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Reproductive and Productive Performances of Local Cows under Farmer's Management in Soro District, Hadiya Zone, Southern Ethiopia

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Research Article

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ABSTRACT

This study was conducted in Soro District, Hadiya Zone of Southern Ethiopia with the objective of assessing reproductive and productive performances of local cows under farmer's Management. Soro district was selected based on high cattle population. A total of 200 households owning cattle were selected randomly and the questionnaire was administered. The mean cattle holding per household were 13.22 ± 1.70 in the district. The mean reported age at sexual maturity for local female and male cattle were respectively 49.0 and 44.7 in Soro district. The mean age at first calving, in months, for local female cattle in the study area was 54.3. The mean daily milk production per cow was 1.20 liter of milk per day. An average lactation length, peak milk yield, lactation milk yield were 11.08, 1.76 and 328.61 respectively. Natural mating was the familiar and major type of mating in the district. Shortage of feed, and water, diseases, recurrent draught, infrastructures and other constraints like land shortage, low capital, and shortage of extension services were major cattle production constraints. Therefore, introduction of improved forages and the proper utilization of crop residues should be emphasized for improving reproductive and productive performances of the cattle production in the area.

INTRODUCTION

In Africa, indigenous livestock breeds support the majority of smallholder rural farmers for whom these genetic resources are important for improved nutrition, income and as investment assets. Africa's indigenous animals are, therefore, vital to the development of appropriate and sustainable agricultural systems in Africa and other tropical regions [1].

Ethiopia has diverse ecology favoring diversification of livestock resources. The livestock sector of Ethiopia has been contributing considerable portion to the economy of the country and promising to rally round the economic development of the country. At the level of the national economy, the livestock sector contributes 26 percent of the agricultural gross domestic product (GDP) and 12 percent to the national GDP [2].

Apart from the large cattle population widely distributed throughout the country, the multiple production and service functions of cattle are crucial in the livelihoods of farmers and pastoralists. They serve as sources of milk, meat, hide, draft power and manure as well as contribute to nutrient recycling at the farm level. The reproductive performance of the breeding female is probably the single most important factor that is a prerequisite for sustainable dairy production system and influencing the productivity [3]. However, only a small number of recognized cattle breed types have a fair description of their indications of their level of production and reproduction attributes [4]. Performance record of local cows is essential for designing breeding and management strategies, for sustainable utilization and conservation.

As cited in Ethiopia livestock master plan [5], dairy cattle breed improvement programs were then directed towards crossbreeding. Hybrid-vigour is an important innovation that raises the potential for increasing milk production from local breeds. Average milk production of crossbreed cattle per lactation is five times greater than that of local breed cattle. This increase in milk production, due to crossbreeding, could result in a marketable surplus and increased sales of milk. However, the proportion of crossbreed cattle compared to the total cattle population was still less than 2%.

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In Ethiopia dairy production depends mainly on indigenous livestock genetic resources; more specifically on cattle and the goats, camels and sheep. Cattle has the largest contribution (81.2%) of the total national annual milk output, followed by goats (7.9%), camels (6.3%) and sheep (4.6%). Despite of its potential for dairy development, productivity of indigenous livestock genetic resources in general is low, and the direct contribution it makes to the national is limited. The national cow milk production estimated by CSA [6] is 4.06 billion liter (excludes milk suckled by calves); Estimated the total cow milk production to be around 1.77 billion liters. In general, milk production in Ethiopia is low. The average lactation period at country level is estimated to be around 6 months. The average in daily milk yield per cow is about 1.85 litters [6].

Different local cows' reproductive and productive performances have been undertaken in Ethiopia even if they have been far from including all the indigenous cows. Local cows of Soro district in Hadiya zone, Ethiopia, which may have some acceptable reproductive and productive performances, have rarely been found in literature and no studies have been conducted so far in understanding their reproductive and productive performances. Therefore, the present study was conducted with the following objectives:

- To evaluate the reproductive and productive performances of local cows in the study area under farmer's management
- To identify factors affecting reproductive and productive performances of local cows in the study area.

