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Assessment of Dairy Cattle Productive and Reproductive Performance in West Guji Zone, Oromia Regional State, Ethiopia

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Abstract

This study was conducted to assess dairy cattle productive and reproductive performance in West Guji Zone of Oromia Regional state, Ethiopia. Three districts namely Bule Hora, Karcha and Dugda Dawa were purposively selected based on dairy cattle production potential. A total of 270 respondents (95 from Karcha, 124 from Bule Hora and 51 from Dugda Dawa) were randomly selected. All the collected data were analyzed using SPSS version of 24. The overall mean of productivity and reproductive performance of dairy cattle were; daily milk yield, lactation length, and average milk yield were assessed. In addition, the overall mean reproductive performance of dairy cattle age at first services (AFS), age at first calving (AFC), calving interval (CI), number of services per conception (NSP) and days open (DO) in the study areas were assessed. The milk production performance of local cows was varying based on stages of lactation in the study areas. Accordingly, high milk was harvested at mid-stage lactation. Generally, it can be concluded that the production and reproductive performances of dairy cattle were low, indicating that the urgent need for coordinated interventions from all the stakeholders. Thus, coordinated works of all concerned bodies should be in place to boost the production and productivity and thereby enhance the livelihood of the dairy farmers in west Guji zone.

Keywords: Dairy cattle, productive, reproductive, performance

1. Introduction

Dairying is an important enterprise for many countries especially an important source of income generation for rural families in developing countries like Ethiopia. With the increase in population size, the demand for milk also increases (Usman *et al.,* 2013). The development of dairy production in Ethiopia could contribute significantly to poverty alleviation and improvement in the health and nutritional status of the whole community at large (Jan *et al.,* 2010).

Ethiopia is one of sub-Saharan Africa with a large potential for cattle production. The country is 1st among African countries and 9th in the world by possessing cattle population. The total cattle population for the country is estimated to be about 60.39 million. Out of this total cattle population, the female cattle constitute about 54.68% (CSA, 2018).

Cattle production gives a multi-purpose role where cattle provide milk, meat, fertilizer, fuel, draft power and also as a means of economic uplift from the sale of milk and milk products. The sector contributes 15 to 17% of gross domestic product (GDP) and 35 to 49% of agricultural GDP and 37 to 87% of the household incomes (Behnke and Metaferia, 2011).

Lower milk production performance is attributed to reduced lactation length, extended calving interval, and late age at first calving, poor genetic and shortage of dairy feeds both in quantity and quality, especially during the dry season (Ahmed *et al.*, 2010). Long calving intervals 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).

The pastoral and agro-pastoral milk production system is one of the major systems of milk production, practiced in the lowland region of Ethiopia where the livelihood of the semi-nomadic transhumance population is dependent on their stock. Milk production in this system is characterized by low yield and seasonal availability (Zegeye, 2003).

Despite having the largest cattle population in the favorable climate, and potentially large market, the contribution of cattle to income and nutrition has remained very limited in Ethiopia (FAO, 2007), due to several reasons such as the low genetic capacity of the indigenous cattle, the poor genetic potential for productive traits, substandard feeding, poor health care and management practices (*Belay et al.*, 2012; Ulfina *et al.,* 2013). This resulted in very low per capita milk consumption in Ethiopia (19 liter/year) as compared to the global average of 100 liters even far below the average for sub-Saharan Africa 40 kg/year (CSA, 2013).

Formal dairy development efforts in Ethiopia began in the late 1940s (Zegaye, 2003) and have continued to the present. So far, so many efforts were made towards dairy development and different

research projects have been undertaken in some parts of the country, the outcome and impact have not been satisfactory. The indigenous breed of cows is generally considered as low milk producers. However, they are the major source of milk in Ethiopia that accounts for 98.24%, while the hybrids and pure exotic breeds were represented by 1.54% and 0.22%, respectively. Currently, the total milk production from 12.39 million milking cows in the country is only estimated at 3.1 billion liters, which is translated into 1.37 liters of milk per cow per day (CSA, 2018).

Among others, poor reproductive performances of dairy cows are the main contributing factor to such low performances of the dairy herd. West Guji Zone is targeted because of its dairy production potential. However, it is neglected from scientific research due to its remoteness, inaccessibility for research and community service so far**.** Nowadays it is believed to have a high potential for dairy, and there is increasing demand for milk and milk products, urbanization and human population. But the supply of milk is lagging as compared to dairy cattle potential. However, information on dairy cattle production parameters like (daily milk yield, average milk yield, lactation milk yield and, reproductive performance such as age at first service, age at first calving, calving interval, day open and the number of services per conception), is unknown and has not been systematically studied and documented. For this reason, the producers may not get reasonable benefit from their dairy activity and the utilization efficiency of dairy and dairy products are low.

