

Productive and Reproductive Performance of Horro Cattle and Dairy Product Utilization by Smallholder Farmers

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Abstract: A survey was conducted in the highland and mid altitude agro-ecologies of Horro and Guduru districts in western Ethiopia to assess the productive and reproductive performance of Horro cattle breed and dairy product utilization practices of smallholder farmers. A total of 210 (60 from highland and 150 from mid altitude) randomly selected households (hh) were involved in the study with the use of semi-structured and pre-tested questionnaire. The results obtained revealed that the mean livestock holding was significantly ($P < 0.001$) higher in the highland (13.00 ± 0.60 TLU/hh) than in the mid-altitude (9.72 ± 0.45 TLU/hh) agro-ecology. There was no significant difference ($P > 0.05$) between the highlands and mid altitudes in herd structure except the number of cows, which was significantly higher ($P < 0.05$) in the highland (3.61 TLU/hh) than in the mid-altitude (2.62 TLU/hh). The mean age at first mating and calving, calving interval, lactation length and number calves born per life time of a cow were comparable for both the highland and mid altitude area. The estimated mean annual milk yield/cow/lactation for the highland (342.75 liter) was significantly higher ($P < 0.001$) than that of the mid-altitude (286.46 liter) and most of the variation could be attributed to the difference observed during the early lactation. About 5% of respondents from the highland and 0.77% from the mid altitude were reported to have sold milk and butter to generate income but none of the respondents reported sale of either soft cottage cheese or yogurt (itittu). Improvements in the reproductive and productive performance of cows through improved feeding, health care and genetic improvement measures as well as improvements in milk processing and dairy products marketing opportunities would be the future direction of research for dairy development in the study area.

Key words: Horro cattle • Milk yield • Milk products • Highland • Mid-altitude • Reproductive performance

INTRODUCTION

Ethiopia has diverse agro-ecologies suitable for different kinds of livestock production. The livestock resources play important economic and social roles both at household and national levels. They sustain and support the livelihood of about 80% of the rural population and make significant contributions to the national economy and foreign currency earnings of the country [1]. The livestock sector contributes about 17% of the overall gross domestic product (GDP) and 45% of the agricultural GDP of the country [2]. Ethiopia holds the largest cattle population in Africa [3]. However, the production and reproduction performance is one of the

lowest. The average milk yield of indigenous cows is about 1.32 litres per cow per day over a lactation period of about 6 months [3]. The per capita milk consumption in Ethiopia is estimated to be 16 kg, the value of which is much lower than that of the other African countries, indicating the availability of relatively higher opportunity for improvement of the dairy sector in the country.

Dairy herd profitability is mainly determined by dairy cattle reproductive performance which in turn affects the efficiency of milk production, the number of calves produced per cow and lifetime milk production status of the animal [4]. The productivity of the dairy sector in Ethiopia is below the expected level mainly due to limitations in land resource, feed scarcity and high

prevalence of animal diseases and poor genetic potential of the indigenous cattle breeds for milk production [5- 7].

Horro and Guduru districts of the Horro Guduru Wollega Zone of Oromia Regional State in western Ethiopia are the original home of the Horro cattle breed. However, there is limited information on the productive and reproductive performance of livestock under smallholder farmers' management in the area. Therefore, the objective of this study was to assess the production and reproductive performance of Horro cattle breed under smallholder farmers' management and the corresponding milk and milk products utilization in the highland and mid-altitude agro-ecologies of the districts.

MATERIALS AND METHOD

Description Of The Study Area: This study was conducted in Horro and Guduru districts of Horro Guduru Wollega Zone of Oromia Regional State in western Ethiopia. Horro district is located at an altitude range of 1450 and 3100 m.a.s.l. The mean annual rainfall and temperature of the district were reported to range between 900 and 1800 mm and 11.8 and 22.7 °C, respectively. Guduru district is located at an altitude range of 1500 and 2450 m. a. s. l. The mean annual rainfall and temperature of the district were reported to range between 1000 and 2400 mm and 14.9 and 17.5°C, respectively.

Data Collection Methods And Selection Of Respondents: A single-visit multi subject formal survey method ILCA [5] was followed to collect data on livestock holding, productive and reproductive performance of the Horro cattle kept under smallholder management condition and milk and milk products utilization of the farmers in the study area. Before the formal survey, preliminary visits were made and focused group discussions were held with selected community members to collect relevant secondary information and to get insights from community members. A semi-structured questionnaire comprising of single and multiple response questions was developed based on the preliminary information collected. The structured questionnaire was pre-tested and refined. Trained enumerators were used to assist in the collection of the data.

