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Lactation and Reproductive Performance of Local and Cross Bred Cows in Selected Urban and Peri-Urban Dairy Production System of West Shoa Zone, Oromia Regional State

Belay Regasa[1] Ulfina Galmessa[2] Lemma Fita[2] Chala Merera[2]
1.Department of Animal Sciences, College of Agriculture and Natural Resources, Assosa University, P.O. Box: 18, Assosa, Ethiopia
2.Department of Animal Sciences, College of Agriculture and Veterinary Sciences, Ambo University, P.O. Box: 19, Ambo, Ethiopia

Abstract
The study was conducted in Ambo, Dandi and Dirre inchini districts of West Shoa Zone, Oromia Regional State. The objective of this study was to assess the reproductive and lactation performance of local and cross bred cows in urban and peri- urban dairy production system. A total of 240 respondents (80 respondents from each district) were purposively selected and interviewed individually. The result of the study indicated that the overall average milk yield per cow per day in Ambo, Dandi and Dirre inchini were 1.66, 1.43 and 1.48 liter for local and 7.56, 7.17 and 7.37 liters for cross bred cow, respectively. The average lactation length in Ambo, Dandi and Dirre inchini were 8.00, 8.41 and 8.18months for local bred and 10.00, 10.06 and 10.25 months for cross bred cow, respectively. The overall estimated average milk yield and lactation length for both local and cross bred cows were statistically different ($P<0.01$) among the districts of the study sites. The average AFS (age at first service), AFC (age at first calving), CI (calving interval), DO (days open), NSPC (number of service per conception) and GL (gestation length) in Ambo were, 42.76 months, 53 months, 21 months, 180.65 days, 1.24 times and 276.7 days for local bred and 26.19 months, 36.5 months, 15.17 months, 85.07days, 1.91 times and 276.3 days for cross bred cow, respectively. The overall estimated mean of AFS, AFC, NSPC and GL for local bred cows were, statistically not different ($P > 0.05$) among the districts of the study sites while the overall mean of CI and DO for local bred cow were statistically different ($p<0.05$) among the districts of the study sites. But the overall mean of AFS, AFC, CI, DO and NSPC for cross bred cows were, statistically different ($P < 0.05$) among districts of the study sites. However, GL for cross bred was statistically not different ($p>0.05$) among districts of the study sites. The average AFS, AFC, CI, DO, NSPC and GL in Dandi were, 41.6 months, 51.88 months, 22.91 months, 206.25 days,1.44 times, 276.8 days for local bred and 23.5 months, 34.11 months,16.25 months 107.17 days, 2.26 times and 276.3 days for cross bred cow, respectively. Similarly, the AFS, AFC, CI, DO, NSPC and GL in Dirre inchini were, 40.5 months,51.07 months, 22.6 months, 212.5 days,1.35 times, 276.87 days for local bred cow and 22.93 months, 33.70 months,16.05 months,110 days, 2.13 times and 276.57 days for cross bred cow, respectively. The prevailing constraints of dairy production in the study areas were lack of breed selection, shortage of feed and feeding, lack of oriented market, shortage of land, lack of health care and lack of extension services. Therefore, from the current study it was concluded that the reproductive and lactation performance are relatively low. Improved management practices are sturdily needed.
Keywords: cross bred, lactation performance, local bred, reproductive performance, West Shoa

INTRODUCTION

Ethiopia is one of the tropical and subtropical countries in Sub-Saharan Africa, has about 53.9 million cattle, 25.4 million sheep, 24.06 million goats and 0.9 million camels, excluding livestock population of three zones of Afar and six zones of Somali regions (CSA, 2013). With this number of livestock population Ethiopia stand first in Africa and 10th in the world. However, the production and productivity of this livestock is not commensurate with the number. For example the dairy industry in Ethiopia is not developed as that of other east African countries such as Kenya, Uganda and Tanzania (Zegeye, 2003).