Therefore, for the appropriate intervention to be implemented, understanding the current production performances of the particular system is a prerequisite. To this essence, the current study was carried out to bridge the information gap on the productive and reproductive performance of dairy cattle in West Guji Zone and provides updated baseline data for further investigation in the study area.

Objective

- ✓ To assess dairy cattle production and reproductive performance in the study area

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in West Guji Zone of Oromia Regional state, Ethiopia. Bule Hora is located at 467km from the capital city of Ethiopia Addis Ababa. The duration of the study was conducted from September 15 - january 20, 2020 in west Guji Zone .West Guji Zone is also found in the southern part of the Oromia Regional State and southeastern part of the country. West Guji zone has a total population of 141,579 of which 78,030 are males and 63, 549 are females. The Zone is located between 38°_40° East longitude and latitude 4°_5° on the North and the altitude ranges from 500m up to 3500m above sea level. The climatic condition of West Guji zone is characterized by three agro-

climatic zones, namely highland ,midland and lowland. The coverage of each climatic zone is highland 33%, midland 47%and lowland20%.The mean annual rainfall of the study area is about 900mm and the annual temperature of the district 25 ^{0}C (WGLEPO, 2012).

The nature of the rainfall is bi-modal: 59% of annual precipitation occurs during March to May (main rain season) and 27% from September to November (short rain season), while the period between June and August is termed as cold dry season and December to February is the long dry season. Three districts were selected purposely based on agro-ecology, accessibility and dairy production potential.

Sampling Techniques and Sample Size

Three districts namely Karcha, Bule Hora and Dugda Dawa were purposively selected based on the potential of dairy production. The number of kebeles and households were selected based on proportional sampling techniques. Accordingly, three kebeles from Karcha, four kebeles from Bule Hora and one kebele from Dugda Dawa districts were selected. In general, a total of eight (8) kebeles were selected from each district. A simple random sampling technique having two-stage procedures was used. Stage I: Households having milking cows of any breed and size was identified and listed in respective kebeles. Stage II: Milking cow owner households were randomly selected from the list for an interview. Generally, from these districts, a total of 270 households (95 from Karcha, 124 from Bule Hora and 51 from Dugda Dawa) were selected proportionally.

Sources and Methods of Data Collection

Both primary and secondary data were collected. The semi-structured questionnaire was pre-tested and edited for its validity, consistency and clarity based on the pre-test result. These Semi-structured questionnaires were used to collect primary data like production and reproductive parameters like average daily milk yield (DMY), lactation length (LL), average lactation milk yield (ALMY) and age at first service (AFS), age at first calving (AFC) calving interval (CI) and the number of serves per conception (NSPC) were, respectively collected. Secondary data such as livestock population, temperature, rainfall, attitude, and longitude, unpublished and published document were included.

Focus Group Discussion and Key Informant Interview

Focus group discussion (FGD) (10 to 12 persons) and key informant interview (4 to 6 persons) which encompass elders, experienced persons, development agents, livestock traders and kebeles leaders were undertaken to discuss milk production and reproductive performance. Before the start of the discussion, participants of each group were informed about the objective of the study and invited to participate in the discussion.

Data analysis

The collected survey data was analyzed using SPSS software version 24. Descriptive statistics such as mean, standard error, was used. The difference was announced significantly at $P<0.05$ unless otherwise stated.

RESULT AND DISCUSSION

Production performance

Daily milk yield

The average daily milk yield of local cows in Bule Hora, Karcha and Dugda Dawa was presented in Table 1. The first and most important norm for cattle rearing is to obtain milk yields used for different purposes. As respondents reported in the current study, the average daily milk yield for local cows in the study areas were 1.73±0.14, 1.92±0.15 and 1.67±0.02 liters/cow/ day in Bule Hora, Karcha and Dugda Dawa districts, respectively. However, the volume of milk produced per cow/day in Karcha district was slightly higher than Bule Hora and Dugda Dawa districts. On another hand, the milk production performance of dairy cattle varies based on stages of lactation. Accordingly, the average daily milk yield from the stage of lactation was 1.73±0.25, 2.02±0.28 and 1.12±0.26 liters at early, mid and late lactations phases, respectively. The overall mean of daily milk yield from locally breedcows were 1.73±0.14, 1.92±0.15 and 1.67±0.02 liters/cow/ day, in Bule Hora, Karcha and Dugda Dawa districts, respectively.