A stratified random sampling technique was followed to select sampling units. The districts were clustered into highland and mid altitude agro-ecologies. Then, 2 kebeles from the highland and 5 kebeles from the mid altitude areas were purposively selected according to the size of the two agro-ecologies and 30 household heads

were randomly selected from each kebele for interview. The criteria for selection of the respondents included livestock and specifically cattle holding, accessibility and experience in livestock keeping. Accordingly, 60 respondents from the highland and 150 respondents from mid-altitude were selected giving a total of 210 respondents.

Statistical Analysis: The data was subjected to statistical analysis using SAS version 9.2 statistical packages SAS [8]. Descriptive statistics like mean, standard error and frequency distributions were used to analyze qualitative data. Furthermore, t-test was used to separate means of significantly different variables between the two agro-ecologies. Differences were considered to be significant at 5% level of significance.

RESULTS AND DISCUSSION

Livestock Holding: The average herd size and composition held per household is summarized in Table 1. The livestock species kept by the farmers comprises cattle, sheep, goats, donkeys, horses and mules. Cattle is the dominant livestock species reared in both agro-ecologies with no significant difference ($P>0.05$) between the two agro-ecologies. The higher proportion of cattle rearing in the two agro-ecological areas could be due to high demand for cattle for cultivation and other farm activities in the area. Cattle breeds kept by the surveyed households were local Horro cattle, which are an intermediate between the Zebu and Sanga types [9, 10]. The overall average number of cattle holding of 9.74 ± 0.39 for highland and 9.24 ± 0.43 in mid altitude were comparably similar with 9.66 TLU that was reported for Selale [11]. However, the average cattle holding reported in the current study was higher than the 4.53 TLU of cattle holding that was reported for Central Ethiopia [12] but lower than the values reported for Pawe, Dibase, Wombara and Guba districts of Metekel Zone of Benishangul-Gumuz Region in western Ethiopia [13]. The variation among such results could be attributed to intensity of farming and variation in agro-ecology of the study sites.

The number of sheep (0.77 ± 0.07 TLU) and goats (0.60 ± 0.07 TLU) held by highland respondents were significantly ($P<0.001$) higher than number of sheep (0.18 ± 0.02 TLU) and goats (0.22 ± 0.03 TLU) held per household in the mid-altitude. This could be due to the presence of higher area of grazing land and less incidence of animal disease in highland than in the mid altitude area.

Table 1: Livestock compositions of highland and mid altitude areas of Horro Guduru Districts

Species	Highland (N=60)	Mid altitude (N=150)	Overall (N=210)	Significance
Cattle (TLU)	9.74±0.39	9.24±0.43	9.38±0.33	NS
Sheep (TLU)	0.77±0.07	0.18±0.02	0.34±0.03	***
Goats (TLU)	0.60±0.07	0.22±0.03	0.33±0.03	***
Donkeys (TLU)	0.54±0.07	0.65±0.04	0.62±0.03	NS
Horses (TLU)	2.56±0.27	0.22±0.05	0.89±0.11	***
Mule (TLU)	0.11±0.04	0.03±0.01	0.05±0.02	*
Total Livestock	13.00±0.60	9.72±0.45	10.65±0.38	***

*= P<0.05; ***= P<0.001; NS=not significant; N= number of respondents

Table 2: Cattle herd structure - holdings/household (means ±S.E)

No.	Species	High land	Mid altitude	Overall	Significance level
		(N=60)	(N=150)	(N=210)	
		Mean ±SE	Mean ±SE	Mean ±SE	
1	Calves	0.35±0.03	0.35±0.02	0.35±0.02	NS
2	Heifers	1.24±0.10	1.23±0.08	1.23±0.07	NS
3	Bulls	1.29±0.10	1.32±0.09	1.31±0.07	NS
4	Oxen	3.61±0.61	3.72±0.16	3.69±0.14	NS
5	Cows	3.24±0.26	2.62±0.15	2.80±0.13	*
Total Cattle		9.74±0.39	9.24±0.43	9.38±0.33	NS

*= P<0.05; ***= P<0.001; NS=not significant; N= number of respondents; SE=standard error

The number of donkeys held in both agro-ecologies is more or less similar, but numerically large number of donkeys were kept in mid altitude areas. The number of horses held by highland respondents (2.56±0.27) were significantly higher (P<0.001) than the number of horses (0.22±0.05) held in the mid-altitude. This could be due to more suitability, presence of larger grazing area and less incidence of disease in the highland. There is also significantly higher number of mules in highland than in the mid-altitude.

