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EVALUATION OF REPRODUCTIVE PERFORMANCE AND MILK PRODUCTION POTENTIALS OF LOCAL COWS UNDER FARMER'S MANAGEMENT IN AND AROUND JINKA TOWN IN SOUTH OMO ZONE, SOUTHERN ETHIOPIA

BOGALE WOLDE ^{a*}, YONAS KEJELA ^a, HUSSIEN SIRAG ^a AND SOLOMON DEBEBE ^a

^a Department of Animal Science, College of Agriculture and Natural Resource, Jinka University, P.O. Box 165, Jinka, Ethiopia.

AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

ABSTRACT

The study was conducted in and around Jinka Town to investigate the reproductive and productive performances of local cows under the farmer's management. Six kebeles were selected from in and around Jinka town by simple random sampling technique. One-hundred and twenty households (60 from each) were used for the household survey. Data were collected through semi-structured questionnaires, focus group discussions, and secondary sources. The data were analyzed by using the SPSS version 20 and the mean comparison was made by LSD. An average age at first mating for male cattle was significantly (p<0.05) higher in Jinka town than around it. Average number of calves produced in lifetime was significantly higher around kebeles than in Jinka town. The overall mean±SE age at sexual maturity for both female and male cattle was 3.75±.05 and 3.38±.05 year, respectively. The overall mean±SE milk production per cow per was 1.28±0.35 liter per a day. Lactation milk yield per cow was significantly higher in town than around kebeles of Jinka town. During focus discussion and interview, the most breeding practices problems that hinder herd productivity were long calving interval, delayed age at first calving, postpartum anoestrous, seasonal fluctuation, the genetic makeup of animals, inadequate AI services and lack of skilled manpower. Generally, milk production in and around Jinka town is of subsistence type. On station investigation of production and reproduction performances of the local cattle is recommended through correlation studies and regular monitoring of the population to select the best animals, pasture improvement, and introducting technology that will enhance nutritive value of crop residue and dry season feed resources are needed.

^{*}Corresponding author: Email: bogalewolde408@gmail.com;

Keywords: Age at first calving; calving interval; lactation length; lactation milk yield; milking frequency; local cows.

1. INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa. This livestock sector has been contributing considerable portion to the economy of the country, and still promising to rally round the economic development of the country [1]. The livestock? sector contributes 20% to the total gross domestic product, supports the livelihoods of 70% of the population, and generates about 11% of annual export earnings. This sector has additional potential to increase and contribute to the economic growth of the country [2]. 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 [3,4].

The total cattle population for the country is estimated to be about 65.35 million. Out of this total cattle population, the female constitute about 55.90 percent. Concerning breed, 97.76 percent of the total cattle in the country are local breeds. The remaining are hybrid and exotic breeds that accounted for about 1.91 percent and 0.32 percent, respectively [1].

"The dairy sector in Ethiopia is not well organized and it is predominantly the domain of small and marginal farmers keeping one to three dairy animals under the mixed farming system. The indigenous cattle are well adapted to the hot environment and produce under the stress of elevated temperature, high disease prevalence, and low level of nutritional status, but their productive and reproductive performances are very poor. The average lactation period per cow at the country level is estimated to be about six months, and average milk yield per cow per day is about 1.37 liters" [5], and "cows usually do not have their first calves earlier than 35 months old, and calving interval is about two years" [6].

"Low nutritional input and limited use of mixed rations characterize Ethiopian dairy production systems with a year round calving. Optimizing reproductive performance needs measurement of current performance, assessment of areas in which performance is less than desirable and subsequent suitable interventions" [7]. According to Fasil and Workneh [8], "only a small number of recognized cattle breed types have a fair description of their level of production and reproduction performances. Record keeping of local cows' performance is essential for designing breeding and management strategies, as well as for sustainable utilization and conservation". However, various studies have been done by different researchers in Ethiopia such as Ayeneshet et al. [9], Kassahun et al. [10], and Getie et al. [11] on different local dairy cows' reproductive and productive performances. There appears to be paucity of information on reproductive performance and milk production potentials of local cows under the farmer's management in South Ari district and Jinka towns of South Omo zone, Ethiopia. Therefore, this study was conducted to bridge the above mentioned research gap.