Despite the huge livestock population of the country the current milk production per annum is very low which has been estimated to be 3.2 million ton and growing at a rate of only 1.2% for indigenous and 3.5% for improved stock per year (Tsehay, 2002). Lower milk production performance is attributed to reduced lactation length, extended calving interval, late age at first calving, poor genetic makeup (Yoseph *et al*., 2003) and shortage of livestock feeds both in quantity and quality, especially during dry season (Ahmed *et al*., 2010).Calving interval might be indicative of poor nutritional status, poor breeding management, lack of own bull and artificial insemination service, longer days open, diseases and poor management practices (Belay *et al*., 2012)

To be effective, the efforts to improve the productivity of smallholder dairy production and improve its market orientation needs to be supported and informed by detailed understanding of the current and dynamic conditions of production, marketing, processing and consumption of milk and dairy product (Asfaw,

2009).

Even though there is high potential in the area for livestock production in general and dairy production in particular. The status of milk production and productivity of the animals has not been systematically studied and documented. The production potential and constraints of these three Woredas in particular and that of West Shoa Zone in general are not well known. Therefore the current study is to assess the reproductive and lactation performance of urban and peri- urban local and cross bred cows in the selected study areas.

MATERIALS AND METHODS

Description of the Study Areas

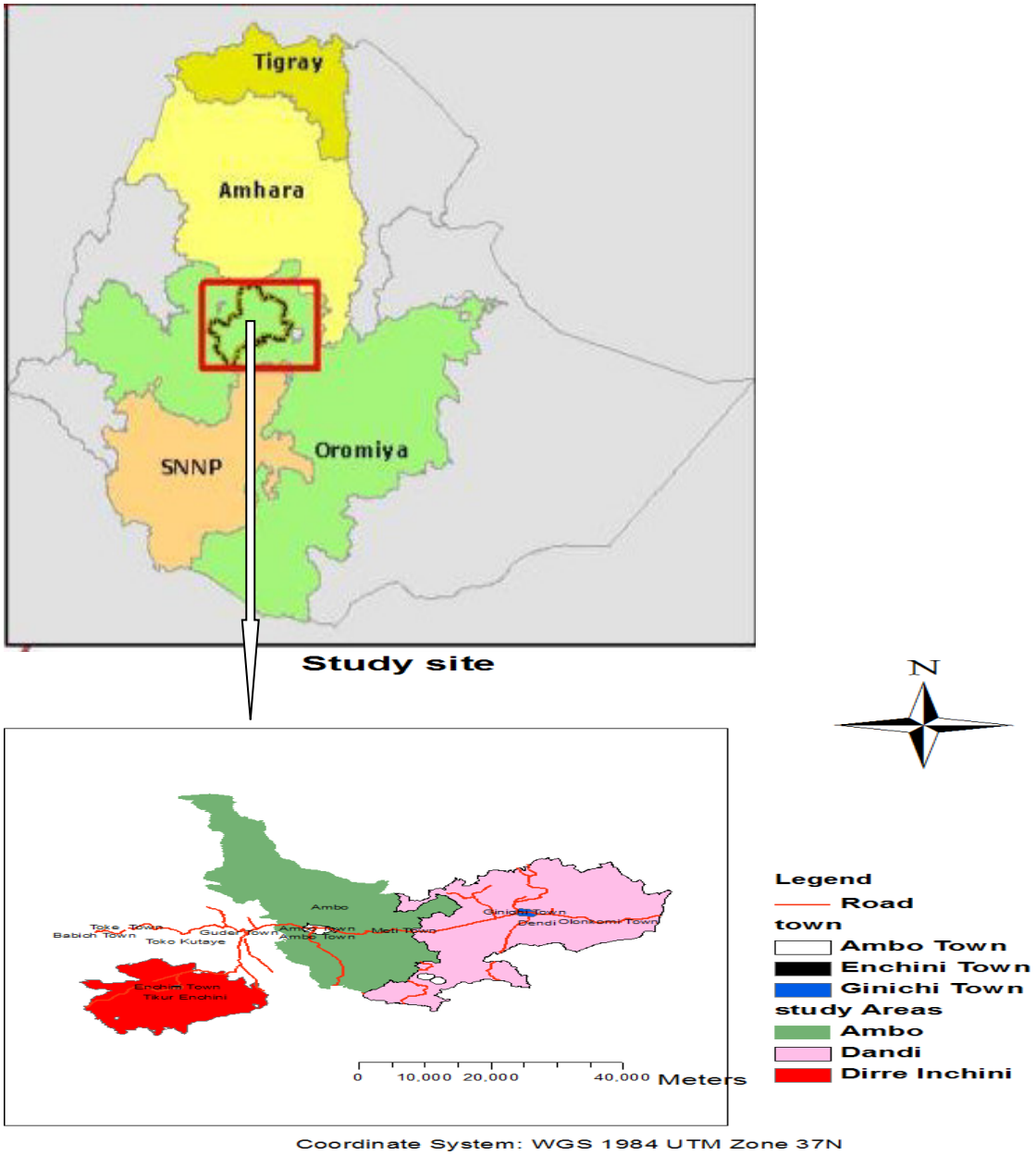
The study was carried out in the urban and peri- urban of Ambo, Dandi and Dirre inchini districts of West Shoa Zone, Oromia Regional State.

