Study of Reproductive and Production Performance of Crossbreed Dairy Cattle under Smallholders Management System in Bishoftu and Akaki Towns

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Abstract: The objective was to assess the reproductive and productive performance of crossbreed dairy cattle under smallholder farmers’ level in Bishoftu and Akaki districts of Ethiopia. The districts were purposively selected based on their potentiality of crossbreed dairy cattle population. A cross-sectional survey and structured questionnaire were used to collect data from 130 households. The data were analyzed using the Statistical Package for the Social Sciences to study the magnitude and direction of variation in months age at first services (AFS), age at first calving (AFC), calving interval (CI), lactation milk yield (LMY) and lactation length (LL) due to management factors. Results revealed that calving interval (CI) was only significantly (p<0.001) found different between the districts. The mean of AFS, AFC, CI, DMY, TLMY and LL were estimated to be (18.7±3.7 and 18.7±3.5 months), (26.9±5.4 and 27.0±3.7 months), (13.0±2.1 and 13.8±1.9 months), (11.6±3.1 and 10.8±2.4 liters per day/cows), (3208.56±108.81 and 3031.56±46.32 litres) and (276.6±35.1 and 280.7±19.3 days), respectively in Bishoftu and Akaki Towns. Poor management was the most probable factors affected the standard expected reproductive and production performance of crossbreed cattle in the study areas. Efficient heat detection and timely insemination, better health management, genetic improvement of crossbreeding, supplementing of good quality feed resources are required for optimal reproduction and production performance.

Key words: Crossbreed · Dairy cattle · District · Productive · Reproductive

INTRODUCTION

Livestock production plays an important role to human health and poverty alleviation in Ethiopia. The cattle production gives multi-purpose role where cattle provide milk, meat, fertilizer, fuel, draft power and also as a means of economic uplift from the sale of milk and milk products. The sector contributes 15 to 17% of gross domestic product (GDP) and 35 to 49% of agricultural GDP and 37 to 87% of the household incomes [1].

Ethiopia has the largest livestock production in Africa. CSA [2] stated that the total cattle population of the country in 2013 was estimated to be about 55.03 million. Out of this total cattle population, the female cattle constitute about 55.38% and the remaining 44.62% were male cattle. The large cattle population; favorable climate for improved, high yielding cattle breeds; and relatively disease free environment make Ethiopia to hold a substantial potential for dairy development [3]. Despite of the existing dairy scenario with a potential for its subsequent development, productivity of crossbreed dairy cattle in general is low thereby impeding its direct contribution towards national economy.

Like most developing countries, Ethiopia’s increasing human population, urbanization trends and rising household incomes are leading to a substantial increase in the demand for livestock products, particularly milk and meat. In order to meet the growing demand for milk in Ethiopia, milk production has to grow at least at a rate of 4% per annum [4]. Ethiopia has given the priority on the development of dairying at farmer’s level to increase the
supply of milk from smallholder dairy farms. Reproductive performance is one of the major factors, other than milk production, that affects productivity and profitability of a dairy herd. The reproductive and production performance of the herd or animal is a key indicator of sustainability of a dairy farming system. The important parameters that determine cattle reproductive and productive efficiency are age at first service, age at first calving, birth weight, total milk yield, average milk yield per day, calving to first service interval and calving interval [5].

Currently, a large number of smallholder dairy farms are operating. However, information on productive and reproductive performance of crossbreed dairy cows in the study area raised under smallholding system is not well elucidated. Most of the research conducted for crossbreed dairy cows has been under controlled conditions at research centers and government-owned institutions and thus has limited application to different production systems in Africa [6]. Moreover, the area is well communicated and the farmers are responsive make the research suitable in the study areas. The present study was therefore undertaken to investigate the productive and reproductive performances of crossbreed dairy cattle in Bishoftu and Akaki under smallholder management system.

MATERIALS AND METHODS

Study Areas: The study was conducted in smallholder dairy farms found in Bishoftu and Akaki Towns of Ethiopia. The two towns were selected due to their high potential for dairy production, role in the commercialization of the dairy sector due to the proximity to Addis Ababa, a huge gap between demand and supply of milk and improved technologies accessibility for research undertaking.

Bishoftu is located in 45 km along South East of Addis Ababa. The area is located at 9°N latitude and 40°E longitude at altitude of 1850 m.a.s.l with annual rain fall of 866 mm of which 84% is in the long rainy season from June to September [8]. The annual average temperature ranges from 12.3 to 27.7°C with an overall average of 18.7°C. The soil and climate are similar to those in many highland areas in Ethiopia. Cattle, small ruminant, poultry and equines are the major livestock species kept with fast growing smallholder dairy production [7].

Akaki district is located 25km away from Addis Ababa at 9°-10°24’ North latitude and 37°56’-40° 35’ East longitude with an altitude range of 1500-3100 m.a.s.l. Its annual temperature ranges from 15°C-27°C. The mean annual rainfall of the district is 800-900mm and the short rain occurs during February, March and April and the long rain extends from June up to August (Unpublished data of 2010/11). The report also shows that all of the domestic animals raised in the District, cattle population takes the first rank with 91,040, followed by 39,055 goats, 39,048 sheep, 22,676 donkeys, 6,136 horses and 2,015 mules.

