystocia) and after gestation (retain fetal membrane and uterine prolapses) and the ultimate manifestation of infertility is failure to produce offspring [17].

Poor husbandry management and low reproductive efficiency are the main constraints to livestock productive. This includes the poor housing system, malnutrition use of low productive breeds, failure of conception mainly incriminated [18]. 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 AI (artificial insemination) or NS (natural service) in dairy animals [19].

Estrus period of receptivity may last for 6-30 hours and occur every 21 day on average. However, the interval between two heat periods may vary normally from 18-24 days [20].

Several 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 [21]. The situation is further aggravated by the fact that high yielding early postpartum dairy cows often suffer from one or other ovarian disorder [22].

Loss of revenue due to lower milk production analyzing the lactation curve, one should realize that peak lactation occurs around 60-90 days after calving and around this period (60-150 days post calving) is the time when the cow generates the most amount of profit. Shortly thereafter (between 150-250 days) the cow enters a “break even point” phase in which cost of production equals the revenue from milk production. Therefore more frequently the cows become pregnant (during its lifetime), the more profit periods per lifetime cow would have. On the other hand the fewer time the cow become pregnant the more time it will spend on the tail end of the lactation curve, resulting in loss of profit [23].

Increasing milk production demand has led to a decline in reproductive performance of dairy cows due to a prolonged inter calving period [24]. In order to maximize productive life, a cow must be bred within 80- 90 days after calving. This will enable it to produce a new calf every 12.5- 12.8 months. Longer calving intervals have determinant effect on the lifetime milk production [25]. Whether producers use AI or NS, heat detection is a critical component of good productive management on the farm. Success in the breeding program is measured by calving interval, which is mostly a function of day to first services. 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 [18]. Different finding indicated different result about reproductive performance in different parts of the country [5,6]. However, in the present study area, though large number of smallholder dairy farm is available, there is no sufficient information pertaining reproductive performance of their dairy cows. For this reason, since it has paramount importance to livestock owners, extension agents, veterinarians and researchers; the study of reproductive performance of the dairy cows in the present study area is highly needed for further development of strategies and prioritization of possible intervention options for performance improvement.

The objectives of the present study were

- To evaluate the reproductive performance of smallholder dairy cows found in Hawassa town
- To assess factors that influences reproductive performance of smallholder dairy cows found in Hawassa town.

MATERIALS AND METHODS

Study Area: The study was conducted from November 2011 to March, 2012 in selected kebeles of Hawassa city which is located 275 Kms away from Addis Ababa in southern direction. The area lies between the altitudes of

1500-2000 meter above sea and between 4.27 and 8.3°N- 34.21 and 39.1°E. The annual mean rainfall is from 800-1000 mm and annual mean temperature is between 20.1-25°C.

Animal Population: The target population for this study are smallholder dairy farms found in Hawassa city.

Sampling Method and Study Design: A cross –sectional study design was conducted in smallholder dairy cow using questionnaire survey. The sample size required for the study was determined according to Thrustfield [26] used for simple random sampling technique. Using the following formula.

$n= 1.96^2 p_{exp} (1-p_{exp}) /d^2$

where:

n = sample size
P_{exp} = maximum expected prevalence
d = 5% desired precision at 95% confidence interval
1.96 = the value of Z for 95% CI

Accordingly, 50% expected prevalence was used since there was no previous data in the study area. In this study, 20% expected prevalence was used to determine the sample size. Therefore; $n=1.96^2(0.2x (1-0.2)/0.05^{2=}245$ smallholder dairy producers were interviewed during study period.

Statistical Analyses: Raw data collected entered into Microsoft Excel spread sheet and summarized using descriptive statistics. Further data analyses were employed using Stata-9 software. Test result considered as significant when p-value is less than 0.05 at 95 % confidence.

RESULTS

A total of 249 smallholder dairy farm producer were randomly selected from Hawassa city administrative. The number of cows owned by each smallholder was from 1 to13 of either local and/or cross breeds. In these smallholders, some of the reproductive performance parameters such as service per conceptions, calving interval and age at first calving were collected. Moreover, some factors that could affect the reproductive performance such as service type, daily milk yield, health problems and feeding system) were considered and recorded as major risk factors. The result indicated that majority of cattle breeds were local Arsi zebu type (59.1%) followed by <50% Holstein Friesian crosses (19.2%), ≥50% Holstein Friesian (17.6%), Boran (1.2%) and Jersey (2.9%).

Table 1: Mean age at first calving in years as compared to different breed observed in smallholder dairy farm.

