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Full Length Research Paper

Reproductive and lactation performances of dairy cows in Chacha Town and nearby selected kebeles, North Shoa Zone, Amhara Region, Ethiopia

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The study was undertaken in Angolellantera, Chacha town and nearby selected kebeles, North Shoa zone of Amhara regional state from September 2011 up to December 2011. The objective of the study was to characterize the overall reproductive and lactation performances of dairy cows in Chacha town and surrounding kebeles. The participatory rural appraisal (PRA) method was used to generate information during exploratory survey and 100 households were selected for formal survey by using random and purposive sampling technique. The overall average estimated lactation yield of local and cross bred dairy cows was found to be 1173.93 ± 899.6. The overall average estimated lactation length of both local and cross bred cows was 10.49 ± 3.08. The overall average estimated daily yield of local and cross bred dairy cows was 3.75 ± 3.25 L. The overall mean estimated average age at first calving was found to be 40.9 ± 6.6 months (n=103). The overall mean calving interval of local and crossbred dairy cows was found to be 23 ± 4.3 months. The overall average reproductive efficiency of local and crossbred cows in Chacha town and nearby kebeles was calculated as 62 ± 14.97%. The dominant cow genotype was local breed cows. In conclusion in order to exploit the potential of dairy cattle to increase the reproductive and lactation performances intervention measures have to be given attention.

Key words: Age at first calving, calving interval, lactation length, reproductive efficiency.

INTRODUCTION

Poverty and food insecurity are the two major problems in the country. As in many developing countries, agriculture is the mainstay of the Ethiopians and about 85% of the total population is engaged in the sector. The

The estimated number of indigenous milk cows in Ethiopia is about nine million and are in the hands of smallholder farmers and pastoralists under traditional contributions of the sector to the country's Gross Domestic Product (GDP) and exports are about 60 and 90%, respectively (World Bank, 1995). Animal production plays a significant role in the country's economy. The livestock sub sector contributes approximately 12 - 15% to the GDP (McDaC, 1999).management systems. In Ethiopia about 300,000 crossbred or upgraded cows are used for milk production under relatively improved management conditions in urban and peri-urban areas. The total milk production per year from cattle is 0.8 million tons out of 1.0 million tons from all the species put

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together in Ethiopia (Azage et al., 2000).

It has been indicated that possible genetic improvement in virtually all traits of economic importance is closely tied to reproductive rate (Kiwuwa et al., 1983). Nutrition plays a pivotal role in influencing the maintenance of efficient reproductive performance. Nutritional status of animals, among other factors, is the main constraint for the productivity of dairy herd (Payne, 1970) and improving the feeding regime can improve the reproductive performance (Mukassa-Mugerewa, 1989).

First calving makes the beginning of a cow's productive life (Meaker et al., 1980). The estimated age at first calving of local cows at Andassa Ranch of Fogera heifers in North western parts of Ethiopia was found to be 53.8 months (Asheber, 1992). (Mulugeta, 2005) indicated that mean age at first calving of the local dairy cows was 58.09 ± 13.04 months (n = 95) and mean age at first calving for crossbred dairy cows was 44.67 ± 17.1 months (n = 24).

Average calving interval in tropical breeds varied between 334 and 730 days. Calving interval is reported to have low heritability and can be improved through better nutrition and early breeding (Falvey and Chantalakhana, 1999). Getachew (2002) has reported that in Ginchi watershed cows have longer calving intervals (22.2 months). (Mulugeta Ayalew, 2005) indicated that the overall average calving rate in the Yerer watershed was 68.7%. The local dairy cows were characterized by longer calving interval (21.66 ± 8.2 months) (n = 84) than for crossbred cows (16.3 ± 4.1 months) (n = 22). Mean calving interval of local cows in the watershed was estimated to be longer than the optimum to be acceptable (12 to 13 months) which might be due to poor nutrition, lack of detection and follow-up for estrus. In the watershed crossbred dairy cows have comparatively shorter calving interval than local cows due to better management conditions and better detection and follow-up in postpartum anoestrus interval, which was influenced by genotype and other management factors. Therefore, improving the management aspects as a whole leads to efficient reproductive performance of cows.

