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On Farm Phenotypic Characterization, Breeding, Husbandry and Fattening Practices of Harar Cattle in Hararghe Highland

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Abstract

The study was conducted in four districts (Jarso and Goro Gutu) from eastern Hararghe and (Tullo and Oda Bultum) from western Hararghe zone of Oromia Regional Sate, Ethiopia, with the objectives of phenotypically characterization and to identify and characterize Harar cattle breeding, husbandry and fattening practice in the study area. Data collection were carried out through field observations, semi-structured questionnaire, focus group discussions, discussion with key informants and linear body measurements of sample indigenous cattle and secondary data collection from different sources. A total of 300 households (75 from each district) were purposively selected and interviewed and 488 adult cattle were sampled for morphological description and linear body measurements. The average cattle herd size was 6.02±0.11heads per household and there were highly significant different ($p<0.0001$) among districts. The coat color type of female Harar cattle was white grey (36.1%) ,white (29%) ,red (23%) black (6.9%) and white and red (5%).The coat color type of male Harar cattle was roan (34.5%),white grey (26.2%),red(20.2%),white(13.1 %) and black(6%).The average body length, chest girth, heig ht at withers,pelvic width,horn length and body weight for f emale cattle was 118.73±0.49,144.53±0.59,116.39±0.38,36. 84±0.26,14.70±0.24cm and 257.12±1.63kg respectively.Bod y length, chest girth, height at withers ,pelvic width,horn len gth and body weight for male cattle were 125.26±0.66,163. 52±1.55,121.32±0.47,39.60±0.55, 12.50±0.38cm and 280.43 ±3.45kg. Natural uncontrolled mating was the main breeding system in all districts. The effective population size of mixed herd was calculated to be 926.5 and the inbreeding coefficient in combined population was estimated to be 0.05%. The majority (95%) of the interviewed respondents practiced cattle fattening. The major challenges that faced the cattle fatteners (farmers) in the study areas are shortage of feed and water, disease and parasite problem, and lack of improved forage.

Key words: Fattening system;Harar cattle; Jarso; Phenotypic characterization; Tullo

Introduction

Ethiopia is generally believed to have the largest population of livestock in Africa. The total number of cattle in all regions of the country except the non-sedentary population of three zones of Afar and six zones of Somali region was estimated to be 59.5 million (CSA). Out of this total cattle population, the female cattle constitute 55.5 percent and the remaining 44.5 percent are male cattle. The majority of these cattle (98.2%) are indigenous breeds which are kept under extensive management. Hybrid and exotic breeds accounted for about 1.62% and 0.18%, respectively
(CSA). The use, development and conservation of livestock biodi versity are of great importance to food security, rural developme nt and the environment (Pilling). Phenotypic characterization of indigenous livestock breeds is critical in breed improvement and conservation (Jing ,Kugonza). The Domestic Animal Genetic Res ources Information System(DAGRIS) database registered 34 phe notypically recognized indigenous cattle breeds in Ethiopia (DAGRIS). However, breed characterization process is not exhaustive in the country. The recent rigorous effort in inventory and characterization has been revealed distinct breeds and will be expected to increase the number of breeds of the country in each species (EBI). Information on both within- and between-breed diversity is important, as the former provides information for management at the breed level and the latter helps to identify divergent breeds that may harbor distinct genotypes and are therefore worthy of conservation efforts even if their within-breed diversity is relatively high (Shah).Understanding the diversity, distribution, basic characteristics, comparative performance and the current status of a country's animal genetics resources is essential for their efficient and sustainable use, development and conservation (FAO).