2. METHODS AND MATERIALS

2.1 Description of the Study Areas

The study was conducted in and around Jinka town of the South Omo zone, Southern Ethiopia. Jinka town is the capital of the zone, and South Ari district is one of the eight districts in South Omo Zone, and the nearest to Jinka. The capital of the district, Gazer is 17 km away from Jinka. Its geographical locations are $5^{\circ}.67'$ - $6^{\circ}.19'$ N & $36^{\circ}.30'-36^{\circ}.73'$ E and its altitude ranges between 1200-3418 m.a.s.l. (Bizuayehu et al., 2016).

2.2 Sample Size and Sampling Methods

South Ari district and Jinka town were purposively selected based on milk shortage in Jinka town. The district and town were surveyed through single rapid exploratory field visits for gathering available secondary information from the districts, experts of the livestock and fisheries office, and the farmers' representatives to define the sampling frame and to obtain the lists of households owning local lactating cows. Three kebeles were randomly selected from the district and town (three from each, six kebeles in total). Individual households owning milking cows were identified and listed in the selected rural kebeles.

Sample size (total number of households n) was calculated in order to provide the statistical variation depending on confidence level, coefficient of variation and accepted level of accuracy. The sample size was calculated according to the formula n= $(zc/x)^2$ from Poate and Daplyn [12], where n is the estimated sample size, z is the confidence level [if α (type I error)] is 0.05 then z is 1.96); c is the coefficient of variation in the population (expected to be high at the field level, 45% was adopted), and x is the accuracy level (8%). The required sample size was rounded up to 120 households.

2.3 Data Collection Methods

Data were collected through a semi structured questionnaire (a type of mixed questions with open ended and closed types), focus group discussions (totally two group focus discussions), and secondary sources. Development agents working in the district office of livestock and fisheries department, and rural kebeles were recruited and trained for handling and administering the questionnaire. The focus areas of questionnaire were milk production and the 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, and health of dairy cattle, constraints for reproductive performance and milk production.

Following that, the actual questions and questionnaires were presented. Accordingly, information about the reproductive and production performance of local dairy cattle (age at first calving, age at first service, calving interval and calf crops, daily milk yield, total lactation yield, lactation length, and dry period) were collected.

2.4 Statistical Analysis

The data were entered and organized in a Microsoft Excel spreadsheet and then analyzed using descriptive statistics by SPSS, version 20. Descriptive statistics were used to display results such as mean and standard error. One way ANOVA comparison was performed using significance level at p < 0.05.

3. RESULTS AND DISCUSSION

3.1 Reproductive Performance

"Average age at first mating for male cattle was significantly higher ($\alpha < 0.05$) in Jinka town than around the town (Table 1). The overall mean±SE age at sexual maturity (years) for female and male local cattle were 3.75±.05 and 3.38±.05 in the study areas, respectively which is analogous to the mean reported age at sexual maturity of 45.7 and 49 months for Kereyu female and male cattle", respectively by Shiferaw [13] but disagree with the finding of Workneh and Rowlands [14] overall mean "sexual maturity of 39.6 months for female and 39.9 months for male of indigenous cattle breed of Oromia regional state. The low reproductive performance of cattle might be due to poor management practices, breeding and poor genotypic potential of the animals". According to Tesfaye et al. [15] body condition, "age of the cow, management system, and AI service performance were factors that affect the reproductive performance of smallholder dairy farms".