Ambo is located at 105 km West of Addis Ababa. Agro-ecologically, it is classified in to lowland (50%), mid land (35.5%) and highland (14.5 %). Its altitude ranges from 1350 to 3300 m.a.s.l. The minimum and maximum temperature of the area is 15^0c & 29^0c, respectively while the minimum and maximum rain fall of the area is 800 mm and 1000 mm, respectively. The dominant livestock species in the area include cattle, small ruminants, equines, poultry and beehives. According to the Office of Agriculture and Rural Development of the study area (2015) report, 14, 4243 cattle, 30,009 goats, 65,652 sheep, 92,030 poultry, 6,684 equines, and 21,643 honeybee colonies are found in the district. Cattle and sheep are the major livestock species in the area.

Dandi is located at 78 km West of Addis Ababa. The total area coverage of the district is 109729 ha of which 73360 is cultivated and 18745 ha used for grazing. Currently the district is sub divided in to 47 rural kebeles and 7 urban kebeles. Agro ecologically, it is classified into mid altitude 71% and highland 29%. The altitude ranges from 2000 - 3288 m.a.s.l. The minimum and maximum temperature of the area is 9.3^0c & 23.8^0c, respectively. The district has potential for development of improved forages and forage seed multiplication to enhance livestock production and productivity in the area.

According to the Office of Agriculture and Rural Development of the area (2015) report, 210,255 cattle, 23,202 goats, 103,868 sheep, 114,176 poultry, 51,349equines, and 19,351 honeybee colonies are found in the district. Cattle and sheep are the major livestock species in the area. The major livestock feed resources of the area include natural pasture, crop residues, crop aftermaths and improved forages.

Dirre inchini is located at 162 km West of Addis Ababa and 50 Km from Zonal town Ambo. Dirre inchini is one of the potential agricultural (Live stock and crops) production. The total area coverage of the district is 38,687 ha of which 22,766 ha is cultivated land, and 8,265 ha is grazing land (West Shoa Zone Agriculture and Rural Development, 2015). Agro ecologically; it is classified in to mid altitude 5% and highland 95%. It has an elevation range from 2200 to 3023 m.a.s.l. The minimum and maximum temperature of the area is 6^0c & 24^0c, respectively. The minimum and maximum rain fall is, 1000 mm and 1400 mm, respectively. The district has potential for development of improved forages and forage seed multiplication to enhance live stock production and productivity in the area. The crop types of the area include cereals, *Enset*, oil crops, vegetables, and other perennial crops while the livestock species which are predominant to the area include cattle, small ruminants, equines, poultry and beehives. According to the Office of Agriculture and Rural Development of the study area (2015) report, 89,965 cattle, 4,652 goats, 49,110 sheep, 34,592 poultry, 43,626 equines, and 5786 honeybee colonies are found in the district. Cattle and sheep are the major livestock species in the area. Dirre inchini is dominated by Enset based agriculture and livestock production. The major livestock feed resources of the area include natural pasture, crop residues, crop aftermaths and improved forages.