The overall livestock holding of highland (13.0 TLU hh⁻¹) was significantly higher (P<0.001) than the overall mean livestock holdings (9.7 TLU hh⁻¹) of mid altitude respondents. The total average numbers of livestock held by respondents of the present study areas (10.65±0.38) was comparable with the value reported for Dendi district of Ethiopia [12] and it was higher than previous reports for Borena mid-altitude area [14] and for central highlands of Ethiopia [15,16]. Other studies showed that livestock holding is higher in low land areas of the country. For example a total livestock holding of 24 TLU and 15 TLU were reported for Mieso and Borena low lands respectively [17, 14].

Cattle Herd Structure: The cattle herd structure in the two agro-ecologies is presented in Table 2. Oxen make up 37.1% of the total cattle holding in the highland and 40.3% in the mid altitude area followed by cows, which account for about 33.3% for the highland and 28.4% for the mid-altitude area. Similar observations were reported for Arsi

highland areas of Ethiopia by Abdinassir [18], who reported cattle herd composition of oxen and cows as 43.2% oxen and 30.3% cows. Tekalign *et al* [19] also reported a cattle herd composition in Ethiopian highlands in which oxen and cows comprised 43.9% and 21.9%, respectively. This kind of herd composition in which more number of oxen than cows is kept by the smallholder farmers typical of the mixed crop-livestock production systems in the highland and mid-altitude agro-ecologies of Ethiopia. However, the trend appears to be different in the cooler highlands and lowland pastoral production systems. According to studies reported by Belay *et al.* [12] in Selale area of central highlands of Ethiopia, the number of cows held per households was higher than the number of oxen. Similarly a larger number of cows (12.9 TLU) than oxen (1.1 TLU) were reported in pastoral and agro-pastoral production system of the Borena lowlands [14].

The variation in number of oxen and cow holdings of the respondents could be due to the variation in objectives of livestock production in the country. Oxen are very vital as sources of draft power for agricultural production in the mixed crop-livestock production systems whereas cows are important for production of replacement animals, draft oxen and heifers, as well as for milk production. Higher proportion of oxen and cows observed in the present study marks the primary importance of livestock for traction and milk production. The number of calves per household was similar in both agro-ecologies of present study but the number is least

Table 3: Reproductive performance of Horro cattle under smallholder farmers

Performance parameter	High land	Mid altitude	Overall	Sig
Age at first puberty (year)	3.65±0.11	4.24±0.05	4.07±0.05	***
Age at first calving (year)	4.66±0.11	5.12±0.05	4.99±0.05	***
Calving interval (year)	2.17±0.05	2.16±0.03	2.16±0.03	NS
No. of calves born per life	6.90±0.14	6.57±0.28	6.80±0.13	NS

NS = noignificants, *** = significant at P<0.001

Table 4: Milk yield of Horro cattle breeds in highland and mid altitude areas

Stage of lactation	High land	Mid-high land	Overall	Sig
Early lactation lt/d	1.48 ±0.08	1.16±0.03	1.25±0.03	***
Mid lactation lt/d	2.25±0.11	2.04±0.06	2.10±0.05	NS
Late lactation lt/d	0.98±0.06	0.92±0.04	0.93±0.03	NS
Average yield lt/d	1.41±0.10	1.34±0.04	1.36±0.04	NS
Lactation yield lt	342.75±28.44	286.46±14.60	302.62±13.31	NS
Lactation length (months)	8.95±0.28	9.23±0.17	9.15±0.15	NS

NS = non significant, ***= significant at P<0.001

from other herd composition indicating large segment of cows are kept in the area dry with low calf crop production for future replacement stock.

Reproductive And Productive Performances Of Cattle:

The reproductive performance of Horro cows under smallholder livestock management is shown in Table 3. The mean age at puberty in the highland (3.65±0.11 years) was significantly (P<0.001) shorter than that of the mid altitude area (4.24±0.05 years). The overall age at puberty (4.07±0.05 years) reported in this study is comparable with 4.57±0.06 and 4.1 ±0.15 years reported for the lowland mid-altitude areas, respectively, of Borena Zone of Oromia Regional State in southern Ethiopia [14] but it exceeds previously estimated age at puberty (15.6-31.5 months) for Bos indicus cattle of Ethiopia and neighbouring countries [20,21]. The higher age at puberty could be due to some environmental factors mainly poor nutrition which delays puberty due to slow growth rate and body weight gain [22].

The mean age at first calving was significantly lower (P<0.001) in the highlands than in the lowlands, which could be due to differences in feed availability and other environmental challenges such as incidence of disease. More or less similar age at first calving of 4.84 years, 4.98 years and 50 months were reported from mid-altitude area of Borena zone [14] Guduru district [23] and Dendi district [12] respectively, in different parts of Oromia Regional State. The age at first calving reported in the present study exceeds 44 months for Bos indicus cattle [24]. The longer age at first calving observed in the current study might be an indication of poor nutritional and management status of cattle under smallholder farmers.