Indigenous cattle have been naturally selected for years towards adaptive traits such as tolerance and resistance to diseases, high fertility, unique product qualities, longevity and adaptation to harsh environments and poor quality feeds (Aynalem). However, a large proportion of indigenous livestock populations in developing world have not yet been characterized or evaluated at phenotypic and genetic levels (DAGRIS). In order to ensure proper conservation and utilization of indigenous breeds, it is necessary to evaluate genetic variations that exist within and among breeds. Accordingly, proper identification,

evaluation, and maintenance of different traits of animal genetic resources are necessary to make them available and relevant for future use without compromising their current utilization (Tekle). Despite the significant contribution of cattle to the country, little attention is given to identify, characterize and conserve the diversity of the various classes of livestock. The current state of knowledge on characterization of cattle genetic resources in Ethiopia shows that there is inadequate breed level characterization information (Rowlands). Phenotypic characterization of Animal genetic resource is the process of identifying distinct breed populations and describing their external and production characteristics in a given environment and under given management, taking into account the social and economic factors that affect them. The information provided by characterization studies is essential for planning the management of Animal genetic resource at local, national, regional and global levels (FAO). Phenotypic characterization is therefore fundamental to the establishment of national inventories of Animal genetic resource, to effective monitoring of Animal genetic resource populations and to the establishment of early-warning and response systems for Animal genetic resource (FAO). Many researchers have worked on phenotypic and genetic characterization of cattle in Ethiopia but there is litt le study done to characterize Harar cattle breed. The Harar cattle are categorized under Small East African Zebu Cattle and distrib uted in the highlands of Eastern and Western Hararghe Zone, (Re ge and Tawah,Workneh ,DAGRIS). Traditionally they are used for meat, milk and draught purposes; and they are known to have good potential for meat and milk production in the study area.

Cattle fattening is an effective tool for poverty alleviation and has become an important business of the small farmers as well as urban dwellers. Particularly, the sector is good opportunity for employment and income generation for the rural poor, especially landless, destitute and divorced women (Ahmed). Meat production and consumption is important in the Ethiopian economy and ruminants contribute over 3.2 million tons, representing over 72% of the total meat production (Belete). In order to increase the meat production and consumption both at national and international level, beef cattle fattening plays an important role. In Ethiopia, there is limited information about their constraints, opportunities, challenges, economic efficiencies, production potentials and performances of beef animals under this sector (Bezahegn) and also particularly, the constraints, opportunities and challenges faced were not properly assessed even though the encouragement of the sector by government. Information about smallholder fattening practices and its constraints is important for researchers, policy makers to take serious measures and suggest possible technologies to improve the productivity of the sector and hence maximize its contribution to the total Gross Domestic Product or economy of the country.

However, there is no sufficient documented information on fattening practices of these smallholders' labors and their challenges in Ethiopia. Moreover, there might be a number of challenges which limits profitability of cattle fattening systems in the area. So, conducting research and raising appropriate improvement strategies of cattle fattening have to be needed. The bulls of the breed, which is commonly called Harar Sanga, was said to have good potential for beef purpose in the East and Central part of Ethiopia. Despite the presence of scanty of information on the production system, the breed was not characterized phenotypically in their environment (in-situ). As the production system is dynamic due to change in grazing land and other inputs it is important to characterize the environment the breed is managed in, so that the main reason for the present and future potential of the breed was identified. Harar cattle breed was reported to produce tender beef compared to beef from Arsi and Bale cattle breed (Gadisa). This has initiated the need to conduct phenotypic and environmental characterization of Harar cattle breed focusing around its anticipated main use, fattening for beef purpose. The objective of this study was thus to phenotypically characterization of local cattle population and understand fattening system of the community in Hararghe highland, to identify and characterize the cattle Fattening practice and to assess breeding and husbandry practices of the community in the study area.

Materials and Methods

Description of the Study Area

The study was conducted in Jarso and Goro Gutu districts of East Hararghe zone and Tullo and Oda Bultum districts of West Hararghe zone of Oromia National Regional State, Ethiopia.

