

Comparative Evaluation on Productive and Reproductive Performance of Indigenous and Crossbred Dairy Cow Managed under Smallholder Farmers in Endamehoni District, Tigray, Ethiopia

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Abstract

The study was conducted in Endamehoni District Sothern zone of Tigray region, Ethiopia. Objective of this study was to investigating productive and reproductive performance of indigenous and crossbred Dairy cow Managed under smallholder farmers in Endamohoni District. The total sampled numbers of household's was 180 dairy cow owners, 90 each from indigenous and crossbred dairy cow owners respectively. The primary data was collected using semi-structured questionnaire and interview. For the analysis descriptive statistics such as frequency, percentage, mean, and standard deviation and test statistics such as chi-square and t-test was used. Average daily milk yield 1.67 and 4.60 liters, average lactation length 8.93 and 9.72 months and lactation yield of 281 and 1208 liter for indigenous and crossbred Dairy cow was recorded, respectively. Productive and reproductive performances of indigenous dairy cows are significantly lower than crossbred cows. These variations are attributed to the genetic variation of the breeds. The major constraints of Dairy cow production in the study area were feed shortage, disease problem and lack of supplementary feed with technological constraints. The present study suggests that crossbred cows were better than indigenous cow's in terms of their productive and reproductive performance improving the livelihood of smallholder farmers.

Keywords: Dairy production, breed preference, age at first calving, lactation yield

INTRODUCTION

Food insecurity is an appearance of famine challenging in many developing countries, especially those found in Sub-Saharan Africa (SSA) and South Asia. One third of the peoples in SSA are food insecure (Graaff et al 2011). Adoption of improved agricultural technologies could motivate overall economic growth through inter-sectoral linkage while conserving natural resources (Sanchez *et al.*, 2009). In the majority of the rural areas of Ethiopia, livestock production plays important role in the provision of draft power, food, cash, transportation, fuel and especially in pastoral areas of social prestige. In addition, dairy production plays significant role as a source of additional income to the farming community through sale of raw milk, processed milk products and live animals (EEA, 2002).

Ethiopia has large livestock population, which is estimated to be 52.13 million cattle, 24.2 million sheep, 22.6 million goats, 1.96 million horses, 6.4 million donkey, 0.37 million mule, 0.99 million camels, 44.89 million poultry and 4.99 million beehives. Out of this total cattle population, female cattle constitute about 55.57 percent and the remaining 44.43 percent are male. From the total cattle population 98.88 percent are indigenous breed, 0.93 percent are cross and 0.12 percent are exotic bred (CSA, 2012).

Cattle productivity is restricted due to low milk yield, high calf mortality and poor growth rates together with unassuming reproductive performance. The main reasons for this problem is indigenous breeds have low genetic potential, diseases problem, poor husbandry practices, seasonal shortage of feeds and a variety of environmental factors like high ambient temperature and humidity (Abeygunawardena and Dematawewa, 2004). It is necessary to evaluate the productive and reproductive performances of indigenous stocks and their crossbred for designing appropriate breeding strategies. In addition, reproductive performance is vital measures for assuring the profitability of many animal production systems. Especially, the economics of dairy enterprise is based on an efficient reproductive performance of dairy animals (Sodakar *et al.*, 1988). Therefore; this study aims to comparatively evaluate productivity and reproductive performance of indigenous and crossbred Dairy cow on smallholder farmers in Endamehoni District.

Materials and methods

The study was conducted in Endamehoni woreda with the adopter and non-adopter of cross breed dairy cows on small holder farmer. The District is potential in crossbred dairy cattle. In order to know the characteristic of indigenous and crossbred dairy cows in the District, proportional sample size of 90 indigenous and 90 crossbred dairy cow household owners leading to a total sample size of 180 dairy cattle owners were selected. Sampling method was purposively considering the availability of indigenous and crossbred dairy cattle on the smallholder farmers prior to the data collection method. The proportions of the sample were 60 dairy cows' owners. The data

were collected using primary data collection method. During the survey study, data were collected from the selected households who have indigenous and crossbred dairy cow of District Endamehoni using questionnaire.