The overall mean±SE age at first calving (AFC) in years for local female cattle in the study area was 4.47±.05 years. This result is comparable to the findings documented by some researchers [13, 16, 17,18] who reported an overall AFC mean of 54.1 for Kereyu and Sheko, 53.1 for Raya Sangaand, and 52.30 months for...., respectively. Similarly, Zewdu [19] reported "54.7 and 53.4 months of AFC for Wegera and Fogera cattle, respectively". This finding disagrees with the AFC reported of 51.24 and 39.4 months for local cattle by Beriso et al. [20] and Niraj et al. [21] in AletaChuko district and Mekele city, respectively. "This might be attributed to the differences in genetic potentials, management and environmental factors. The overall mean calving interval (CI) estimated for local cattle (1.44±.02 years) in the study area was in line with the range of CI for Ethiopian zebu cattle ranging from 12.2 to 26.6 months" [22], but disagrees with the reported mean CI of 19.93 months for local cattle in Aleta Chuko district [20]. Also this CI disagrees with the reported 431.08±78.03 and 468.33±71.42 days in and around Mekele, Ethiopia by Niraj et al. [21], and for Abrha et al. [23] the in central Zone of Tigray, respectively. The overall mean±SE of reproductive lifespan (RLC) and lifetime calf crop production (LCP) of local female cattle in the study areas were 10.79±.22 years and 5.89±.16 calves, respectively. This finding is strongly similar to the result reported for Gojam highland zebu [8]. Calving interval, age at puberty and age at first calving are major factors which affect the lifetime productivity of a cow.

The overall mean \pm SE of breeding bull reproductive lifespan of local cattle (LBB) was $3.62\pm.13$ years in the areas. This finding is shorter than the 6.5 years reported by Takele [16] for Sheko breeding bulls. The overall mean \pm SE age at castration (CA) for local male animals in the study area was 5.9 ± 0.1 years. This finding is comparable to the result of Shiferaw [13] and Takele [16] who reported 5.4 and 5.7 years for Kereyu and Sheko, respectively. According to the farmers, bull castration is essential because it enhances docility and physical strength of the bull, in addition to control breeding and obtaining a better price.

3.2 Milk Production Performance

3.2.1 Lactation length, Peak milk yield

In the current study area, the overall mean±SE daily milk production per cow was 1.28±0.35 liters per day. Overall mean±SE lactation length (days), peak milk

yield (L), and lactation milk yield (L) were 269.78±6.71, 1.62±.04 and 371.51±9.09 respectively. The milk vield per day per cow is similar to the finding of Amanuel et al. [24] who reported $1.18 \pm$ 0.52 liters per cow per day in West Wollega Zone, Gimbi District of Ethiopia. The result was lower than the national average (1.48 liters) reported by CSA [1] and to Abera et al. [18], who reported 1.51 liters per day per cow in selected districts of Sidama Zone, Southern Ethiopia. The lactation milk was lower than 464.34±41.75 liters in and around Mekele, Ethiopia [21], 947±42.3 liters in Borona [25], and 645 litres in Begait breed [26]. According to Msanga et al. [27] and Epaphras et al. (2004) genetic makeup, climatic condition, diseases, feed and feeding practices, year and season of calving, breed, age, stage of lactation, parity and milking frequency have been reported to affect milk production and lactation length. The average lactation length agreed with the finding of Mulugeta and Belayneh [28] and Niraj et al. [21] who reported an average of 9.1 months and 247.11±22.64 days at North Shoa Zone and in and around Mekele, Ethiopia, respectively.

3.3 Breeding Problems Affecting Herd Productivity in and Around Jinka

Breeding, late age at first calving, postpartum anoestrus, long calving interval, breed issues, seasonality, heat detection problems, animal health problems, insufficient AI facilities, and a lack of qualified manpower were the most frequently mentioned factors affecting herd efficiency during discussions focus group and interviews. Environmental factors such as a scarcity of quantity and quality feed, diseases, and parasitic burden all play a role in these issues. Abortion and calving difficulty was also reported as a breeding problem. Tonamo et al. [29] "in Essera district reported that inaccessibility to AI services, the difficulty of getting inseminator, fear about the small size of local cows to carry the pregnancy and deliver the progeny of improved breeds, and lack of awareness, were problems limiting the success of breeding in the district". According to Regassa et al. [30], housing, feeding, watering, breeding and hygienic practice were the major factor that affect cattle productivity in Mekele City, Tigrai, Ethiopia.

