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Occurrence of Reproductive Problems and Reproductive Performance of Crossbred Dairy Cows in Central and Southern Ethiopia

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Abstract: This survey was conducted to investigate the occurrence of major reproductive health problems and to evaluate the reproductive performance of dairy cows in central and southern Ethiopia during May 2019 to May 2020. The study involved a questionnaire survey including 720 cows and heifers in 98 herds. Of the examined cows 13.4%, 7.3%, 19.3%, 10.2%, 41.1%, 26.5%, 34.0% and 40.3% had history of occurrence of abortion, dystocia, calf mortality, uterine infections, mastitis, retained fetal membranes (RFM), anestrus and repeat breeding (RB), respectively in their reproductive life. The mean (±SD) calving interval (CI), calving to first service interval (CFS), age at first calving (AFC) and number of services per conception (NSC) recorded in the study were 458.8 (±125.0) days, 130.9 (±115.4) days, 32.3 (±6.9) months and 2.13 (±1.3), respectively. The study revealed that a considerable proportion of dairy cows encounter reproductive health problems during their reproductive life and reproductive performance of dairy cattle in the study area is suboptimal. Reproductive health status of herds, along with management practices, needs to be monitored and improved to increase reproductive and productive efficiency of dairy cattle in the study area.

Key words: Dairy Cattle · Ethiopia · Reproductive Problems · Reproductive Performance

INTRODUCTION

Ethiopia has a large cattle population estimated at 60.4 million. But improved dairy cattle represent only a small fraction of the cattle population [1]. The local cattle, which dominate the population, are genetically poor for milk production [2, 3]. As a result there is shortage in milk and dairy products supply in the country; and the country is net importer of milk and dairy products [4]. Problems associated with feeds and nutrition, shortage of improved (crossbred) dairy animals, poor husbandry practices, diseases and problems in milk and milk products marketing are considered as some of the important limiting factors for dairy development in Ethiopia [4].

Reproductive performance affects dairy herd profitability through impacting milk yields, available replacement heifers and culling rates [5]. It is influenced by the interactive effect of environment, management, health and genetic factors [6, 7]. Reproductive health problems occur frequently in lactating dairy cows and cause considerable economic loss to the dairy industry due to negative effect on reproductive performance [5]. Some of the most common reproductive problems include dystocia, abortion, stillbirth, retained placenta, metritis and mastitis [8, 9]. Diseases related to the reproductive tract (dystocia, retained placenta and metritis) are interrelated and can affect the length of calving interval, the number of days open and the reproductive efficiency in general. These diseases can also affect the overall productivity of dairy cows by reducing milk yield [8].

Several studies conducted in different parts of Ethiopia reported suboptimal reproductive performance in dairy cattle herds. Long calving interval, extended calving to conception interval, older age at first calving, high level of anestrus and repeat breeding, have been reported [10-14]. Dystocia, abortion, stillbirth, retained fetal membranes, calf mortality, mastitis and uterine infections have been reported among the reproductive problems [13, 15-18].

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Identification of the most important reproductive problems occurring in a herd would help to develop management strategies for prevention and control of the problems to improve reproductive performance. Therefore, the objectives of the present study were to assess the occurrence of major reproductive health problems and to evaluate the reproductive performance of dairy cows in central and southern Ethiopia.

MATERIALS AND METHODS

Study Area: The survey involved dairy cattle herds in Hawassa, Wolaita Sodo and Arsi Negele towns and Alage and Wondo Genet colleges in southern Ethiopia (Hawassa-Shashemene milkshed (HSMS)) and Addis Ababa, Debre Berhan, Bishoftu (Debre Zeit) and Tulefa (Sheno) towns in central Ethiopia (Greater Addis Ababa milkshed (GAAMS)). Herds were visited between May 2019 and March 2020 for extraction of data from farm records where available, direct observation of the farms and administration of questionnaire to owners or attendants with the relevant knowledge. The GAAMS is the most developed in the country. The HSMS is also one of the potential areas where much has to be done to develop the dairy sector [19, 20].