Source: West Shoa Zone Administration, 2015

Figure 1: Map of the Study Areas

Sampling Techniques and Household Selection

The urban and peri-urban areas of the three districts in West Shoa Zone (Ambo, Dandi and Dirre inchini) were purposively selected based on accessibility and importance of dairy production in the areas. Initially discussions were held with districts livestock experts; secondary data were collected; published and unpublished information were assessed; in addition, the districts were visited for better understanding of the areas. Random sampling techniques were employed to select kebeles and households in and around the capital town of each district. Accordingly, 4 kebeles from Ambo, 4 kebeles from Dandi and 4 kebeles from Dirre inchini (total =12 kebeles) were purposively selected. For household selection at least two years of experience in dairy production and a minimum of one dairy cow have been taken as criteria. Then a total of 240 households (80 household from each woreda) were purposively selected. Semi- structured questionnaire was used to collect primary data. The major questions included in the questionnaire were, lactation performance like lactation length and milk yield per cow per day, source of artificial insemination and reproductive performance of dairy animals like, age at first service, age at first calving, calving interval, number of service per conception, gestation length, Many factors influence the reproductive performance of lactating dairy cows.

Sources and Methods of Data collection

The study was based on both secondary and primary source of data. Secondary data were obtained from livestock resource, production and health office and Agricultural and rural development office of the study areas.

Primary data were collected using Semi-structured questionnaire through formal interview method.

Data Analysis

The collected data were analyzed using Microsoft office Excel 2007 and SPSS (version 20) soft ware. The results were summarized by using figures, percentages, means, charts and Standard error. Means separation were made using Duncan's multiple range tests. Level of significance considered were at alpha of P<0.01 and 0.05.

RESULTS AND DISCUSSION

Productive and lactation performance

Milk yield

The result of the average daily milk production in the study areas was shown in Table 1. The overall average milk yields in the study areas were 1.52 liter/day/cow for local and 7.37 liter/day/cow for crossbred, respectively. The average milk yield for local cross cow was significantly different (P< 0.01) among the districts of the study sites. The results obtained in the present study were lower than that of Ulfina *et al*. (2013) who reported an overall mean of 2.2 liter/cow/day for local bred cows and higher than 6.5 liter/day/cow for cross bred in the peri-urban dairy production system of western Oromia. Similarly, Lemma (2004) reported lower average milk yield of 1.0 liter for local Arsi cow and 5.8 liters for crossbred cows. These variations could be attributed to difference in feeding and other management practices.

Higher average daily milk yield of 1.66 and 7.56 Liter/cow/day were reported from Ambo for local and crossbred cows, respectively. Whereas, the lowest average daily milk yields 1.43 and 7.17 liter/cow/day for local and crossbred, respectively were reported from Dandi. The finding of current study was lower than the result of Belete *et al*. (2010) who reported 3.4 liters of milk production for local cows and higher than milk production of crossbred cows which was 5.5 liters. The present finding is also lower than the finding of (Tesfaye, 2007) who reported 1.9 liters for indigenous cows. This difference might be due to better management practices in terms of health care both quality and quantity of feed and feeding and watering and difference with agro ecology in the study sites.

Lactation Length

The overall average lactation length for local and cross bred cows of the study areas were 8.19 and 10.10 months, respectively (Table 1). The average lactation length for both local and crossbred cows was significantly different (P< 0.01) among the districts of the study sites. It was noticed from the present findings that lactation length is higher in all urban than peri urban for both local and cross bred. These results for both local and cross bred cows were, lower than the average lactation length of (9.1 months) and (11.1months) local and cross bred cows, respectively at North Shoa Zone (Mulugeta and Belayneh, 2013). The lactation length for local cow observed in the study areas was higher than the average lactation length of 7.29 months (Kedija (2007) at *Meiso* district Oromia Regional state. However, it is lower than 9.5 months reported by Lemma *et al*. (2005) for local cows in the East Shoa zone Oromia regional state. Lower lactation length might be different aspects like unimproved feeds and feeding practice, Poor management milk yield for and lack of supplementation of cows especially during lactating period. The current finding is similar with Nigusu and Yoseph (2014) who reported lactation length was higher in urban than secondary town dairy production system. This might probably be due to better management practices in terms of health care and feeding system in urban than the counter peri-urban areas.