Breed type	Nº Sample	Mean AFC	95%CI	SD	p-value
Arsi zebu	290	3.39	[3.2- 3.6]	±0.09	0.00
Cross<50% HF	94	2.78	[2.5-3.0]	±0.13	
≥50% HF	86	2.29	[2.1- 2.5]	±0.11	
Boran	6	1.88	[0.7- 3.1]	±0.61	
Jersey	14	2.54	[1.9- 3.1]	±0.31	

Evaluation of Reproductive Performance of Smallholder Dairy Cows

Age at First Calving: First calving marks the beginning of a cow's productive life. Age at first calving in different breed showed significant difference ($p<0.05$). Arsi zebu breed had longest period of calving compared to all other breeds whereas, Boran breed had shortest period at first calving than the other breeds observed as shown in Table (1).

Number of Service Preconception: The number of service preconception (NSC) depends largely on the breeding system used. It is higher under uncontrolled natural breeding and low where AI is used. A range of values for NSC is presented in Table (2).

Calving Interval: Calving interval has been extensively analyzed and reported. It is probably the best index of a cattle herd's reproductive efficiency. A range of value CI presented (Table3).

Factors That Influences of Reproductive Performance of Smallholder Dairy Cows

Source Feed and Feeding System: Among the interviewee it was shown that according to the responses of respondents 46.2%, 14.9% and 37.3%, of the feeding system was indoor, outdoor and both respectively. Regarding the feed sources 42.9% uses zero grazing and concentrates bought from markets (32.1%) grazing on field and supplement the concentrate and relatively low proportion (23.3%) animal owners were feed only from grazing

Service Type Used: The proportion of service type indicates that 98% of Arsizebu mainly used natural mating where as exotic and cross breeds used artificial

Table 2: Mean number of service per conception as compared in different breeds

Breed type	Nº Sample	Mean service per Conception	95%CI	SD	p-value
Arsi zebu	290	1.18	[1.1-1.2]	±0.025	0.00
Cross<50% HF	94	1.50	[1.4 -1.6]	±0.074	
≥50% HF	86	1.72	[1.6 -1.9]	±0.085	
Boran	6	2.17	[1.6 – 2.8]	±0.31	
Jersey	14	2.29	[1.7 – 2.9]	±0.32	

Table 3: Mean calving interval in months and standard deviations of different breeds observed in smallholder dairy farms Hawassa town.

Breed type	Nº Sample	Mean CI (range)	SD	p-value
Arsi zebu	290	14.2 [13.3-15.1]	±0.44	0.01
Cross breed <50% HF	94	12.4[10.9-13.9]	±0.77	
Cross breed ≥50% HF	86	11.3[9.8-12.8]	±0.77	
Boran	6	11.8[14.0-19.7]	±4.00	
Jersey	14	12.4[8.6- 16.2]	±1.93	

Table 4: Proportion of service type used to inseminate cows that are in heat

Breed type	Nº Sample	Natural (%)	AI (%)	Both Natural and AI (%)
Arsi zebu	290	285(98)	2(0.01)	3(1.0)
Cross <50% HF	94	19(20)	67(71)	8(8.5)
≥50% HF	86	9(10.5)	77(89)	0(0)
Boran	6	2(33.3)	3(50)	1(16.7)
Jersey	14	2(14.3)	12(85)	0(0)
Total	490	317(65)	161(32.9)	12(2.5)

Table 5: Mean daily milk yields in liters reported in different breeds kept by Hawassa smallholder dairy farms

Breed type	Nº Sample	Mean daily milk yields	95%CI	SE	p-value
Arsi zebu	290	2.2	[2.0- 2.3]	±0.06	0.00
Cross<50% HF	94	7.3	[6.4- 8.2]	±0.45	
≥50% HF	86	11.2	[10.1- 12.4]	±0.59	
Boran	6	5.0	[1.5- 8.4]	±1.8	
Jersey	14	9.4	[7.4- 11.3]	±1.0	

insemination as shown in the Table 4. Mean number of service per conception shows that local Arsi zebu has significantly low number of service per conception as compared to the cross breeds.

During questionnaire survey, assessment about the perception of the community on the failure of artificial inseminate was carried out and 10.8%, 3.6% and 15.7% of the respondents suggested due to poor knowledge of the attendant, cow problem, due to poor knowledge of practitioner

Mean Daily Milk Yield: Local breeds had shown low daily milk yield than other cross breeds. Average daily milk yield in different breeds of the study animal had shown statistically significant ($p<0.05$). Low daily milk yield was observed in Arsi zebu breed, while high daily milk yield was recorded ≥50% HF (Table 5).

Reproductive Health Problem: According to the animal owners interviewed, the highest calf mortality 28 (11.2%) recorded in calves of age one to three months followed three months of age up to one year 20 (8.1%) and calves whose ageless than one month 13 (5.2%).The major health problems recorded in the study area was uterine prolapse, retained fetal membrane and milk fever.