Study Herds: The study was conducted on 720 cows and heifers belonging to 98 dairy herds. The herds included smallholder and commercial dairy herds of different size located in urban and peri-urban areas, herds owned by higher learning institutions and a breeding herd. The study herds were Holstein-Friesians (HF) and HF-Zebu crosses with variable blood levels. One herd (a breeding herd) was of Jersey cows. The animals were kept under intensive management and spend the whole or most of the day indoors. Most of the herds were vaccinated against foot and mouth disease, lumpy skin disease, anthrax and blackleg.

Study Design, Sampling and Sample Size: Study animals and herds were selected with a two stage random sampling scheme. As the study was originally designed to estimate the sero-prevalence of bovine viral diarrhea virus (BVDV), the sample size (the number of animals and herds to be included in the study) for each geographic region (GR) included in the study, *i.e.* central Ethiopia and southern Ethiopia, was calculated with 32.6% estimated prevalence [21] of BVDV, desired 95% confidence level and 5% accepted error [22]. The minimum required sample size was calculated as 338 per GR (a total 676 for the two GR) and allocated to the selected towns proportional to their dairy cattle population size. The final number of samples collected from each GR, however, was slightly higher (493 and 465 from southern and central regions, respectively). Accordingly, a total of 954 dairy cattle were sampled from 98 herds from southern and central parts of the country. Herds in each town were randomly selected from the list of dairy farms in the areas obtained from the respective departments of agriculture. Data were collected from about 20 to 50% of female cattle over 6 months old. Data only from 720 animals were found relevant for reproductive health problems and reproductive performance analyses.

Data Collection: Data were collected regarding history of occurrence of reproductive problems and reproductive performance of cows. A cow is considered to have a history of a certain reproductive problem if the problem has occurred at least once in the entire reproductive life of the cow. Reproductive performance indicator traits such as calving interval (CI), calving to first service interval (CFS) and number of services per conception (NSC) were calculated for the most recent occurrence of the events: the last two calving for CI, the last calving for CFS and the most recent pregnancy/conception for NSC. Data used to define reproductive performance and occurrence of reproductive health problems were collected through a semi-structured questionnaire and examination of farm records where available. Some information was also obtained by direct observation of the farms. The information collected regarding reproductive problems and reproductive performance included: anestrus, repeat breeding, abortion, calf mortality, fetal membranes retention, dystocia, mastitis, uterine infection, interval between the two most recent calving (CI), the most recent calving to first service interval (CFS), number of services (natural or artificial) for the most recent pregnancy (NSC) and age at first calving (AFC).

Statistical Analysis: Data were stored and managed in Microsoft Excel® (Microsoft Inc. USA) and statistical analyses were performed using Stata® version 13.0 (StataCorp, College Station, Texas). Descriptive statistics (proportions and means) was used to summarize and present the data.

Table 1: History of occurrence of reproductive problems in dairy cows in central and southern Ethiopia

Reproductive problem	No. of observations	No. (%) affected	95% CI
Abortion	710	95 (13.4)	11.1, 16.1
Retained fetal membranes	680	180 (26.5)	23.3, 29.9
Mastitis	705	290 (41.1)	37.5, 44.8
Uterine infection	688	70 (10.2)	8.1, 12.7
Dystocia	686	50 (7.3)	5.6, 9.5
Anestrus	720	245 (34.0)	30.6, 37.6
Repeat breeding	715	288 (40.3)	36.7, 43.9
Calf mortality	683	132 (19.3)	16.5, 22.5

Table 2: Mean (±SD) reproductive performance indices of dairy cows in central and southern Ethiopia

Reproductive traits	No. Obs.	Mean (±SD)	Min	Max
Calving interval (days)	398	458.8 (±125.0)	319	1095
Calving to first service interval (days)	457	130.9 (±115.4)	30	730
Age at first calving (months)	499	32.3 (±6.9)	22	63
Number of services per conception	601	2.1 (±1.3)	1	10

RESULTS

Of the study cows 13.4%, 26.5%, 41.1%, 10.2% and 7.3% respectively had abortion, retained fetal membranes (RFM), mastitis, uterine infection (abnormal vulvar discharge) and dystocia at least once in their life. About 19% of the cows lost at least one calf during their past life, whereas 34.0% and 40.3% cows encountered anoestrus and repeat breeding (RB), respectively, during their past reproductive life (Table 1).