MATERIAL AND METHODS

Description of the study area

The study was conducted in Soro district of Hadiya zone; Southern Ethiopia. The district is located at a distance of 32 km from Hossana. Agro-ecologically, 8% of the district is highland (*dega*), 55% of the district is midland (*woinedega*) and 37% of the district is lowland (*kolla*). The mean annual total rainfall is about 1260 mm and has average temperature of 19°c (Soro district farming and crop production department, 2015).

Sample size and sampling method

Soro district was selected based on cattle population potential. The district was surveyed through single rapid exploratory field visits for gathering available secondary information from the district experts of the livestock and fisheries department, and the farmers' representatives to define the sampling frame and to obtain the lists of households owning local lactating cows. The district consists of a total of 46 rural kebeles. Ten rural kebeles were selected randomly. Individual households owning milking cows were identified and listed in selected rural kebeles. Then twenty households maintaining such cattle were selected randomly from each selected rural kebele so that total households under the study were two hundred (10 x 20 = 200).

Data collection methods

In each study area, a structured questionnaire that has a type of mixed questions with open ended and closed types was administered. Development agents working in the district office of livestock and fisheries department, and rural kebeles were recruited and trained on way of handling and administering the questionnaire. The focus areas of the questionnaire were milk production and reproductive performances (lactation length (LL) and lactation milk yield (LMY) as milk production performance, age at first calving (AFC) and calving interval (CI) as measures of reproductive performance), milking frequency, socioeconomic background of respondent, available feed recourses, grazing system, and health of dairy cattle, constraints of reproductive performance and milk production, milking and milk handling practices. The process of data collection was closely supervised by the researchers.

Statistical analysis

The SPSS statistical computer software (SPSS, version 20) was used to analyze the survey data and descriptive statistics (mean, standard error and frequency) were performed.

RESULTS AND DISCUSSION

General socio-economic characteristics

Percent sex, educational background and mean age (years) of the respondents are presented in **Table 1**. The male respondents were in larger proportions 73.3% in the study district. The largest percent (30%) of the respondents in the study area were able to read and write. Similarly Yisehak et al. [7] in Dedo district reported the percentage (30%) for literacy. As indicated in **Table 1**, majority of respondents in the study area had attended certain level of education. The mean age (years) of the respondents in the study district was 42.92, which is similar with age of the respondents (41.00) reported by Yisehak et al. [7] in three districts of Jimma zone of Western Ethiopia.

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Table 1. Background of the respondents.

Descriptor	Soro	
Sex of the respondents	**N (200)**	**%**
Male	147	73.3
Female	53	26.7
Educational level of the respondents		
Illiterate	37	18.5
Read and write	60	30
Primary school	43	21.5
Secondary school	30	15
Diploma and above	30	15
Age of the respondents	**Mean±SD**	
	42.92±11.99	

N=number of respondents, SD=Standard Deviation.

Family size and livestock holding

Mean ± SE for family size and livestock holding per house hold in the study area is presented in **Table 2**. The mean family size in the study area was 5.72 ± 0.24. This result is in agreement with Tesfaye [8] in Metema district and Kedija et al. [9] in Meiso district who reported mean family size of 5.7 ± 0.13. Family size depends on practices such as social and cultural perceptions of the society. Having many children is thought as an asset for farming activities and being large in number in a household has social prestige showing the strength of that family. Similarly, study by Tonamo et al. [10] in Essera district indicated that having many wives is one of wealth indicators and commonly practiced type of marriage. The mean cattle holding per household was 13.22 ± 1.70. The figure for district was larger than that of Tesfaye [8] with 12.25 ± 0.23 cattle per household in Northwestern Ethiopia and smaller than that the reported figure (14.7 ± 0.55) by Ayantu et al. [11] in Horro district of Oromia region and (14.00 ± 0.58) by Tonamo et al. [10] in Essera district of Southern region.

Table 2. Mean family size and livestock holding per household.