	Study districts									
Breed type	Ambo			Dandi			Dirre inchini			Overall
Local	Urban	Pre-Urban	Total	Urban	Pre-Urban	Total	Urban	Pre-Urban	Total	
Milk yield	1.88 (0.49)^{a}	1.44(0.04)^{bc}	1.66(0.26)	1.69(0.12)^{ab}	1.18(0.05)^{c}	1.43(0.08)	1.59(0.12)^{ab}	1.38(0.05)^{bc}	1.48(0.09)	1.52 (0.14)
Lactation length	8.83(0.16)^{a}	7.17(0.08)^{c}	8.00(0.12)	8.66(0.14)^{a}	8.18(0.2)^{ab}	8.41(0.16)	8.60(0.16)^{ab}	7.76(0.18)^{bc}	8.18(0.17)	8.19(0.15.)
Cross										
Milk yield	8.29(0.16)^{a}	6.83(0.33)^{c}	7.56(0.24)	7.50(0.20)^{abc}	6.84(0.18)^{c}	7.17(0.19)	7.80(0.31)^{ab}	6.95(0.15)^{bc}	7.37(0.23)	7.37 (0.22)
Lactation Length	10.35(0.12)^{ab}	9.66(0.31)^{b}	10.0 (0.21)	10.39(0.15)^{ab}	9.72(0.24)^{b}	10.06(0.19)	10.80(0.13)^{a}	9.70(0.12)^{b}	10.25(0.13)	10.10(0.18)

Table1: Overall and least squares means of Milk yield per liter per day/cow and Lactation length per month/cow.

Means in the same row with different superscripts are significantly different (P< 0.01). Values in the brackets are Standard error and values out of brackets are mean

Reproductive performance

Age at First Service

The overall mean of age at first service for local and crossbred heifers were 41.62 and 24.19 months, respectively. Average age at first service for local bred was statistically not significant (P>0.05) among the districts of the study sites. However, it was statistically different (P<0.05) among the districts of the study areas for crossbred cows. The present finding for local heifers was in the range of age at first service (28 ± 2 to 47 ± 2 months) reported by Ulfina *et al*. (2004) for Horro heifers under different feeding regimes. The present finding

for cross bred is similar with the finding of Belay *et al*. (2012) who reported an average AFS of 24.3±8.01 months at *Jimma* town Oromia regional state. But Nibret (2012) reported lesser age at first service for cross bred (15.5 months) than the present value at *Gondar*, Amahara regional state. Age at first service was higher in Ambo than Dandi and Dirre inchini for both local and cross bred (Table 2). This difference might be associated with management in terms of feed and feeding, health care and with agro ecology.

Age at First Calving

Table 2 show the overall mean and standard error of age at first calving (AFC) for local and cross bred heifers in the study areas. The overall mean of AFC for local and crossbred heifers were 51.98 and 34.78 months, respectively. Age at first calving for local breed was statistically not different (P>0.05) among the districts of the study sites. However, age at first calving for cross bred heifer was statistically different (P < 0.05) among the districts of the study sites. The mean AFC obtained for local heifer in the present study was agreement with Ulfina *et al*. (2004) who reported a range of 40 ± 2 to 59 ± 2 months of AFC for heifers of Horro breed maintained under different feeding management at *Bako* Agricultural research center. However, the mean age at first calving reported in the study areas for local breed were lower than the value 54.6 months reported by Gidey (2001) for indigenous Fogera heifers. The mean age at first calving reported for local breed in Ambo was higher than that of Belay *et al*. (2012) who reported the mean age at first calving of 50.59 months in *Dandi* district. This different might be an indication of poor management practices regarding with nutrition in terms of quality and quantity and poor heat detection.

Calving Interval

The overall mean of calving interval for local and crossbred heifers were 22.17 and 15.82 months, respectively (Table 2). Calving interval for both local and cross bred cows was statistically different (P<0.05) among the districts of the study sites. The result from the study areas for local bred were, lower than that of Mulugeta and Belayneh (2013) who reported 24.94 days for indigenous breed in North Shoa Zone of Oromia regional state. Similarly, the reported average calving interval for local breed in the study areas were, lower than the value (25 months) reported by Mukasa-Mugrewa *et al*. (1989) in Zebu cattle; but higher than the value (14.63 months) reported for Boran breed (Million and Tadelle, 2003). The average calving interval reported from Ambo and Dirre inchini for crossbred cows were comparable with that of Bekele *et al*. (1991) who reported average CI of 15.83months for small holder cross bred dairy cows in the central highland of Ethiopia. The result from the study areas for local bred cow agreed with Belay *et al*. (2012), who reported average CI of 22.19 months at *Dandi* district of West S*hoa* zone Oromia Regional State. Long calving interval in the study areas might be an indication of poor management practices regarding with nutrition, poor heat detection, etc.