The overall mean of the present finding was relatively in agreement with the value 1.8±0.045 liters/cow/day reported by Taju (2018) in Dawro zone of southern Ethiopia. However, the overall mean of daily milk yield of the current result was lower than the value 2.02±0.8 liters/day/cow reported by Ketema *et al.* (2018) for local cows in Walmera special zone of Oromia regional state, around Finfine. Similarly, the present finding was lower than the overall mean of daily milk yields 2.2 liter/cow/day reported by Ulfina et al. (2013) for local bred cows in the pre-urban dairy production system of western Oromia. In contrary to this, the current finding is greater than the results 1.37 liters/day/cow reported by CSA (2018) at the national level, in Ethiopia. This difference might be due to different management practices like feed, health care, breed and West Guji Zone has a high potential for dairy production as compared to a national level and less at the urban and pre-urban dairy production system

Lactation length

Lactation length is defined as the period between two consecutive calving during which cows are capable of producing milk or lactating (Amasaib *et al.*, 2008). Table 1 depicts the average lactation

length (in months) for local cows in Dugda Dawa, Bule Hora and Karcha districts. The average lactation lengths for indigenous cows were 7.82 ±0.12, 7.20±0.12 and 6.87±0.11 months in Dugda Dawa, Bule Hora and Karcha, respectively. In the study areas, the average lactation length for indigenous cows was higher (7.82±0.12months) in Dugda Dawa district when compared with Bule Hora (7.20±0.12 months) and Karcha (6.87±0.11 months) districts.

The current finding was lower than the results 8.23months, 8.6± 0.93 months and 9.5 months of lactation lengths reported by Megersa (2016); Taju (2018) and Lemma *et al.* (2005) for local cows in west Shewa zone, Dawro zone of southern Ethiopia and East Shewa zone of Oromia regional state, respectively. Similarly, the present finding was lower than the value 8.23 months reported by Niraje *et al.* (2014) for local cows in Tigray region. However, the lactation lengths of the present result were higher than the value 6.11±1.53 months reported by Ketema *et al.* (2018) in Walmera special zone of Oromia regional state, around Finfine. In contrary to this, the overall mean of lactation length in the current study for local cows was greater than the results 6 months of lactation length reported by (CSA, 2018) for local cows at the national level in Ethiopia. The difference in different sites might be due to differences in the types of breed, feed quality, poor management and lack of supplementation for cows during the lactation period being provided

Average Lactation Milk yield

The average lactation milk yields of local cows in the study area were presented in (Table 1). Lactation milk yield is the volume of milk produced throughout the lactation period. The Average lactation milk yield for indigenous cows was 391.78, 373.68 and 395.71 liter/cow/year, in Dugda Dawa, Bule Hora and Karcha, respectively.

The current finding disagree with the result of 542.3 liters of milk yield in the lactation period reported by Megersa (2016) for indigenous breeds in the west Shewa Zone of Oromia regional state. Similarly, the present study's finding was lower than the results ranging between 400 to 680 liters of average lactation yield reported by Belete *et al.* (2010) for indigenous cattle breeds. This difference might be due to factors like breed, level of nutrition, parity, suckling and other management aspects.

Reproductive performance

Number of services per conception (NSPC)

The number of services per conception is the number of services (natural or artificial) required for successful conception. The average NSPC of local cows in Bule Hora, Karcha and Dugda Dawa districts were presented in (Table 1). The current study revealed that the average numbers of services

per conception for local cows were 2.97±0.13, 1.73±0.67 and 2.2±0.5 in Bule Hora, Karcha and Dugda Dawa districts, respectively. The NSPC reported in Karcha district was lower than Bule Hora and Dugda Dawa districts. When the value of NSP becomes small, the animals have good reproductive performance while when the value of NSPC is large the dairy cows have poor reproductive performance. In the fact, the dairy cattle breed found in Bule Hora and Dugda Dawa districts had poor NSPC which was more than two points. The average number of services per conception for local cows was significantly different $P<0.05$ between the three districts.