Descriptor	Mean±SE
Family size	5.72 ± 0.24
Livestock species	
Cattle	13.22 ± 1.7
Goats	3.73 ± 0.50
Sheep	3.05 ± 0.18
Donkey	1.33 ± 0.10
Chicken	7.56 ± 0.79
Horse	0.45 ± 0.06
Mule	0.32 ± 0.06

SE=standard error.

Purposes of keeping cattle

Farmers keep cattle for multiple purposes like milk, meat, blood, hides, and horns as source of income [12,13]. Socio-cultural functions of cattle include their use as bride price and payment of fines in settling disputes in communal areas [14]. They are also reserved for special ceremonial gatherings such as marriage feasts, weddings, funerals and circumcision. Cattle are given as gifts to relatives and guests, and as starting capital for youth and newly married men. They are used to strengthen relationships with in-laws and to maintain family contacts by entrusting them to other family members [15].

The people share many similarities with other people for having distinctive motive to keep cattle for different purposes. They keep large size of herd considering it as a wealth, cultural and social security. The motive behind the society is to secure the cultural title of '*Tibima/Abegaz/Garad and Kumima'* which is attained in ascending order after achieving the first stage/title *"Tibima/Garad"* of possession of at least 100 cattle and the second, *"Kuma''* title in which single individual can own more than 1000 cattle [16]. Due to this reason farmers in Soro district own larger number of livestock and the district has the largest livestock population among all the districts of the zone.

The results of individual interviews with farmers in the study area show that cattle have multipurpose functions. The major functions of cattle in the area are: draught power, milk/meat production, source of income, cultural purpose, social security and manure. Similar report was recorded by Fasil and Workneh [4] on purposes of keeping cattle in Amhara region. Largest number of respondents in the study area ranked milk and draught as primary purposes of keeping cattle. As shown in **Table 3**, 91.7% of respondents in the study area keep cattle primarily for milk. Similarly Etafa et al. [17] reported that 99.4% of the respondents Hararghe kept oxen primarily for draft power, while 86.6% of the respondents kept cows for sale of milk.

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Table 3. Percent of respondents reporting major functions of cattle in the district.

Purposes	Rank	N(200)	%	Index
Meat	1st	70	35	0.15
	2nd	127	63.3	
	3rd	3	1.7	
Milk	1st	183	91.7	0.18
	2nd	17	8.3	
	3rd	-	-	
Draught	1st	187	93.3	0.19
	2nd	13	6.7	
	3rd		-	
For social security	1st	30	15	0.1
	2nd	63	31.7	
	3rd	107	53.3	
Manure	1st	17	8.3	0.11
	2nd	127	63.3	
	3rd	56	28.3	
Selling for money	1st	80	56.7	0.16
	2nd	73	36.7	
	3rd	47	6.7	
Cultural	1st	43	21.7	0.1
	2nd	40	20	
	3rd	117	58.3	

N=number of respondents.

Index= sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) given for each function (purpose) divided by sum of (3 X number of household ranked first + 2 X number of household ranked second + 1 X number of household ranked third) for all function (purpose).

Feed resources and feeding system

As per Ulfina et al. [18], inadequate supply of feed both in quantity and quality is the single most important problem for low productivity of livestock. Based on interviews and focus group discussions made in the study district **(Table 4)**, natural pasture for communal/ individual grazing/ cut and carry system (35%), and crop residues (28.3%) were found to be the major feed sources for cattle in the study district. Natural pasture that was utilized by either grazing or cutting, 'enset' and its byproducts were also found to be feed sources for cattle in the district. Similarly Belay et al. [19] in Dandi district, Beriso et al. [20] in Aleta Chuko district and Tonamo et al. [10] in Essera district reported that natural pastureland was the most dominating feed source for the cattle.

Table 4. Major sources of feed in the district.