Given the current number of milk cows and lactation yield, the projected demand-supply variance for milk in the urban sector is about 2.74 billion liters per annum. In order to fulfill the increasing demand, at least a consistent four percent annual increase in milk production will be required (Azage et al., 2000). Hence, the objective of this study were to characterize the over all reproductive and lactation performances of dairy cows in the study area.

MATERIALS AND METHODS

Study area

The study was undertaken in Angolelan tera worda in Chacha ketema the North Shoa Administrative Zone of Amhara Region, Ethiopia.

Location and climate of the area

Chacha town of Angolelan tera woreda located 20 km from Zonal town, Debre Brahan and 110 km from Addis Ababa. The town has only one kebele called chacha 01 kebele and surrounding the woreda town there are three rural kebele called Serity, Chefanen and Bura The woda has 44,754 male and 43,370 female human populations. The live stock population estimated to be 102,174 cattle among these 34,870 oxen and 37,046 cows 135,412 sheep, 14759 goats, 33,978 Equine and 75,835 chicks. The estimated number of cross bred dairy cows in the town is 430 the average minimum and maximum rain fall is 750 and 1100 mm respectively (WBOA 2010) office report. The altitude of the woreda ranges from 1700 - 3044 m. a.s.l. and the woreda town (Chacha) has 2780 m a.s.l.. The woda has three agro climatical conditions (85% dega, 13% woyna dega and 2% kola). The particular study area was 100% dega, regarding the topography most of the area is plane. The woerda has 21 total kebeles among them two of them are peri-urban kebeles.

Data required

The data that will be generated by exploratory survey and secondary information includes; Attempts will made to identify; major farm and off-farm activities, current practices, perception of the system in which the farmers operate and also to identify exogenous factors (which influence production pattern and the links between them), endogenous factors (which influence production-decision at the household level and the manner in which each affect the other) and the constraints (which they perceive to be important and their attitude to risk).

Sampling procedure

By defining the boundary of a dairy shed based on the information collected during the informal diagnostic survey, the geographical distribution of these sampling units within the dairy shed was established. Resource constraints will be decided, although sample size was sufficiently large to permit statistical analysis, financial, human resource and time constraints was taken in to account prior to sample selection and survey execution. When a prior knowledge of the size of the target

Table 1. Number of cows milked per house hold.

Ref no	Number of cows milked	Number of /hh head	Percent
1	1	16	15.8
2	2	43	42.57
3	3	21	20.79
4	4	11	10.9
5	5	6	5.96
6	6	2	1.98
7	7	1	1
8	8	1	1
	Total	101	100

hh= house hold.

population is poor, a random sample selection with a given sampling intensity may be difficult to obtain. It may then be preferable to sample purposively, i.e. sample using a sub-set of the population but whose characteristics are known and meet desired criteria (Jabbar et al., 1997).

Field instrument: At dairy shed level as a preliminary step of collecting information on the production to consumption system, secondary sources was reviewed and discussions was held with knowledgeable key informants. At household level it is anticipated that much of the information required for characterization of the production to consumption system was gathered through primary data collection at the household level.

The methodology proposed was multipurpose single visit survey method a formal survey of a representative sample of dairy production units within the dairy shed. The sample size proposed is in the range 100 to 150 units Rey et al. (1999). Farmer-recall (over one year) techniques were used for collecting the production data.

From literature review and considering the cost, time and resource limitations a total of 100 households were considered adequate from three kebeles for the formal survey interview. List of female and male households obtained from each PA's officials was used for random selection of the households for the formal interview. Random table was used for household selection. Hence, stratified proportionate random sampling or purposive sampling technique was used for the study.