The overall mean NSPC for local cows in the Karcha district was in line with the result (1.7) reported by Lobago (2007) in the highland of Ethiopia. The current result in Karcha and Dugda Dawa districts was slightly similar with the value of 1.93 of the average NSPC on-station reported by NAIC (2011) in Ethiopia. The present finding was higher than the value 1.6 of NSPC reported by Ketema *et al.* (2010) in Arsi zone. The average number of services per conception for local cows in Bule Hora and Dugda Dawa districts was in line with the results (2.1 and 3.0) reported by (FAO, 2009; NAIC, 2002; Kelay, 2001). Mukassa *et al.* (1989) reported that the number of services per conception (NSC) higher than 2 should be considered as poor which was inline with the current study in Bule Hora and Dugda Dawa districts. This difference might be due to management, agro-ecology, season, availability of feed, placenta expulsion, lactation length, long day open and parity.

Age at first services (AFS)

Age at first services is the age at which heifers attain body condition and sexual maturity for accepting service for the first time. The average age at first services in Bule Hora, Karch and Dugda Dawa for local cows was presented in (Table 1). The average AFS for local cows were 3.76±0.07, 2.45±1.16 and 3.39±0.42 years in Bule Hora, Karch and Dugda Dawa districts, respectively. The result of the current finding revealed that the age at first services for local heifers in the Karcha district was lower than the other two study districts. The current result shows the heifers in the Karcha district enter production phases at early age than heifers found in Bule Hora and Dugda Dawa districts. The average age at first services (AFS) for local cows was significantly different $P<0.05$ among the districts.

The results of the current study in Bule Hora and Karcha districts were greater than the value of (3.35 years) reported by Amin *et al.* (2013). However, the overall mean of AFS in the Dugda Dawa district was in line with the results (3.35 years) reported by Amin *et al.* (2013). Similarly, the present finding was relatively similar to the results of 38.1months of age at first services reported by Ayeneshet *et al.* (2018) in the smallholder farm management system of the North Gondar zone. In contrary to this, the current finding was lower than the value 48.85 months reported by Damissu *et al. (*2013) for Horro

breeds in Horro Guduru Wollega Oromia regional state. This difference in different sites might be due to breed, availability of feed and management.

Age at first calving (AFC)

Age at first calving is the period between birth and first calving. Age at first calving determines the beginning of the cow's productive life and influences her lifetime productivity. The average age at first calving in Bule Hora, Karch and Dugda Dawa has been shown in (Table 1). The average age at first calving were 4.52±0.11, 3.12±1.41 and 4.71±0.03 years in Bule Hora, Karcha and Dugda Dawa districts, respectively. The age at first calving for indigenous heifers of Karcha district was lower than Bule Hora and Dugda Dawa districts. When the age at first calving was prolonged, the lifetime production performances of the cows become decreased. The overall age at first calving in West Guji Zone was 4.12±0.52 years (49.44 months). The average age at first calving (AFC) for local cows was significantly different $P<0.05$ among the three districts.

The average age at first calving in the present finding was lower than the result 58 months which was reported by Ayantu *et al.* (2012) for local cows in Horro district. However, the current result was in line with the value 48.9 months of age at first calving reported by Taju (2018) for indigenous dairy heifers in the smallholder farm management system of Dawro zone, southern Ethiopia. In the contrary, age at first calving in the present study was greater than the recommended value (23 and 25 months) reported by Hammound *et al.* (2010) which is considered as optimum and increased the profitability of the dairy business. This variation of age at first calving between the study areas might be due to the nutritional status and management differences of dairy cows.

Calving interval (CI)

Calving interval (CI) refers to a time elapsed between two consecutive successive parturitions. The average calving interval in Bule Hora, Karch and Dugda Dawa districts were shown in (Table 1). The average calving interval for local cows was 12.19±0.13, 16.44±0.7 and 21.5±0.76 months in Bule Hora, Karcha and Dugda Dawa, respectively. The Overall mean of calving interval (CI) in the west Guji Zone was 16.71±0.53 in months. The average calving interval (CI) for local cows was significantly different $p<0.05$ among the districts. The calving interval of local cows found in Bule Hora district was lower than the cows in Karcha and Dugda Dawa districts. This result indicated that the cows kept in Bule Hora district have good fertility rate than the cows found in Dugda Dawa and Karcha districts. The calving interval of the present study in the Karcha and Dugda Dawa districts was greater than the value (14.63 months), but in the Bule Hora district it is less than the results 14.63 months reported by