DISCUSION

Ethiopian government has started long ago to improve daily milk yield through breed improvement; the change in this regard is limited where the demand exceeds by far from supply, the problem was not yet tapped. In this study, it was understood that dairy farm development in Hawassa city is at its infant stage; where the farming system was mainly dependent on grazing

In the present study, the mean value for age at first calving for Arsi zebu breed was 3.39 years (n=290) whereas Mugerwa et al. [10] and Alberro [27] recorded that age at first calving in Ethiopian cattle were reported to be longer for zebu than for cross breed cattle. The work done in the central high land and in Addis Ababa indicated on over all mean for first calving of 40.6 month

for Zebu cattle [28]. The mean value for AFC of cross breed in this finding was 2.78 less than 50% HF and 2.29 for greater than or equal 50%HF (n=94 and 86). There are also similar reports by Yoseph *et al*. [28] with mean of 29.0 month. The mean value of age at first calving of Boran breed and Jersey were 1.88 and 2.51years, respectively which is greater compared to the finding of Reinhardt [29] who reported 34month of age.

The overall mean for the number of services preconception (NSC) of the Arsi zebu breed was 1.18(n=290). The present finding was lower than Azage et al. [30] who reported NSC ranging from 1.74 -1.8. The mean value for the number of services perconception (NSC) of cross breed in the current finding was 1.5 and 1.72 (n=94 and 86) which is in agreement with the results of Yoseph et al.[28] with NSC of 1.5 and 1.72. Similarly, Mekonnen [15] also reported NSC value of 1.7 at Abernosa ranch.

The mean value for the number of services preconception of Boran breed was 2.17(n=6) and Jersey breed was 2.29(n=14) which reflects poor reproductive performance of the Boran and Jersey breeds.

The mean value for calving interval (CI) of small holders in Hawassa was 14.2 (13.5-15.1months) for Arise zebu cattle which is similar with the report of Swenson et al. [31] with CI of 12.9-15.1 month. The calving interval for crosses of <50% and ≥ 50% HF with local zebu breeds was 12.4 (10.9-13.9 months) and 11.3 (9.8-12.8 months) respectively. This finding is in agreement with the results of other investigators from the central highland of Ethiopia [32].

As per the respondents the feeding system in the study area were indoor, outdoor and both with the proportion of 46.2%, 14.9% and 37.3%, respectively. Majority of the smallholders uses zero grazing (42.9%) with the additional feed of concentrates, molasses, maize and wheat bran and mineral supplements. 32.1% of the interviewed owners feed their animals by direct grazing on the field by supplementing with concentrate and 23.3% of respondents were used only grazing on the field. The feeding practice in the study area is different and this influences the reproductive performance of the local and cross bred animals. The available source of feed in the area were concentrate, crop residue (straw), grass hay and pasture. This may be the average period required to gain sufficient bodyweight and condition to start cycling and conceive again, given the limited nutritional resources of the traditional system [10].

Regarding the service type 65%, 32.9% and 2.5% were using natural, AI and in both natural and AI insemination, respectively. AI service may increase the chance of missing the right time of insemination and the knowledge of inseminator to deposit. The assessment of about the perception of the community on the failure of artificial insemination indicated that respondents have different view such as poor knowledge of the attendant, cow problem and poor knowledge of practitioner as indicated by 27 (10.8%), 9 (3.6%) and 39 (15.7%) of the interviewee but the rest don't know the reason of AI failure.

Local breeds had low daily milk yield than other cross breeds due to low feeding system, environment factor and health problem that influence RP. Lactation has negative effect on cow's bodyweight and thus indirectly affects animal reproduction [33].

In present finding there are also calf mortality in different age groups of calves and the mortality rate in calves of age one to three month, three month to one year and in those caves its age is less than one month was 28 (11.2%), 20 (8.1%) and 13 (5.2%) respectively. The most common disorders occurred in the dairy farms are uterine prolapses, retained placenta and milk fever according to the (1%), 21(8.4%) and 10 (4%) of respondents and similar reports were also reported by Zewdu [34].

CONCLUSION AND RECOMMENDATION

Survey of reproductive performance of dairy cows is essential because it helps one to make management and other correction in case of suboptimal productive or reproductive performance which could be related to individual animal problems and on the other hand to proceed on what is found to be optimal to increase the economic gain. The dairy cows were found to be low reproductive performances which are indicators of the management system in general. Moreover, the extended period for age at first calving and calving interval as well as higher number of service preconception were recorded in the study area. The major encountered factors that influence reproductive performance were service type, feeding system and daily milk yield and health problem. The major health problems recorded in the present study were uterine prolaps; retain fetal membrane, milk fever and calf mortality. The other problem recognized in this study was lack knowledge for estrus detection and right time insemination of the AI technician. Generally, with a better efficient of heat detection, timely insemination,

postpartum reproductive health management and feeding, it is possible to improve the reproductive performance of the cattle.

Based on the present findings and conclusion, the following recommendations are forwarded

- Great attention must be given to estrous detection of dairy cows.
- The animal must be provided with good nutrition to enhance reproductive performance.
- Awareness should be created about animal health management and AI service.
- Sufficient supplement of AI equipment and semen to improve the reproductive potential of the cows.

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