Sources of feed	Study district
Natural pasture	35
Established pasture and improved forages	6.7
Hay	10
Crop residue	28.3
House made leftover	8.3
Others (*Enset* and its byproducts)	11.7

The availability of feed for cattle in the study area shows seasonality according to the respondents and focus group discussions. Crop residues from crops are more important feed sources especially in the dry season when grazing pasture is less covered. Conservation of different crop residues is a common practice in the district mostly when there are available sources of crop residues in dry season. Communal and individual grazing lands throughout the study area in general, and established pasture, in particular, in the district were reported as more useful sources of feed in the wet season before the major crops are harvested. In the district, (highland), as mentioned above, 'enset' and its by products are good sources of feed for cattle in dry season and also there are good practices of using established pasture. During focus group discussions and interview, utilization of improved forages was also reported as sources of feed for cattle.

Reproductive performance

The reproductive performance of breeding female is the determinant of all forms of output and varies most in a population [21]. The poor reproductive performance of animals can be related to inappropriate management practices (poor nutrition, disease, etc.) and/or the genotype of the animals. As per **Table 5**, the mean reported age at sexual maturity (months) for female and male local cattle were 49.0 and 44.7 in the district which is comparable with the mean reported age at sexual maturity of 45.7 and 49

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months for Kereyu female and male cattle respectively by Shiferaw [22] but longer than the reported overall mean sexual maturity of 39.6 months for female and 39.9 months for male of indigenous cattle breed of Oromia regional state by Workneh and Rowlands [23].

Table 5. Indicative reproductive performance of local cattle in the study area.

Performance parameters	District (Soro)	
	Mean	SD
Weaning age (male)	11.8	6.34
Age at sexual maturity (male)	44.7	9.16
Age at sexual maturity (female)	49.0	9.08
Age at first calving (month)	53.2	13.4
Reproductive life span (yr)	8.2	2.68
Lifetime calf-crop production (number)	5.6	2.29
Calving interval (month)	20.9	8.05
Life span of bull (yr)	7.9	2.13
Castration Age (male)	5.74	1.40

SD= Standard Deviation.

The reported mean age at first calving (AFC) in months for local female cattle in the study area was 53.2 months. This result is comparable with the overall mean AFC of 54.1 months reported by Shiferaw [22] for Kereyu breeding female cattle. On-farm AFC was reported for some indigenous cattle types by different authors. Takele [24] reported 54.1 months for Sheko breed whereas, Dereje [25] reported 53.1 months for Raya –Sanga cattle. Similarly, Zewdu [26] also reported 54.7 and 53.4 months of AFC for Wegera and Fogera cattle, respectively. The reported AFC in current study is longer than that of (51.24) reported by Beriso et al. [20] in Aleta Chuko district for local cattle. The calving interval (CI) estimated for local cattle (20.9 months) was within the range of the earlier estimates of CI for Ethiopian zebu cattle ranging from 12.2 to 26.6 months [27] even though longer than the reported mean CI by Beriso et al. [20] which was 19.93 months for local cattle in Aleta Chuko district. The mean reported reproductive lifespan (RLC) of local cattle breeding female in the study area was 8.2 year with associated lifetime calf crop production (LCP) of 5.9 calves which is strongly similar with result reported for Gojam highland zebu by Fasil. In fact, the mean reproductive period (RLC) and LCP in the study area exceeded the figure for African cattle, which might be due to some interventions has been done in aspects of management and veterinary services enabled animals to survive better in current conditions than previous conditions. The mean and maximum LCP for most African cattle was reported to be 2.1 and 8 calves respectively [28].

The lifetime productivity of a cow is influenced by age at puberty, age at first calving and calving interval. The mean reported reproductive lifespan of local cattle breeding bulls (LBB) 7.9 years in the district which is longer than that reported LB of 6.5 year by Takele [24], for Sheko breeding bulls. The mean age at castration (CA) for local male animals in the study area was 5.74 years that is comparable with the reported value (5.4 year) for kereyu cattle by Shiferaw [22] and to the reported value (5.7) for Sheko male animals by Takele [24]. According to the farmers, oxen become docile and more powerful after castration in addition to control of breeding and better price **(Table 6)**.

Table 6. Productive performance of cows.

Variables	Mean	SD
Milk production/day/cow (L)	1.20	0.41
Lactation length (month)	11.08	5.53
Peak milk yield (L)	1.76	0.69
Lactation milk yield (L)	328.61	100.99

SD= Standard Deviation.