Data collection

Both exploratory and diagnostic survey was used to generate qualitative and quantitative data for the study. To have an overall view of the farming system, an exploratory survey was carried out using checklists to discuses with farmers. The Participatory Rural Appraisal (PRA) was used to generate information during exploratory survey. Moreover, a rapid survey technique with key-informant interview method was used. Based on the information generated through PRA, the questionnaire (Jabbar et al., 1997; Rey et al., 1999) was used and record sheets were developed for the formal interview/diagnostic survey. Before starting the actual formal survey, developed questionnaires was pre-tested for the suitability of the study. Field observation was taken of respondent farmers in the sampling area. Details on animals were gathered from owner's interview. Each farmer's degree of perception towards the importance and priority of identified constraints and endogenous factors which influence production to consumption decision at household level was identified by using card sorting method. Critical problems and constraints was identified from secondary data and qualitative information obtained in the exploratory survey.

Statistical methods

The statistical analysis to be used in the study was vary depending on the type of variables and information obtained. However, the quantitative data was analysed using descriptive statistics (percentage, mean comparison, mode, median, standard deviation, etc). Correlation and regression analysis was used to determine the significance of associations among categorical variables. Computer software such as Excel was used for data management and analysis respectively.

RESULTS AND DISCUSION

Reproductive and lactation performances

Lactation yield

The overall average estimated lactation yield of local and cross bred dairy cows was found to be 1173. 93 ± 899.66 L of which 457.87 ± 86.4 litres were for local cows (n=103), and the mean lactation yield for crossbred cows

Table 2. Average lactation yield of cows based on farmer's estimation in litters in chacha ketema.

Cow genotype	N	Mean	SD	Minimum	Maximum
Local cows	33	457.887	86.4	285	630
Cross bred	70	1511.5	1092.1	375	5310
Average	103	1173.93	899.6	285	5310

Table 3. Lactation lengths of local and crossbred dairy cows in Chacha and surrounding areas in months.

No	Cow genotype	N	Mean	SD	Minimum	Maximum
1	Local cows	33	9.13	2.63	6	15
2	Cross bred	70	11.13	4.84	7	22.14
	Average	103	10.49	3.08	6	22.14

Table 1. Daily milk yield of dairy cows in Angolellanatera (Chacha) based on farmers response in litres.

No	Cow genotype	N	Mean	SD	Minimum	Maximum
1	Local cows	33	1.67	0.41	0.93	2.79
2	Cross bred	70	4.73	3.2	1.13	17.08
	Average	103	3.75	3.25	0.93	17.08

Table 5. Ages at first calving of local and crossbred dairy cows in chacha ketema based on farmers' response in months.

No	Cow genotype	N	Mean	SD	Minimum	Maximum
1	Local cows	33	47.16	8.7	24	55.2
2	Crossbreed	70	37.95	9.4	24	72
	Average	103	40.9	6.6	24	72

was 1511. 5 ± 1092.1 L. Table 1 shows 43% of the households have only two milking cows.

This result was better than Yerer watershed study based on(Mulugeta, 2005) which was 238 L of local cows yield due to better feeding and might be due to better manage mental aspects in the chacha town and nearby kebeles and computable to crossbred dairy cows lactation yield productivity which was 1558 litres of cross bred dairy cows. Table 2 shows there were cows with a minimum yield of 285 L up to 5310 L lactation.

Lactation length

The overall average estimated lactation length of both local and cross bred cows was 10.49 ± 3.08 months, of which local cows were 9.13 ± 2.63 months. The lactation length of Holstein Friesian –local cows crossbred of unknown blood level was 11.13 ± 4.84 months. Table 3 shows there were cows with lactation length of six to 22.14 months in the study area.

The result of lactation length in the study area was much higher for local cows when compare with the Boran cows which was 4.63 according to (Wahid, 1976) due to long calving interval and better feeding conditions and cross bred cows result was also higher than Yerer watershed result which was 8.63 months (Mulugeta, 2005) due to same reason to local cows what we have indicated.