Productive and reproductive performance parameters of indigenous and crossbred dairy cows considered as the main components of the study. The productive performance parameters of cows were, the average daily milk yield (liter), lactation length (months), and lactation yield (liter). The studied reproductive performance parameters of cows included: age at first services (month), age at first calving (months), calving interval (months) and service per conception (number).

Mean comparison test were used to compare the productive and reproductive performance of indigenous and crossbred dairy cows. The t-test and chi-square tests help to see the presence of statistically significant differences in the characteristics of indigenous cow owners and crossbred cows owners in terms of some assumed variables. Ranking method was used to rank the variables that prioritize by the small holder farmers like major constraints of indigenous and crossbred dairy cattle production in the study area of Endamohoni District.

RESULTS

Table1. Milk production performance parameters in different lactation

Parameters	Indigenous (N=90)		Cross (N=90)		t-test (P-value)
	Mean	SD	Mean	SD	
First lactation (months)	2.51	0.58	5.65	1.13	0.000***
Second lactation (months)	1.70	0.47	4.64	1.09	0.000***
Third lactation (months)	0.92	0.32	3.63	1.09	0.000***
Daily milk yield (liter)	1.67	0.51	4.60	1.09	0.000***
Lactation length (months)	8.93	2.97	9.72	1.58	0.028**
Lactation yield (liter)	281.0	111.48	1208.3	322.0	0.000***

Significant level: P<0.01, P<0.05; N=respondent; SD=standard deviation

Table 2. Reproductive performance parameters of indigenous and crossbred dairy cow

Parameters	Indigenous (N=90)		Cross (N=90)		t-test (P-value)
	Mean	SD	Mean	SD	
Age at first services (months)	44.97	7.57	28.27	5.66	0.000***
Age at first Calving (months)	53.97	7.57	37.32	5.66	0.000***
NSPC (number)	1.34	0.67	1.31	0.55	0.17(ns)
Calving interval (months)	23.91	4.97	17.91	3.11	0.000***
Open day (months)	7.40	2.98	4.43	2.40	0.000***

Sig= Significance level: *** = P<0.01; NSPC=number of service per conception;

Table 3. Major Constraints of dairy cattle production

Constraints	N	%	Rank
Feed Resource	156	87.6	1
Disease and parasite	131	72.8	2
Supplementary feed	89	49.4	4
Drought problem	109	60.6	3
Low breed performance	76	40.6	6
Technological awareness problem	80	44.4	5
Breeding problem	67	37.2	7
Veterinary services access problem	50	27.8	8

N=number of respondents

DISCUSSIONS

Productive Performance of Dairy Cows

Daily milk yield

The average daily milk yield of indigenous cow was 2.5, 1.7 and 0.9 liters for the first, second and third lactations, respectively with an overall average of 1.67 liters per day. The average daily milk yield of crossbred cows was 5.65, 4.64 and 3.6 liters for the first, second and third lactations, respectively, with an overall average of 4.6 liters per day. The average total milk yield of crossbred cow was higher than indigenous cow (Table 1). According to (Asaminew and Eyassu 2009), that the average daily milk yield of local cows was 2.0, 1.2 and 0.6 liters for the first, second and third lactations, respectively, with an overall average of 1.2 liters per day and

average daily milk yield of crossbred cows was 7.3, 5.5 and 3.5 liters for the first, second and third lactations, respectively, with an overall average of 5.2 liters per day in the in Bahir Dar Zuria and Mecha woreda of West Gojam Zone in Amhara Regional State. Similarly, the findings reported by (Mulugeta 2005) indicated that the average daily milk yield of indigenous and crossbred cows was 1.09 and 5.97 liter per day, respectively. The present study result showed slightly higher yields for indigenous cows and lower for crossbred cows. In addition, the present finding for the crossbred cows average daily milk yield was lower as compared with (Belay 2012) who reported 8.52 liters. According to (Azage et al 2013), the average daily milk yield of indigenous and crossbred was 1.85 liter which ranged from 1.24 to 2.31 liter/day in rural areas of Mieso and for crossbred cows it ranged between 10.21 to 15.9 liter/day. This result is higher than the present study. This variation in the daily milk yield might be due to the difference in the availability of feed resources and feeding practices, dairy husbandry practices and the blood level of the crossbreds in the study area.