Milk production performance

In current study area, the mean daily milk production per cow was 1.20 liter of milk per day. An average lactation length, peak milk yield (L), Lactation milk yield (L) were 11.08, 1.76 and 328.61 respectively. Indigenous breeds of cows are generally considered as low milk producers. However, they are the major source of milk in Ethiopia that accounts for 97% of the total milk production in the country. Milk yield has remained extremely low with average of 1.4 litre per day cow in Oromia regional state [23] which is nearly similar with current study. Similarly for north Gonder indigenous cattle, the overall estimate lactation yield was 540 liters per head, which is very low due to poor genetic makeup, shortage of land and poor management conditions [29]. The lactation length of local cow in mieso district is 7.29 month [9]. Average milk yield of cow by regions of Ethiopia is indicated in **Table 7**.

Table 7. Average milk yield of cow by regions of Ethiopia.

Region	Average Daily Milk Yield in Liters
Oromia	1.5
Amhara	2.13
SNNPR	1.65

Somalia	1.6
Afar	2.69
B/Gumuz	1.25
Gambella	2.11
Harari	2.09
Tigray	1.29

(Source: CSA, 2010).

Major cattle diseases

Diseases have numerous negative impacts on productivity of herds i.e. death of animals, loss of weight, slowdown of growth, poor fertility performance, decrease in physical power and the likes. In current study biological, nutritional and physiological health problems were reported to be among the major factors affecting cattle in the study area. Major animal diseases and parasites were identified through group discussion involving key informant farmers, development agents and veterinary technicians. As reported by Tajebe et al. [30] economic losses due to disease and parasites have quadruplet their effect further when factors such as feed shortage, poor management practices and environmental factors are prevalent.

Drought and feed shortage were considered as the two major factors that predisposed the cattle for a variety of infectious and non-infectious diseases. Most of the infectious diseases were reported to occur in dry season while the prevalence of parasitic diseases increased at the beginning and at the end of the wet season. Cattle diseases reported in the studied district was common but the intensity of prevalence for a disease type was different. The reported common and economically important diseases throughout the study area were infectious diseases (anthrax, blackleg, pasteurellosis, brucellosis, contagious bovine pleura pneumonia, lumpy skin disease and foot and mouth disease), external parasites (ticks and lice), internal parasites (fascioliasis) and vector borne diseases (trypanosomiasis and babesiosis). In addition to these some metabolic diseases were also reported but their occurrence was rare. Lumpy skin diseases and foot and mouth diseases were reported to be occurring widely throughout the study area in the year of study.

During focus group discussions most of the participants reported that the farmers have their own hypodermic needles to inject medicine to their cattle in case of disease outbreak. None of them have ever been trained or received prescriptions from veterinarians. They explained that they commonly administer penicillin for acute diseases. Doses are quantified in terms of bottles and may increase or decrease according to the number of animals suffering from diseases in a given herd, level of disease severity and the amount of drug available for use. The same information was reported by Fasil in Amhara region.

Many of the veterinary clinics in the study area had shortage in terms of medical supplies and human power; and are often distantly located as indicated during focus group discussions. They also revealed that control measures were vaccination, deworming and spraying. Traditional methods of treatment for some diseases were also reported by farmers. Feeding red colored *'enset'* leaf for cattle when there is placenta retention, branding the area around the ribs with hot iron and incising around the shoulder for anthrax were some reported traditional treatment ways.

Outcomes of focus group discussions in Soro district revealed that the cattle are severely affected by trypanosomosis especially in the kebeles located near Gibe river basin and the farmers purchase and administer deltametri for prevention of tsetse fly in the area. Veterinary professionals during focus group discussion revealed that there was a problem of use of low dose of medicine by farmers for cattle treatment which not only limits the effectiveness of the drugs but also develops drug resistance. Soro district was also reported to be known by movement of cattle which could be the reason for high prevalence of disease in the district.