Days Open

The overall mean of DO for local and crossbred heifers were 199.8 and 100.75 days, respectively. The mean of DO for local and cross breed cow was statistically different (P < 0.05) among the districts of the study sites. The current finding of DO for local cow is lower than 340.3 days for Boran cows at *Tatessa* cattle breeding center reported by (Yifat *et al*., 2012). From the result of the study it was observed that the average days open for cross bred in the study areas were, higher than the mean of 155.7 days (Belay *et al*., 2012) at *Jimma* town Oromia Regional state. Similarly, the current finding of DO from Ambo (85.07 days) is almost similar with the result of (Nibret, 2012) who reported 87 days for cross bred cows at *Gondar* North Western Ethiopia while the current finding DO from Dandi (107.17 days) and Dirre inchini (110 days) were, higher than the result of (Nibret, 2012) who reported 87 days for cross bred cows at the same area. This might be attributed to lack of proper management and problem of proper heat detection in the study areas which prolong the day open for both local and cross bred cows.

Number of Service per- Conception

The overall mean of NSPC for local and crossbred heifers were 1.34 and 2.10 times, respectively. The mean of NSPC for local breed was statistically not different (P>0.05) among the districts of the study sites. However, the differences were statistically significant (P < 0.05) among the districts of the study sites, for crossbred cows. The result from the study areas for crossbred are comparable with the range of NSPC (1.5 to 2.00) reported by Yoseph *et al*. (2003) for crossbred cows and the result from Ambo (1.91 times) is almost similar with the value (2.00) reported by Negussie *et al*. (1998) for cross bred cows at *Asella* livestock farm. However, the results in the study areas for cross bred cows are higher than the number of service per conception (1.3) reported for tropical condition (Rahman *et al*., 1998). According to Mukessa-Mugrewa (1989) number of service per conception greater than two considered as poor. However, according to respondents (42%) in the study areas were lack of identifying proper heat detection and lack of skill of the artificial insemination technician is the main reason for repeated services.

Gestation Length

Results observed from the study areas indicated that the overall average gestation length for local and cross bred cows were 276.79 and 276.36 days, respectively. Non-significant differences (P> 0.05) were observed in gestation length of both local and cross bred cows, among districts of the study sites. The current findings of

average gestation length for local bred in the study areas are almost similar to (277.7 days) by Yifat *et al*. (2012) for Boran bred at *Tatessa* central bred but slightly shorter than the range of gestation length (277 to 285 days) reported by Ulfina *et al*. (2004). Similarly, the overall average gestation length in the study areas for cross bred were similar to the value (276.6 days) reported by Nibret (2012) at *Gondar* Western Northern Ethiopia.