Daily milk yield

The overall average estimated daily milk yield of local and cross bred dairy cows was 3.75 ± 3.25 L and for local cows was 1.67 ± 0.41 L (n=103). The average daily yield of crossbred dairy cows was 4.73 ± 3.2 L. Table 4 shows there were cows with daily yield of ranging from 0.93 to17.08 L/day.

Daily milk yield of local cows in the study area was

Table 6. The average estimated calving interval of dairy cows in chacha ketema in months.

Cow genotype	N	Mean	SD	Minimum	Maximum
Local cows	32	24.94	4.1	12	36
Crossbred	54	22	4.4	12	36
Average	86	23	4.3	12	36

Table 2. Calculated reproductive efficiency of local and cross-bred dairy cows.

Cow genotype	N	Mean	SD	Minimum	Maximum
Local cows	33	62.1	11.34	43.8	84.7
Cross bred	70	61.95	16.48	20.4	100
Average	103	62	14.97	20.4	100

Figure 1. The cross bred types of dairy cattle in the study area.

better than the national average which was 1.09 L according to Degena and Adugna (1999) because of industrial by products utilization and difference in variation among local types in the country and crossbreeds daily yield almost compatible or similar studies undertaken by Gashaw (1992) indicated that the mean milk yield per day of lactation for ½ Friesian × ½ zebu crosses in Selale was 5.1 kg (Kiwuwa et al., 1983).

Age at first calving

The beginning of productive life the heifer is called age at first calving. The overall estimated average age at first calving was found to be 40.9 ± 6.6 months (n=103), of which 47.16 ± 8.7months for local cows, and 37.95 ± 9.4 months for cross bred cows, which was higher than the expected to be achieved. Table 5 shows there were cows with a maximum of age at first calving up to 72 months.

The age at first calving study in the study area was almost similar to studies on Boran cattle type which was 45.5 months according to (Mekonnen, 1987; IAR, 1991), and when we compare crossbred cows result was better than that of Yerer watershed 44.5 months according to (Mulugeta, 2005) due to accessibility in AI utilization better heat detection awareness in the study area.

Calving interval

The gap between two successive calving is called calving interval. The overall mean calving interval of local and crossbred dairy cows in the study area was found to be 23 ± 4.3 months of which for local cows 24.94 ± 4.1 months and for crossbred 22 ± 4.4 months, the over all calving interval in the study area was prolonged, and on the other hand, crossbred cows calving interval was shorter and better than local cows (Table 6).

The calving interval in the study area particularly crossbreds was a bit higher than studies conducted in Selale which was 15.4 months by Gashaw (1992) and 14.3 months Kiwuwa et al. (1983) due to Selale areas were very known in a better awareness in dairy production and productivity. The local cows calving interval result was compatible to that of (Getachew, 2002) study conducted in Ginch watershed which was 666 days.

Reproductive efficiency of dairy cows in the study area

The parameter which measures reproductive efficiency could be calculated, the information gathered from the dairy owners based on, the number of calves born, age of cow in months and age at first breeding in months of dairy cows.

$$\text{Reproductive efficiency (RE)} = \frac{12 \times \text{numbers of calves born}}{(\text{Age of cow in months} - \text{ages at first breeding in months}) + 3} \times 100$$

The overall reproductive efficiency of local and crossbred

Figure 2. Replacement stocks of crossbred dairy cows in the study area.

Figure 3. Low graded cow and its calf in the study area.

cows in Chacha ketema and its near by kebeles were calculated based on the age of the cow, age at first breeding and number of calves born. Based on this there were average reproductive efficiencies of 62 ± 14.97% of which for local cows 62.1 ± 11.34% and for cross bred cows was 61.95 ± 16.48% which shows the presence of wastages by half than the expected to be achieved (Table 7 and Figure 1).