Outcomes from group discussion in also revealed that there was production loss in the area due to high parasites infestation during summer (*kremt*). Fascioliasis (*Fasciola hepatica*) was reported to be the cause for this production loss because animals graze around a local lake in the area known for parasitic infestation. Deworming animals in early summer season was reported to be the controlling method.

The district veterinary agent, farmers and extension workers during focus group discussion additionally revealed that the most prevalent diseases in the area were mainly of parasitic diseases especially external parasitic diseases such as ticks, fleas and lice for which the most commonly used treatment was diazinone. Internal parasites such as fascioliasis and cestodes were also reported as common for which the treatment used was broad spectrum anthelmintic drugs like albendazole.

Breeding problems that affect herd productivity

Major breeding problems most frequently reported during focus group discussions and interviews that affect herd productivity were late age at first calving, postpartum anoestrus, long calving interval, breed problem, seasonality, heat detection problems, animal health problems, inadequate AI services and shortage of skilled man power. Environmental factors such as unavailability of feed both in quantity and quality, diseases and parasitic burden contribute much to these problems. Abortion and calving difficulty were also reported as breeding problems. Tonamo et al. [10] in Essera district reported that inaccessibility to AI services, difficulty of getting inseminator, fear about the small size of local cows to carry the pregnancy and deliver the offspring of improved breeds and lack of awareness were problems limiting the success of breeding in the district.

It was reported that there are animals with postpartum and ante partum anoestrus problem. Animals having this problem may have onset of estrus in cycle; and be mated by breeding bulls but they don't conceive. This could be due to the development of cyst in the uterus that gives a wrong perception that such animals are pregnant. Due to this reason animals show signs of estrus again after completing one cycle of estrus. Farmers reported that they overcome such a problem by using traditional treatment method of cutting the cyst by sharp blade. By inserting their finger to the uterus, they check for the presence or absence of cyst [31].

CONCLUSION AND RECOMMENDATIONS

Milk production in Soro district is subsistence type despite of its great role in consumption and income generation. Indigenous local zebu cattle with unknown breed are dominant cattle population in the area with low milk production potential. Improving such low milk production potential of local breed through AI service is constrained by animal factor, lack of awareness among farmers, inadequate AI service and feed shortage. Milk production in the study area is also constrained by shortage of grazing land, disease and parasites, shortage of land for improved forage production, inadequate veterinary service, and low milk production potential of cow.

From the result of this study, it can be concluded that lower reproductive performances were recorded, namely age at sexual maturity of both female and male, estimated age at first calving, number of calves born by cow and calving interval of a cow when compare to the various previous.

Based on the above conclusions the following recommendations were forwarded:

- Feed shortage in terms of quality and quantity was among the major constraints of cattle production in the study area which need to be addressed. Therefore, introduction of improved forages and the proper utilization of crop residues should be emphasized for improving the productivity of the cattle production in the area.
- The association of production and reproduction performances of the local cattle need to be determined through correlation studies and regular monitoring of the population so that suitable stock can be selected showing all the favorable attributes. Disease prevention and control strategies particularly for tse-tse fly and other prevalent diseases as well as drug administration and distributions should be emphasized. Hence the veterinary services in the area need to be strengthened.

CONFLICT OF INTEREST DECLARATION STATEMENT AND AUTHORS AGREEMENT

This statement is to certify that all Authors have seen and approved the manuscript being submitted. We warrant that the article is the Authors' original work. We warrant that the article has not received prior publication and is not under consideration for publication elsewhere. On behalf of Co-Author, the corresponding Author shall bear full responsibility for the submission.

This research has not been submitted for publication nor has it been published in whole or in part elsewhere. We attest to the fact that all Authors listed on the title page have contributed significantly to the work, have read the manuscript, attest to the validity and legitimacy of the data and its interpretation, and agree to its submission to the Journal of Life Science Group.

All authors agree that author list is correct in its content and order and that no modification to the author list can be made without the formal approval of the Editor-in-Chief, and all authors accept that the Editor-in-Chief's decisions over acceptance or rejection or in the event of any breach of the Principles of Ethical Publishing in the Journal of Life Science Group being discovered of retraction are final. No additional authors will be added post submission.

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