Animals with postpartum and antepartum anoestrus problems were reported in the study areas. Animals having this problem may have an onset of estrus in cycle; and be mated by breeding bulls but they don't conceive. This could be due to the development of a cyst in the uterus that gives a wrong perception that such animals are pregnant. Farmers around Jinka town reported that they overcome such a problem by using the traditional treatment method of cutting the jugular vein with sharp materials like knife and blade.

 Table 1. Reproductive performance of cattle in and around Jinka town in South Omo Zone, Southern

 Ethiopia

Indicator	In Jinka	Around Jinka	Overall	P value
Average age at first mating for male (years)	$3.52 \pm .08^{a}$	$3.24 \pm .06^{b}$	$3.38 \pm .05$	0.007
Average age at first mating for female (years)	$3.79 \pm .07$	3.71±.06	$3.75 \pm .05$	0.375
Average age at first calving (years)	$4.55 \pm .08$	4.39±.07	$4.47 \pm .05$	0.168
Average reproductive lifetime of cow (years)	$10.66 \pm .25$	10.93±.36	$10.79 \pm .22$	0.543
Average number of calves produced in lifetime	$5.42 \pm .14^{b}$	$6.36 \pm .27^{a}$	$5.89 \pm .16$	0.003
Average calving interval of a cow (years)	$1.39 \pm .03$	$1.48 \pm .03$	$1.44 \pm .02$	0.40
Average reproductive lifetime for bull (years)	$3.77 \pm .20$	3.46±.16	$3.62 \pm .13$	0.237
Age of bull castration (years)	6.26±0.13 ^a	5.58 ± 0.14^{b}	5.9 ± 0.1	0.00

Table 2. Milk production parameters of dairy cattle in and around Jinka town in South Omo Zon	ıe,
Southern Ethiopia	

Indicator	In the Jinka	Around Jinka	Overall	P value
Milk production (L/cow/day)	1.4 ± 0.5	1.15±0.4	1.28±0.35	0.00
Lactation length (days)	251.95±8.23	287.6±10.16	269.78±6.71	0.007
Lactation milk yield (L)	403.20±12.30 ^a	340.34±12.20 ^b	371.51±9.09	0.00
Peak milk yield (months)	$1.82 \pm .06$	$1.42 \pm .05$	$1.62 \pm .04$	0.00
Weaning age (months)	$8.27 \pm .24$	8.95±.29	8.61±.19	0.077
Milking frequency				
Once in the morning	15(25%)	11(18.3)	26(21.67%)	
Once in the evening	0	1(1.7)	1(0.83%)	
Twice a day(morning & night)	45(75%)	48(80.0)	93(77.5%)	

4. CONCLUSION AND RECOMMENDA-TIONS

It was concluded from this investigation that low milk production potential and reproductive performances (namely age at sexual maturity of both female and male, estimated age at first calving, number of calves born and calving interval) were characterized in and around Jinka town in South Omo Zone, Southern Ethiopia. In addition, poor breeding performance, inadequate AI facilities and poor manpower are the major limiting factors affecting the development of local dairy industry in Jinka town.

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, the 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. Based on the outcome of this study, the following recommendations were made:

- i. Governmental and non-governmental organizations should establish sustainable cattle breeding centers in and around Jinka town;
- ii. To establish improved pastures and introducing technologies that will enhance the nutritive value of crop residues and other dry season feed resources; and
- iii. Intensify studies on improving the physiology and genetic makeup of cattle in the study areas

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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