The reproductive efficiency was as a whole shows the presence of wastage of days which could be manifested by morbidity losses (Figures 2 and 3).

The basis for variation in the study area

Variation is the basis for selection. The presence of variation within the local cows was observed in the study area based on farmers' response, and the overall result can be characterized as follows. The first group of local cows were those with vary low productivity and do not produce surplus milk and having aggressive behaviour.

Second group of local cows were those with better yield, short lactation lengths and shorter calving interval. Third group could be categorized as, those cows with longer lactation length longer calving interval and minimum milk yield per day based on the farmers response. The above categories indicate the presence of high genetic variation both in reproductive and lactation performances among local cows. Based on farmers response behaviourally local cows vary from highly aggressive to docile (like exotic breeds) were perceived during formal surveillance.

Milk price in the study area

The average price of fresh liquid milk in peri-urban and urban (Chacha) town was 6 Birr/L and butter was sold 110 Birr/kg and there was no trend of selling cheese in Angolellanatera (chacha). In rural areas, butter was the dominant marketed dairy commodity and may be due to absence of milk collection centres and traditional beliefs.

The milk price in the study area was match better than the previous times due to increase in income and urbanization when we see according to Alganesh (2002) reported an average price of 2.75 - 2.88 Birr/L of milk and the butter price was also match higher than previous times according to Yitaye (1999) which was 27 Birr/kg

Household consumption unit

In the study area, the mean household consumption unit was 6.46 ± 2.9 and the mean family labour force was 3.42 ± 1.48 which indicate that the presence of idle family members who were not fully engaged in work, this fact indicts the number of children and old aged family members were high. Among farmers of Angolellanatera (Chacha). 94.06% do not have activity other than farming which might be due to lack of education and absence of small scale-industries in the area.

Family labour utilization in the study area

In rural areas (particularly chefanene and serity), both male and female households can also perform milking of the cows. Generally the feeding, the herding management aspect were the duty of male household head, children, or hired labourer. Table 8 indicates majority of the house holds engagement was farming.

ANIMAL HEALTH

Disease has numerous negative impacts on the productivity of livestock that is loss of animals through death, high morbidity rate or loss of productivity, (meat, milk, egg, and hide and skin) and loss of power. There has been many ways of fighting against diseases and among these vaccination (preventive measures) and treatment (curative measures) were the major ones. Even though there was few logistical problems the woreda gives veterinary services for all farmers including for the

Table 3. Occupation of household head.

Occupation	Percent
Farming	82
Private business	14
Active civil servant	4
Miscellaneous	0
Total	100

livestock rearing community of Chacha town and surrounding kebeles 7 - 10 km radius.

All types of disease prevention methods were practiced. The vaccination program was given according to the disease category based on their prevalence anthrax, black leg, pasteurellosis (endemic diseases) Trans boundary diseases, Lumpy skin disease (LSD), sheep and goat pox, Newcastle, were given annually (Figure 4).

The finding in the study area was also compatible to previous studies by (Getachew, 2002). Even if there were veterinary services delivered by the office of agriculture, only few framers take their animals to the veterinary service. This was because of the fact that high cost for the medicine and low productivity of the animal which discourages farmers from use of veterinary services and according to ADB (1993) indicated that for dairy animals, poor nutrition and feeding problems followed by increased susceptibility to diseases and physiological stresses were the two main constraints. Berhanu (2002) indicated one of many factors affecting the adoption of crossbred dairy cows in Selale animals were health problems.

Major constraints of dairy production in the study area

There was Artificial Insemination services /AI/ since 1983 in Chacha ketema and near by kebeles and the dominant cow genotype was local cows. Direct suckling was the dominant practice in the study area and there was no calf weaning when cows were milked. There was purchased feed available for farmers but it was costly and there was hay, crop residue and communal grazing were the known feed resources in the area. There was seasonal feed shortage in dry seasons due to deterioration of hay land and shortage of communal grazing areas. Generally in the study area animal health problems prioritized by farmers and ranked in decreasing order were mastitis, gastro-intestinal parasites including liver fluke, blackleg, and pneumonia and pasteurellosis. There were also reproductive diseases (problems) and abortions.