The mean time interval between the two most recent calving of the cows (CI), the mean calving to first service interval (CFS) for the most recent calving, the mean age at first calving (AFC) and the mean number of services per conception (NSC) for the most recent pregnancy were 458.8 days, 130.9 days, 32.3 months and 2.13, respectively (Table 2).

DISCUSSION

Reproductive Performance: Productive life, milk yield, reproductive performance and health of primiparous cows are closely related to their AFC [23, 24]. The 32.3 months AFC obtained in this survey compares favorably with 31.5 m and 32.7 m recorded for 50% and 75% Boran-Friesian crosses at a ranch in central Ethiopia [25]. But it was significantly lower compared to about 40 m to 47 m reported for crossbred dairy cattle from various locations in Ethiopia [10, 14, 18, 26, 27]. Though the AFC observed in our study looks good compared to previous reports in the country, it is however over 8 months higher compared to the recommended target of ≤24 months of age at first calving [28]. A substantial delay in the attainment of sexual maturity has a profound influence on the total cost of raising dairy replacements, due to an additional, non income-generating period of the cow [29]. Nutrition is a very important factor that determines pre-pubertal growth rates, reproductive organ development and time of onset of puberty and subsequent fertility [30].

The observed CI (458.8 days), in our study, was comparable to 422-446 days [27] and 475 days [18] reported for dairy cows in Ethiopia. However it was shorter compared to 516-561.3 days recorded for crossbred cattle from different parts of the country [10, 11, 14, 25]. The CI we have observed is 2 to 3 months longer compared to the 12 to 13 months CI generally considered to be economically optimal for dairy cows [31]. Shorter CI would result in more calves being born, increase the lifetime milk production per cow and maximize income [8]. Efficient and accurate estrous detection, proper semen handling techniques, timely artificial insemination (AI) and good management of postpartum anestrus would help to shorten CI [31-33].

Our observation of 130.9 days CFS is comparable to the 141.98 [10] and 141 days [11] recorded for crossbred dairy cows in central Ethiopia. But it is much higher compared to 67 days reported from Iran for Holstein cattle [34]. Reducing days to first service usually translates into improved reproductive performance, as measured by other traits such as average days open and CI [35]. Although the present estimate is within the range of the previous reports in the country, it is inadequate compared to the optimum calving to conception interval (CCI) recommended (75–85 days) to achieve the target 12-month CI [32]. The high occurrence of postpartum anestrus observed in the current study may partly explain the extended CFS noted in this study. Lobago *et al*. [16] attributed the prolonged CCI they observed in dairy cows

in different production systems in central Ethiopia to inadequate nutrition, poor health services and managerial problems.

The 2.1 NSC observed in the present study is comparable to NSC of 2 obtained by Asseged and Birhanu [36] in central Ethiopia. However, several studies in the country recorded lower NSC as compared to ours: 1.61-1.81 [25]; 1.75% [10]; 1.6 [16] and 1.69 [14]. The optimum NSC is considered to range between 1.6 and 1.8 [37, cited by 38] . Higher NSC could be attributed to failure to detect heat in time, poor AI technique and certain diseases.

Reproductive Problems: In the present study, 13.4% of the cows experienced abortion in their reproductive lifetime. Although numerous questionnaire surveys reported prevalence of abortion in dairy cattle in the country only few explicitly indicated whether it refers to occurrence in the entire reproductive life of the cow or restricted only to one pregnancy. Nonetheless Bitew and Prasad [13] recorded a similar abortion rate (13.9%) in western Ethiopia. However, our observation is higher than the 5.7% [15], 5.9% [12] and 8.0% [18] abortion prevalence reported in crossbred dairy cows in central Ethiopia. Annual abortion rate in dairy farms is recommended not to exceed 2 to 5% [39]. Abortion in excess of 5% should be a major concern at it results in considerable economic losses through reduced life time milk production (associated with longer CI); loss of calf (loss of potential female herd replacements); expenses associated with rebreeding; and premature culling of cows [40].