Lactation length

The average lactation length of indigenous and crossbred cows was 8.93 and 9.72 months respectively (Table 1). Significant variation was observed on the lactation length between indigenous and crossbred dairy cows in case of milking time during birth. Some of those dairy breed were dry before and after the recommended time of drying time. So the result was based on average of months those breeds on staying producing milk. The present finding of lactation length for indigenous and crossbred dairy cow was lower than the results reported by (Asaminew and Eyassu 2009) as 9.8 and 10.1 months for indigenous and crossbred dairy cows respectively. However it was higher than the findings of (Addisu 2013) who reported 203.75 days for indigenous and 262.25, 284.25 and 294.25 days for 50, 75 and 87 crossbred cows respectively. The variation of lactation length of indigenous and crossbred dairy cow was influenced with exotic blood level in the case of crossbred cows, availability of feed resources and feeding practices, calving year, parturition number and dairy husbandry practices

Lactation yield

The lactation milk yield of indigenous cow was lower than crossbred dairy cows. The estimated overall average lactation yield was 281 and 1208.33 liters for indigenous and crossbred cows respectively (Table 1). The higher lactation yield in the case of crossbred was resulted due to longer lactation length and higher daily milk yield as compared with the indigenous cows. The present finding was lower as compared with (Mulugeta 2005) findings of 238.35 and 506.78 liter for indigenous and crossbred cows in Adaliben woreda in Oromia region state of Ethiopia. This variation might be related with lactation length, genotype of the cows and availability of feed resources and management practices in the study area.

Reproductive Performance of Indigenous and Crossbred

An important precondition for the sustainability of a dairy production system is that cows must have efficient reproductive performance. This is essential for the production of the main commodity of interest of milk, as well as to provide replacement animals.

Age at first service

Age at first service (AFS) indigenous and crossbred cows were 44.97 and 28.2 months respectively. AFS of indigenous breed in the study was comparatively lower than crossbred cows (Table 2). The current finding contradicts result of (Hunduma 2013; Haftamu et al; 2010; Belay et al; 2012) they reported that age at first service of crossbred was 24.9 months (range 18 to 36 months), 722.24 days and 24.30 months respectively. This current finding was slightly higher than with the results of the above mentioned authors. This might be due to the access of feed availability, heifer management during calf age with supplementation concentrate feeds during weaning age and genotype of the breeds.

Age at first calving

First calving results the beginning of an indigenous cows for productive life and influences both the productive and reproductive life of the female, directly through its effect on life time calf crop and milk production and indirectly through its influence on the cost invested for up-bringing (Mukassa-Mugerewa 1989). The age at first calving (AFC) of the indigenous and crossbred was 53.97 and 37.32 months, respectively (Table 2). The current finding was contradict with Kumar and Tkui 2014, and Hunduma 2013 they reported that AFC in local breed cows was 3 years and 2 years in crossbred cattle around Mekelle city, mean AFC of crossbred 34.8 months (range 27 to 46 months) at Assela area. However, the present findings of AFC was lower from the results of (Mulugeta 2005) who reported 58.09 and 44.09 months for indigenous and crossbred dairy cows respectively in Adelina wereda of Oromia regional state of Ethiopia respectively. This variation might be due to feed availability, genetic level, access of concentrate feed, access of AI, dairy husbandry practices.