The constraints were in consistent with as per Falvey and Chantalakhana (1999) the influencing factors can be classified into four categories: a) technical components, b) institutional, c) government policies, and d) farmers'

Figure 4. The local cow and its cross-calf in the study area which were positive for fasciolosis.

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Calving interval in the area was also 24.94 months for local cows which was a bit higher by 12 months than the expected to be achieved and this was might be loss in heat detection lack of awareness of farmers and shortage of feed.

The overall reproductive efficiency of local cows was around 62.1% which was less by half from the potential to be exploited this might be due to delayed in age at first calving, absence of supervision for heat detection and scarcity of AI technique in the area.

Following the fluctuated nutritional deficiency disease was also one of the major problems affecting livestock productivity. Generally disease problems prioritized by farmers and ranked in decreasing order were mastitis,

gastrointestinal parasites, liver fluke, blackleg, pneumonia and pneumonic pasteurellosis regardless of trance boundary diseases.

In conclusion in the study area the main stay of the farmers was Agriculture. The presence of variation within the local cows indicates the presence of higher scope for improvement through selection. Governmental, non governmental, and livestock rearing community should work together to increase milk production and productivity of livestock. Strong extension service and training of farmers in breeding, feeding, health care, forage development, and housing etc were recommended.

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Appendix Table 1. Reproductive index.

No	Reproductive index	optimum	acceptable
1	Age at first puberty	< 18	<24
2	age at first calving (months)	< 30	<36
3	Calving to first service (days)	< 60	<90
4	Calving to conception (days)	<85	<115
5	Calving interval (months)	12-13	13—14
6	First service conception rate %	>66	>55
7	Overall conception rate %	>80	>75
8	Calving rate %	>75	>70
9	Service per conception	<1.16	<1.8

Appendix Table 2. Family labour and household consumption unit conversion factor.

Age	Sex	Full time work	Part time work	Consumption unit
<8 years	M	0	0	0.7
	F	0	0	0.7
8—14 years	M	0.5	0.25	1.1
	F	0.5	0.25	1.1
15-65 years	M	1	0.5	1
	F	0.5	0.25	0.8
> 65 years	M	0.5	0.25	0.8
	F	0.5	0.25	0.6

Appendix Table 3. Tropical livestock conversion factor.

	Animal category	Amount of TLU
1	Adult male goat	0.1
2	Adult male sheep	0.1
3	Adult male cattle	0.7
4	Adult female goat	0.1
5	Adult female sheep	0.1
6	Adult female cattle	0.7
7	Horse	0.8
8	Donkey	0.5
9	Mule	0.7
10	Poultry	0.01
	Weaners	
11	goat	0.07
12	Sheep	0.07
13	Cattle	0.5
	Suckling animals	
14	Goat	0.03
15	Sheep	0.03
16	Cattle	0.02
17	Camel	1

Appendix Table 4. Livestock population in the study area.

PA	Cattle	Sheep	Goat	Horse	Mule	Donkey	Camel	Chicken
serity	5281	1138	8	1080	18	675	--	1843
chefanene	11315	1245	2	1436	25	898	--	11244
bura	7820	1727	8	1285	10	802	--	6683
Total of the study kebeles	24416	4110	18	3801	53	2375		19770
Total of the Wreda	71522	13542	1476	13532	105	8457		75835

Appendix Table 5. Human population in the study area.

PA	No. of household			Human population		
	M	F	Total	M	F	Total
serity	398	76	474	1332	1312	2644
chefanene	683	175	858	2537	2460	4997
bura	646	202	848	2166	2167	4333
Total population in the study	1727	453	2180	6035	5939	11974