	Ambo (N =80)			Dandi (N= 80)			Dirre inchini (N= 80)			
	Urban	Peri urban	Total	Urban	Peri Urban	Total	Urban	Peri urban	Total	overall
AFS										
Local	40.86 (1.05)^{a}	44.66(4.07)^{a}	42.76(2.56)	40.5(1.02)^{a}	42.68(1.56)^{a}	41.60(1.29)	39.4(0.81)^{a}	41.60(1.32)^{a}	40.50(1.06)	41.62(1.63)
Cross	25.53(1.25)^{ab}	26.84(1.19)^{a}	26.19(1.22)	22.67(0.78)^{a}	24.50(0.94)^{ab}	23.50(0.86)	22.50(1.18)^{a}	23.36(0.70)^{ab}	22.93(0.94)	24.19(1.00)
AFC										
Local	52.00(2.27)^{a}	54.00(1.58)^{a}	53.00(1.92)	50.58(1.08)^{a}	53.18(1.77)^{a}	51.88(1.43)	50.40(0.85)^{a}	51.75(1.17)^{a}	51.07(1.01)	51.98(1.45)
Cross	35.91(1.19)^{ab}	37.15(1.65)^{a}	36.53(1.42)	33.57(0.94)^{ab}	34.66(0.92)^{ab}	34.11(0.93)	33.3(1.22)^{ab}	34.10(0.54)^{b}	33.70(0.88)	34.78 (1.08)
CI										
Local	20.00(1.03)^{b}	22.0(0.47)^{ab}	21.00(0.75)	22.00(1.27)^{ab}	23.82(0.66)^{a}	22.91(0.96)	22.3(0.71)^{ab}	22.9(0.64)^{a}	22.6(0.68)	22.17(0.79)
Cross	15.02(0.27)^{b}	15.33(0.37)^{ab}	15.17(0.32)	15.93(0.42)^{ab}	16.55(0.73)^{a}	16.25(0.57)	16.0(0.39)^{ab}	16.10(0.29)^{ab}	16.05(0.34)	15.82(0.41)
DO										
Local	180(18.97)^{b}	181.29(11.0)^{b}	180.65(15)	187.5(10.53)^{ab}	225 (12.29)^{a}	206.25(11)	207(10.44)^{ab}	218(7.18)^{ab}	212.5(8.81)	199.8(11.60)
Cross	77.64(3.54)^{b}	92.50(6.87)^{b}	85.07(5.21)	83.57(6.05)^{ab}	130.78 (6.8)^{a}	107.17(6.4)	102(12)^{ab}	118(6.73)^{ab}	110(9.37)	100.75(6.99)
NSPC										
Local	1.16(0.21)^{a}	1.32(0.89)^{a}	1.24(0.55)	1.42(0.19)^{a}	1.46(0.13)^{a}	1.44(0.16)	1.3(0.15)^{a}	1.4(0.12)^{a}	1.35(0.14)	1.34(0.28)
Cross	1.73(0.14)^{b}	2.09(0.15)^{ab}	1.91(0.14)	2.03(0.21)^{ab}	2.50(0.22)^{a}	2.26(0.22)	1.9(0.18)^{ab}	2.36(0.13)^{a}	2.13(0.16)	2.10(0.17)
GL										
Local	276.76(0.00)^{a}	276.79(0.31)^{a}	276.7(0.16)	276.5(0.58)^{a}	277.17(0.48)^{a}	276.8(0.53)	276.7(0.75)^{a}	277.03(0.45)^{a}	276.87(0.6)	276.79 (0.43)
Cross	276.00(8.06)^{a}	276.73(0.49)^{a}	276.3 (4.3)	276(0.25)^{a}	276.57(0.19)^{a}	276.3(0.22)	275.9(0.1)^{a}	277.23(0.4)^{a}	276.57(0.25)	276.39 (1.59)

Table 2: Overall and mean of ages at first service (month), age at first calving (month), calving interval (month), days open (days), number of service per conception (number) and gestation length (days)/cow for both local and cross breed cows as reported by respondents.

Means in the same row with different superscripts are significantly different (P< 0.05). Values in the brackets are Standard error and values out of brackets are mean; N=number of respondents; AFS=ages at first service; AFC= age at first calving; CI= calving interval; DO= days open; NSPC= number of service per conception; GL = gestation length

CONCLUSION

Results of the study revealed that both local and cross of Holstein Frisian were being kept in the areas. Lack of knowledge about heat detection / Lack of animal owner to identify when their cows/heifers manifest estrus cycle contributed delayed age at first mating for heifers and prolong calving interval for cows. There are several uncertain blocks that hinder the improvement of lactation and reproductive performance of dairy cows in the areas. Concerning the availability of improved genotypes, crossbreeding programs have lacked coordination and have been further constrained by problems of infertility, instability of the crossbreeds and inefficient artificial insemination services at the farm level. Lack of designed breed improvement scheme, insufficient AI service, shortage of land, inadequate feed in terms of quality and quantity, market related problems, inadequate veterinary service and inadequate extension services were some of the identified determinants for the improvement of dairy cattle in the areas. Based on the results of the study it was concluded that the reproductive and lactation performance of both local and cross breeds were generally poor in the study areas. Hence the following recommendations have been made to divert the existing situation and improve dairy cattle productivity in the areas.

Since problems related to breed improvement and AI service was found to be one of the major problems in the urban and peri-urban dairy production system of west Shoa zone, there should be well coordinated breed improvement scheme to curtail the existing disturbing factors to improve dairy production in the areas. There has to be improved extension system which could improve the provision of veterinary services and appropriate technology to improve the availability and quality of feed for dairy farmers.

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