Sampling and Data Collection Method: Bishoftu and Akaki were selected based on their crossbred dairy cattle population, ease of access, feeds and feeding systems and other characteristics of herd management. Smallholder farmers were selected from the list using a stratified random sampling procedure based on the information of city agricultural desk. Sample size was determined using the formula given by Arsham [9] for survey studies:

\[ N = \frac{0.25}{SE^2} \]

Where, \( N \) = sample size
\( SE \) = Standard error of the population.

Accordingly, a total of 130 (61 from Bishoftu and 69 from Akaki) smallholder farmers were selected at 4.38% standard error by random sampling method.

Data Collection Method: Structured questionnaire was prepared and used to collect information from crossbreed dairy cow owners under smallholder condition in one visit interview and reproductive performance of their crossbreed dairy cows were studied. The questionnaires were checked for clarity of the questions prior the interview. Prior the interview, respondents were briefed to the objective of the study. Following that, the actual questions and questionnaires were presented. Accordingly, information about the reproductive and production performance of crossbreed dairy cattle >50% blood levels (age at first calving, age at first service, calving interval and calf crops, daily milk yield, total lactation yield and lactation length) were collected.

Data Analysis: The data were entered and organized in the excel spread sheet and then they were analyzed using descriptive statistics (SPSS, version 20). Descriptive statistics was used to display the result such as mean and standard deviation. ANOVA comparison was performed using significance at p<0.05.
RESULTS AND DISCUSSION

Reproductive and Production Performance of Dairy Cattle: This section describes the reproductive and production performances of dairy cattle. The performance of the breed in the two districts was compared to assess their suitability in different management practices. Reproductive traits considered were age at first calving, calving interval, calf crops and number of service per conception while the production performance included were daily milk yield, total lactation yield, lactation length and dry period.

Reproductive Performance of Dairy Cattle

Age at First Service: Age at first service (AFS) is the age at which heifers attain body condition and sexual maturity for accepting service for the first time. The respondents reported that the mean age at first serviced were 18.7±3.7 and 18.7±3.5 months (range of 13 to 26 months) old for crossbred cattle reared by the farmers in Bishoftu and Akaki, respectively (Table 1). There were not significant differences (p<0.05) in age at first services (AFS) of the crossbreed in the two districts. The mean estimated AFS observed in this study was shorter than findings of Belay et al. [10] where the AFS crossbreed dairy cows were 24.30±8.01 in Jima Town and 27.5 months of AFS crossbreed dairy cows reported by Zewdie [11] in the highlands and central rift valley of Ethiopia. The largest age recorded in these areas could have resulted from the low level of management and poor feeding of calves and heifers at the earlier stages, which consequently had reduced growth rate and delayed puberty.

Age at First Calving: Age at first calving is the age at which heifers calve for the first time. The means±SD (minimum 18 months and maximum 36 months) of age at first calving (AFC) were 26.9±5.4 and 27.0±3.7 months for crossbreed cattle in Bishoftu and Akaki, respectively (Table 1). Age at first calving did not differ significantly between the two districts (P < 0.05). In the present study the average age at first calving is lower than AFC of 31.9±0.22 months, which is reported by Yifat et al. [12] for crossbreed in Zway. Moreover; the mean result of the age at first calving in the present study was lower than that of Hunduma [13] in Assela, kumar and Tkui [14] in Mekelle and Nibret [15] in Gonder who reported 34.8±4, 36.4 ±1.7 and 32.4 months, respectively for crossbred cows. The high age at first calving observed here may be related to environmental conditions and husbandry practices which may affect on the cattle growth. These may retard growth rate, delay puberty, reduced fertility and conception, thus, the high age at first calving of the imported breed. Hence, there should be concerted efforts to improve the feeding and nutrient profile of feeds offered to the animals, housing, disease prevention and management especially during harsh climatic conditions in order to improve on age at first calving. The other reasons determining AFC or conception in particular should also have been considered; in other case the reasons affecting AFS and AFC are completely overlapping.

Calving Interval: The calving interval is the period between two consecutive parturitions and ideally should be 12 to 13 months. Calving interval (CI) is one of the major components of reproductive performance that influences livestock production system. The means±SD (minimum 12 months and maximum 21 months) for CI were 13.0±2.1 and 13.8±1.9 months for crossbred cattle at Bishoftu and Akaki, respectively. There is a statistically significant (P<0.05) difference in the mean length of calving interval in the two areas. Presented results are in concordance to the previous findings of Hunduma [13], with 372.8±5.9 days (12.4 months) in Assela Town. However, the mean calving interval observed in this study is shorter than 17.8 months reported by Emebet and Zeleke [16] in Dire-Dawa and in line with 13.6 months reported by Yifat et al. [12] in Zway for crossbreed dairy cows. The high calving interval reported in the present study may be related to poor management practices and