Number of service per conception

Number of service per conception (NSPC) for indigenous and crossbred cows was 1.34 and 1.3 respectively (Table 2). The current finding was in agreement with (Hunduma 2013; Kumar; Tkui 2014) and (Belay et al 2012) who reported that service per conception was 2.5, 1.52, 1.5 and 1.56 Around Addis Ababa, Assela, Mekelle town and Jimma town respectively. This might be the effectiveness of the AI services, management

system of the owners and genotypic characteristics of the breed to conceive in small number of services or breeding through Artificial insemination and natural mating practices that perform well by the smallholder farmers in the study area.

Calving interval

The calving interval of indigenous and crossbred cows was 23.91 and 17.91 months, respectively (Table 2). The current finding was in agreement with (Mulugeta 2005; Gebrekidan et al 2012; Azage et al 2011; Kumar and Tkui 2014) who reported that the calving interval of the indigenous and crossbred in the in Adaliben weroda in Oromia region state of Ethiopia was 21.66 and 16.39 months, 22.8 and 16.8 months central zone of Tigray and 16-26 months rural lowland system of Mieso and 16 months in months in rural highland dairy system of Bure for indigenous and 469.45 (15.6 months) for crossbred cows respectively. The difference reproductive efficiency could be explained mainly by environmental factors such as nutritional management, farm husbandry practices, insemination time and genetic characteristics of the breeds.

Open days

The average open days for indigenous and crossbred cows were 7.40 and 4.43 months, respectively (Table 2). The present finding was contradicted with (Rokonuzzaman et al 2009) who reports in Bangladesh the service period of indigenous and Frisian cross were reported 134 days (4.67 months) and 86-121 days (2.87-4.03 months), respectively. This result could be vary due to genetically difference of breed, available feed resource and other management practices to differentiate in open days of those breeds.

Major Constraints of Indigenous and Crossbred Dairy Cattle Production

Major constraints feed shortage in terms of quality and quantity was ranked as first problem by 87.6% respondents followed by diseases (72.8 %) as second problem and drought (60.6%) as third problem of the respondents in the study area. Breeding problem (37.2%) and veterinary services (27.8 %) were ranked as seventh and eighth constraints by the respondents (Table 3). In the study areas animals feed sources are entirely dependent on pasture grazing land and crop residues. However, the practice of improved forage cultivation remained low and this has motivated the supply of low quality feed resources. In addition, the grazing land areas has shrunk in the recent years because most of the grazing lands are substituted for crop cultivation purpose and this resulted in the shortage of feed supply. The current finding was in line with (Azage et al 2013; Asaminew and Eyassu 2009) and Belay 2012) who reported that the major constraint of dairy cow production are shortage of feed resource, disease outbreak, lack of supplementary feed and problem of extension services (credit access, AI services, veterinary services, new technologies) and other related problems to affect the dairy production system on smallholder farmers. Those types of constraints might happen due to shortage of irrigation, grazing land, awareness and knowledge of the non-adopters and adopters, lack of industries to process animal.

CONCLUSION

Productive and reproductive performances of indigenous dairy cows are significantly different from crossbred cows for parameters including daily milk yield, lactation length, lactation yield and age at first service, age at first calving, calving interval and open days. The variation in respect to productive and reproductive performances between indigenous and crossbred cows was attributed due to the genetic variation of the breeds. Therefore the indigenous breeds were highly preferred by non- adopters for their excelling attributes of low feed requirements, high disease resistance, easily availability at local market and good drought resistance ability in the study area. The major constraints of dairy cattle production in the study area were feed shortage, disease problem, and lack of supplementary feed with technological constraints. It can be concluded that crossbred cows were better than indigenous cow's in terms of their productive and reproductive performance improving the livelihood of smallholder farmers.