In this study, 34.0% of the cows were found to have been affected, once or more, with postpartum anoestrus during their reproductive life. Our result agreed with 38.6% prevalence of postpartum anoestrus reported in crossbred dairy cows in central Ethiopia [15]. Haile *et al*. [12], on the other hand, observed a much lower rate (10.1%) in Addis Ababa milk-shed. A study in India identified anoestrus to be responsible for 65% of infertility cases in crossbred cattle [41]. It should also be noted that silent estrus and missed heat are counted as anestrous. Using milk progesterone assay Lobago *et al*. [11] identified 67.4% of the examined dairy cows in central Ethiopia to have a delayed postpartum (>55 days) resumption of ovarian activity.

A large proportion (40.3%) of dairy cattle involved in this study had history of occurrence of RB. Our result is very high compared to previous reports from Ethiopia: 1.3% in Jimma [17], 3% in Bedelle [13] and 6.2% in Addis Ababa milk-shed [12]. Repeat breeding is one of the most important causes of infertility in cattle. An Indian study identified RB, caused by ovulatory disturbance and reproductive tract infections, in 25% of infertility cases in crossbred cattle [41].

The finding that 26.5% of the cows in the current study experienced retained fetal membranes compares favorably with the findings of Bekele *et al*. [42] (7.1% to 28.8%) in central highlands of Ethiopia, while several other studies found lower prevalence of RFM (5.4% - 19.2%) in different parts of the country [12, 13, 15-17]. A high prevalence of RFM, exceeding 10%, should be a concern as the condition is usually related with reproductive tract infection and subsequent infertility [15, 16, 43].

Signs of uterine infection (abnormal vulvar discharge) were observed in 10.2% of the cows included in the study. This finding is within the range of many earlier reports (2.8% - 16.9%) from various parts of the country [13, 15, 16]. Some reviews also put the prevalence of metritis [44] and endometritis [45] at around 10 to 20%. The risk factors most frequently associated with uterine infection include dystocia, stillbirths, retained fetal membranes, deficiencies in hygiene and metabolic imbalances around parturition [45].

The observation of 7.3% cows experiencing dystocia in their entire calving does seem acceptable in view of earlier cross-sectional observations as high as 6.6% in local and crossbred cattle in various parts of Ethiopia [12, 13, 17].

The current study demonstrated that 41.1% of the study cows developed clinical mastitis in their past life. Our finding is higher than reports of earlier studies on clinical mastitis in different parts of Ethiopia ranging between 3.4% and 37.0% [46-50].

Of the cows included in the survey 19.3% have lost at least a calf to death in their life. In studies conducted in central Ethiopia Lobago *et al*. [16] and Wudu *et al*. [51] found more or less similar high calf mortality rates of 17.4% and 22.3%, respectively. However, much lower calf mortality rates (about 9 %) were observed in different production systems in the country [52, 53].

Interpretations and comparison of results of occurrence of reproductive problems obtained in this study should take into consideration the potential differences in the study approaches used among the studies. Our study, for example, recorded the occurrence

of the event of interest for the life of the animals while others might have only considered occurrence of the condition during the most recent pregnancy, calving or postpartum period.

The limitation of this study was relying largely on recall information in determining occurrence of reproductive problems and estimation of reproductive performance indicators, as virtually all of the small farms and some of the large farms do not keep reproductive record. The present study demonstrated that dairy cows in the study areas experience considerable level of reproductive health problems that are known to severely affect reproductive efficiency. The reproductive performance indices observed in the study were also far from being optimum. Reproductive health monitoring and management, along with improved husbandry practices, should be practiced to improve the reproductive and productive performance of dairy herds in the study area.

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Ethical Approval: The study was conducted after Ethical Clearance was obtained from Animal Research Ethics Review Committee of the College of Veterinary Medicine and Agriculture of Addis Ababa University (Ref: VM/ERC/08/11/018,21/12/2018). Informed verbal consents were obtained from all animal owners who participated in the study.

Conflicts of Interest: The authors declare that they have no conflicts of interest.

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