Million and Tadelle (2003) for Borana breed. The overall mean of the current study was almost similar with the value of 16.0±0.141 months of calving interval for local breeds reported by Taju (2018) in Dawro zone, southern Ethiopia and less than 22.19 months reported by Belay (2012) in the Dandi district of west Shewa zone. Similarly, the calving interval in the present study for local breeds disagree with the value of 20.9 months of CI for local cows reported by Bayissa *et al.* (2017) in the Abuna Gindeberet district of west Shewa Zone of Oromia Regional state. This variation might be due to poor nutrition, lack of own bull, longer days open, disease and poor management practices

Open days (OD)

Days open (also called calving-to-conception interval) is the period between calving and conception in cows. The average open days in the present study were 96.3±0.6, 59.4±0.52 and 118.8±0.03 days in Bule Hora, Karch and Dugda Dawa districts, respectively. The overall mean of days open in west Guji Zone was 91.5±0.38 days. The average days open for local cows were significantly different $P<0.05$ among the districts.

The average days open in Bule Hora and Dugda Dawa districts were in line with the value ranges between (85 to 115 days) reported by Gebeyehu *et al.* (2007) and Tadesse *et al.* (2010) which is considered as optimum for dairy cows. Whereas, days open in the Karch district was less than the value (85 days open) reported by Gebeyehu *et al.* (2007) and Tadesse *et al.* (2010) indicated that days open less than 85 days are being bred early. Similarly, the overall mean of days open in the west Guji zone was in line with the value ranges between (85 to 115 days) reported by Gebeyehu *et al.* (2007) and Tadesse *et al.* (2010) which is considered as optimum for dairy cows. In the contrary, the current finding of days open in the study area for local cows was lower than 148 ±1.72 days reported by Tadesse *et al.* (2010) in Coletta. This difference might be due to agro-ecology, availability of feed, poor heat detection, silent heat. Thus, all factors should be corrected concerning agroecology.

CONCLUSION AND RECOMMENDATION

This study was conducted to assess dairy cattle's productive and reproductive performance in the West Guji Zone of Oromia Regional state. In the study areas, the production performance of local cows was low. As the current result revealed, the milk production performance of dairy cattle were vary among lactation stages. The average milk yield produced by indigenous dairy cattle of the study areas was higher in mid-lactation than early and late lactation stages. Similarly, the reproductive performance of dairy cattle reared in the study areas was poor which might be due to less management and poor genetic makeup of local cows.Generally, it can be concluded that the production and reproductive performances of dairy cattle was low, indicating that the urgent need for coordinated interventions

from all the stakeholders. Based on the above conclusion, the following recommendation was forwarded:To improve the performance (production and reproductive) of dairy cattle, improvement of extension and veterinary services as well as the adoption of appropriate dairy technology such as artificial insemination is mandatory. Thus, coordinated works of all concerned bodies should be in place to boost production and productivity and thereby enhance the livelihood of the dairy farmers.

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Table 1:Production and reproductive performance of dairy cattle in the study areas

Variables	Bule Hora (No.= 124)	Karcha (No.=95)	Dugda Dawa (No. = 51)	Overall (No.= 270)
Production performance				

Lactation length (month)	7.20±0.12	6.87±0.11	7.82 ±0.12	7.3± 0.12
Daily milk yield/day/cow (liters)	1.73±0.14	1.92±0.15	1.67±0.02	1.77±0.10
Average milk yield yield(liters)	373.68±0.02	395.71±0.02	391.78±0.002	387.63±0.012
Reproductive performance				
Number of services per conception	2.97±0.13	1.73±0.67	2.2±0.5	2.3±0.43
Age at first services (years)	3.76±0.07	2.45±1.16	3.95±0.03	3.39±0.42
Age at first calving (years)	4.52±0.11	3.12±1.41	4.71±0.03	4.12±0.52
Calving interval (months)	12.19±0.13	16.44±0.7	21.5±0.76	16.71±0.53
Day Open (DO)(days)	96.3±0.6	59.4±0.52	118.8±0.03	91.5±0.38
Milk production by stage of lactation				
Early lactation months	1.72±0.05	1.83±0.64	1.65±0.06	1.73±0.25
Mid-lactation months	1.93±0.05	2.2±0.78	1.92±0.02	2.02±0.28
Late lactation months	1.16±0.05	1.34±0.69	0.85±0.04	1.12±0.26