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REFERENCE

- Abeygunawardena, H. and Dematawewa, C. M. B. 2004 Prepubertal and post-partum anestrus in tropical Zebu Cattle Animal Reproduction Science, 83, 373 -38
- Addisu Hailu 2013 Crossbreeding effect on milk productivity of Ethiopian indigenous cattle: Challenges and opportunities. Journal of Agricultural Science, 3(11), 515-520.

- Asaminew Tassew and Eyassu Seifu 2009 Small holder Dairy Production System and Emergence of Dairy Cooperatives in Bahir-Dar Zuria and Mecha Woredas. *World Journal of dairy and Food science*, 4 (2), 185-192
- Azage Tegegne, Berhanu Gebremedhin, Dirk Hoekstra, Berhanu Belay and Yoseph Mekasha 2013 Smallholder dairy production and marketing systems in Ethiopia: IPMS experiences and opportunities for market-oriented development Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project - International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia. Working Paper No. 31
- Belay Duguma 2012 Productive and reproductive performance and management practices of crossbred Dairy cow at Jimma College of agriculture and veterinary medicine dairy farm. *International Journal of Current Research*, 4, (1), 87-92
- Belay Duguma, Yisehak Kechero and Janssens, G.P.J. 2012 Productive and Reproductive Performance of Zebu X Holstein-Friesian Crossbred Dairy cow in Jimma Town, Oromia, Ethiopia. *Global Veterinarian*, 8 (1), 67-72
- CSA 2012 Central Statistical Agency of Federal Democratic Republic of Ethiopia, Agricultural sample survey, volume-II, Report on livestock and livestock characteristics, statistical bulletin, 532, Addis Ababa, Ethiopia.
- Ethiopian Economic Association - EEA 2002 A research report on land tenure and agricultural development in Ethiopia, October 2002, Addis Ababa, Ethiopia.
- Gebrekidan Tesfay Weldelesse, Zeleke Mekuriaw and Gangwar, S.K 2012 Reproductive and productive performance of Dairy cow in central zone of Tigray, Northern Ethiopia *International Journal of advance biological research*, 2(1), 58-63
- Graaff, J.D., Kessler, A., Nibbering, J, J. W. (2011). Agriculture and Food Security in selected countries in Sub-Saharan Africa: diversity in trends and opportunities. *Food Security*, 3,195-213
- Haftamu Lemma, Kelay Belihu and Dessie Shiferaw 2010 Study on the reproductive performance of Jersey cows at Wolaita Sodo dairy farm, Southern Ethiopia Wolaita Sodo University, *Veterinary Journal*, 14 (1), 53-70
- Hunduma Dinka 2013 Reproductive performance of crossbred Dairy cow under smallholder condition in Ethiopia *African Journal of dairy farming and milk production*, 1(5) 101-103
- Kumar, N. and Tkui, K., 2014 Reproductive performance of crossbred Dairy cow in Mekelle, Ethiopia. College of Veterinary Medicine, Mekelle University, Ethiopia *Scientific Journal of Animal Science*, 3(2) 35-40.
- Mukassa-Mugerewa, E 1989 A review of reproductive performance of female *Bos indicus* (Zebu) Cattle Monograph 6 ILCA (International Livestock Centre for Africa) Addis Ababa, Ethiopia
- Mulugeta Ayalew 2005 Characterization of dairy production systems of yerer watershed in Ada liben woreda oromiya Regional State Msc. Thesis, Haramaya University, Haremaya, Ethiopia
- Rokonuzzaman, M., Hassan, R., Islam, S. and Sultana, S 2009 Productive and reproductive performance of crossbred and indigenous Dairy cow under smallholder farming system *Journal of Bangladesh Agriculture*, 7(1), 69-72.
- Sanchez, P. A., Denning, G. L. and Nziguheba, G. 2009 the African Green Revolution Moves Forward. *Food Security*, 1, 37-44.
- Sodakar, S. B., Singh, B.N., Khan, F.H. 1988 Studies on breeding efficiency in Friesian x Sahiwal crossbred. *Indian Journal of Dairy Science*, 41,185-187