On the contrary, there was no significant difference (P>0.05) in calving interval between the highlands and mid-altitude areas in the current study. The Calving interval reported in the present study agree with reports of Belay et al. [25] who reported 21.36 month (1.94 years) for Zebu and Zebu Holstein Friesian crosses in Jimma of Ethiopia. According to Pullan [26] calving intervals shorter than 410 days (13.6 months) are very good, those of 411-460 (13.6-15.3 months) are satisfactory and those greater than 461 days (15.3 months) are unsatisfactory. Therefore, the calving interval observed in the present study falls under unsatisfactory level. This could also be due to poor nutrition and management system of cattle in the current study areas in addition to the low genetic potential of the breed. There was no significant difference in mean number of calves; a cow can have throughout her productive life between the two agro ecologies. However, the overall mean number of 6.8 calves reported in the present study was larger than 3-5.4 calves reported for Zebu cattle [27- 29]. This could be due to long productive life of cattle in the present study area.

Milk Production: Milk and milk product is the second important economic reason for livestock rearing in the study area and this was depicted in Table 4. The results of present study showed that mean milk production level of indigenous cows (Horro breeds) kept under smallholder management system showed variations in accordance with difference stage of lactation. According to the respondent of the study area, the mean milk yield of local Horro cows was estimated to be about 1.25, 2.1 and 0.93 liters during early, mid and late lactation stages, respectively. The mean annual milk yield was estimated to be 342.8 liters for the highland and 286.5 liters for the mid

Table 5: Practice of milk and milk products marketing

Practice of selling dairy product	High land		Mid high land		Overall	
	Sell N (%)	No N (%)	Sell N (%)	No N (%)	Sell N (%)	No N (%)
Milk	3 (5.0)	57 (95)	1 (0.7)	149 (99.3)	4 (1.9)	206 (98.1)
Yogurt	-	60 (100)	-	150 (100)	-	210 (100)
Cheese	-	60 (100)	-	150 (100)	-	210 (100)
Butter	60 (100)	-	150 (100)	-	210 (100)	-

altitude with an estimated mean daily milk yield of 1.41 and 1.34 liters per cows respectively. This result was smaller than the annual milk yield of 458 liters reported from Chacha area of North Shewa [30] and 474 liters reported from Dendi district of the Ethiopian highland [12]. The mean daily milk yield obtained from the current study was comparable to that of the national average (1.32 liter) as reported by CSA [3] and 1.31 liters reported for Chewaka district of Ilu Ababora Zone of Ethiopia [31]. There was no significant difference in lactation length between the two agro-ecologies, the values of which was 8.95 and 9.23 months for the highlands and mid altitudes respectively. The mean lactation length observed in this study is in line with the mean lactation length of 9.13 months reported for Chacha town and surrounding [30]. The lactation length is comparable with average lactation length 8.96 months reported for central highlands of Ethiopia [12] but longer than the value estimated by CSA [3] as national average lactation length of 6 months.

Milk And Milk Product Utilization Method: The results of the survey conducted on the traditional milk utilization method practiced in the study area are presented in Table 5. Even though milk is considered to be the second important reason for keeping livestock in the Horro and Guduru districts, only 5% of respondents of the highland and almost none of mid altitude respondents reported to have sold raw milk. Among home processed milk products, it is only butter that is reported to be sold for family income generation. Milk and milk products are either consumed at household levels or offered to needy neighbors free of charge. Lack of market and some cultural taboos are reported to be the major impediments in marketing milk and milk products in the study area. This is in agreement with previous report (32-34) who reported the absence of formal milk marketing system in peri urban and urban areas of western Ethiopia. All the respondents indicated that they occasionally sell butter as means of income generation for the family.

CONCLUSIONS

The present study concluded that cattle are the dominant livestock species kept in both agro-ecologies and that the cattle herd structure is dominated by oxen followed by cows. Oxen are very important as means of traction for crop production and such herd structure dominated by oxen shows that the primary purpose of keeping cattle as sources of traction power where the primary role of cows to produce replacement animals and milk production is of secondary importance. The productive and reproductive performances of cows were generally low. In both agro-ecologies farmers have no tradition of milk and milk product marketing except some butter churned at home in a traditional way. Therefore, the following recommendations are forwarded for the improvement of livestock production of the two agro-ecologies.

- The general low productivity of cows could be improved by improving on-farm feed production, use of supplementary feeds and improving feeding management as well as improved health care system.
- Accurate and dependable record keeping system should be in place to cull poorly performing animals and to improve the genetic potential of the local animals for higher level of productivity.
- Any dairy improvement program like crossbreeding and good management to enhance milk production and productivity should consider market linkage through extension services. Awareness creations of milk marketing practices are among key issues farmers should obtain to get more benefit from the dairy farming.

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