<table>
<thead>
<tr>
<th>Table 1: Reproductive performance of crossbreed dairy cows</th>
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<tr>
<td>Parameters</td>
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<td>-------------</td>
</tr>
<tr>
<td>AAS (in months)</td>
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<tr>
<td>AFC (in months)</td>
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<tr>
<td>CI (in months)</td>
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AFS = Age at First Service, AFC = Age at First Calving, CI = Calving Interval, SD = Standard Deviation * = shows significant difference (p <0.05)
Table 2: Productive performance of crossbreed dairy cows

<table>
<thead>
<tr>
<th>Production parameters</th>
<th>Bishoftu (Mean±SD)</th>
<th>(Akaki Mean±SD)</th>
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<tbody>
<tr>
<td></td>
<td>1st stage</td>
<td>2nd stage</td>
</tr>
<tr>
<td>DMY (liter)</td>
<td>14.3±5.4</td>
<td>12.7±2.7b</td>
</tr>
<tr>
<td></td>
<td>11.6±3.1</td>
<td></td>
</tr>
<tr>
<td>TLMY/cow (liter)</td>
<td>3208.56±108.81</td>
<td></td>
</tr>
<tr>
<td>LL (Days)</td>
<td>276.6±35.1</td>
<td></td>
</tr>
</tbody>
</table>

**DMY=** Daily milk yield; **TLMY=** Total lactation milk yield; **LL=** Lactation length; **SD=** Standard deviation; b = shows statistical significant difference (p<0.05)

Other environmental stress that could affect the animals return to oestrus, heat detection, serving and conception at Bishoftu and Akaki Towns.

**Production Performance of Dairy Cattle:** Lactation yield was not measured in the survey, but based on farmers’ knowledge about their production both per cow and per day.

**Daily Milk Yield:** The milk productions at different stage of lactation of crossbred dairy cows are presented in Table 2. The mean milk yield was 14.3±5.4 litter, 12.7±2.7 litter and 7.9±2.5 liters for the first, second and third stage of lactations, respectively with an overall average of 11.6±3.1 liters per day/cows in Bishoftu. The mean milk yield was 14.5±3 litter, 10.6±2.67 litter and 7.1±2.0 liters for the first, second and third stage of lactations, respectively with an overall average of 10.8±2.4 liters per day/cows in Akaki. The milk production was significantly decreased in third than first and second stage of lactation. The milk yield of this study is greater than Addis et al. [17] that were reported to be 7.01±2.73, 5.55±2.83 and 3.50±1.64 liters for the first, second and third stage of lactations, respectively with an overall average yield of 5.35±1.23 liters per day. However, the result of this study is slightly greater than Adebabay [18] who reported 10.96, 9.12 and 5.04 liters for first, second and third stages of lactation respectively.

**Total Lactation Milk Yield:** Table 2 shows that the total mean lactation milk yields (TLMY) of crossbred dairy cow was found to be 3208.56±108.81 liters and 3031.56±46.32 liters respectively. The mean lactation milk yield found in these study areas, were lower than 3025, 5807 liters reported by Dennis [19] in Kenya and Naceur *et al.* [20] in Tunisia, respectively. The lower value obtained here could have been influenced by the environment and poor management practices.

**Lactation Length:** Lactation length refers to the time of period from when a cow starts to secrete milk after parturition to the time of drying off. A lactation period of 305 days is recommended to take advantage of 60 days dry period. The mean±SD lactation length of crossbreed cows in the present study was found to be 276.6±35.1 days, 280.7±19.3 days, respectively (Table 2). The effect of study sites on lactation length was not significant (P>0.05). The estimated lactation length was comparable to the ideal lactation length of 305 days as defined by Foley *et al.* [21]. The lactation length of the present study is shorter than with the result of Mulugeta and Belayneh [22] where the lactation period for crossbred dairy cows were 333.9 days in North Showa and with the findings of Ketema [23] who reported the average lactation period of crossbred cow was 303 days in Kersa Woreda. Zewdie [10] reported that the average lactation period of crossbred dairy cows in Debre-Birhan, Jima and Sebeta were 291.0±21.2, 288.5±21.2 and 300.0±21.2 days, respectively. The result is almost similar with the present finding. Level of management achievable in Ethiopia is unfavorable to higher exotic inheritance levels than 50% Holstein Friesian inheritance [24].

**CONCLUSIONS AND RECOMMENDATIONS**

The smallholder dairy productions are important, where they help to safeguard the large difference between milk demand and supply around the towns. It is concluded that the results obtained for AFS, AFC, CI, LL and LMY were below the standard expected from commercial dairy herd. Management differences (Proper feeding, housing, AI services/breeding, watering and health care) are the major constrain to decrease the productive and production performance of crossbred cattle in the study areas. In order to improve the relatively low average daily milk yield, the extended AFC and CI and the short LL and milk production associated with these,
efficient heat detection and timely insemination, better health management, genetic improvement of crossbreeding, supplementing of good quality feed resources are necessary.

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REFERENCES