Jarso district is located in east Hararghe zone having 9°7′60′′N latitude 37°28′0′′E longitude and an area of 504.54 km2. The altitude of the district ranges 1500 to 3060 meter above sea level. Average rain fall 400-900mm.The cattle populations of the district is estimated at 76873. Goro Gutu is also found in East Hararghe zone of Oromia Regional State. The altitude of the study district ranges 1250-2575 meter above sea level. The average annual rain fall is estimated to be 850 mm and the average temperature is 29°C.The study district lies between 41°10 E 9°20 N latitude and 41.167°E 9.333°N longitude. The cattle populations of the district are 87,650 (East Hararghe Zone Livestock and Fisheries Development Office, 2018).

Tullo is one of the districts found in Western Hararghe which is located in the Eastern part of Ethiopia at 370 km from Addis Ababa. The mean elevation of the study area is from 1600 to 2400 meter above sea level with the mean maximum and minimum temperature of 32°C and 17°C, respectively. The area is located at an altitude of 41°6 E longitudes 9° 13 N latitude. The area receives an average 600-900 mm of rainfall annually. The cattle populations in the area is 131,643. Oda Bultum district is also located in west Hararghe Zonal Administration. It is situated 364 km East of Addis Ababa and 38 km from Zonal city, Chiro. The study area is located at an average altitude of 1780m. The temperature of the area is with average of 25°C and the annual average rain fall is around 1200mm. The cattle population of the district is estimated at 96,491 (West Hararghe Zone Livestock and Fisheries Development Office, 2018).

Sampling Techniques and Data collection

Before deciding on the survey areas, discussions were held with the district experts of the rural and agricultural development office and the farmers' representatives about the

local cattle of the area and also about the current production systems and area dominated by pure Harar cattle breed in the study area. After discussion four districts (two each from East and West Hararghe) were selected based on Harar cattle ownership, distribution of Harar cattle population, and mobility of these cattle. Accordingly, three kebeles from each district were selected purposively for the study based on availability of cattle population. Then twenty-five households were selected from each kebele based on the distribution of the cattle through discussion with key informants in the village and secondary information in order to get a greater insight into the topics covered during the structured interviews and to check whether patterns that are found in the household was validated by the focus group. Data was collected by administrating a semi-structured questionnaire, individual interview employing field measurement and observations, organizing group discussions and from secondary sources. Moreover, linear measurements were conducted.

A modified questionnaire was prepared by adopting a questionnaire prepared by ILRI (International Livestock Research Institute) for survey of livestock breeds. It is used to collect information on general socio-economic household characteristics, herd structure, breeding management, feeds and feeding management, diseases prevalence and production constraints. The questionnaires were pre-tested before administration and some re arrangements, reframing and correcting in accordance with respondent perception was done. The questionnaire was administered to the randomly selected household heads or representatives by a team of enumerators recruited and trained for the purpose with close supervision by the researcher. To substantiate the information obtained from the formal interview, local agricultural development agents; local leaders and cattle owners were also interviewed informally to incorporate local knowledge about cattle breeds. Sets of open-ended questions were used to guide focus group discussions with key informants, local agricultural extension staffs and knowledgeable elders.

A semi structured questionnaire was also administered on Harar cattle owning farmers in three kebeles identified by the focus group discussions to collect data on cattle husbandry practices and desirable and undesirable traits of Harar cattle and questionnaire interviews was developed to discover feeding system, frequency of fattening per year, housing and other major husbandry practices, constraint of cattle fattening practices and marketing system of live fattened cattle. Also it includes fattening practice, sources and preferred cattle for fattening, feed and feeding, health management. Focus group discussions were held with elderly farmers, village leaders and socially respected farmers who are known to have better knowledge on the present and past social and economic status of the study areas, to substantiate the information collected through individual farmer interview. Through group discussions information on the fattening cattle practice, current status and major constraints of the breed, indigenous knowledge on management of breeding, major constraints and alternative approach to tackle these problems were collected. Besides, secondary data on human and livestock population, agro-ecology, and land use pattern, topography, soil type, and climate was gathered from Zonal and district Agriculture and Rural Development offices.

Morphological and linear body measurements

Quantitative (body measurements) and qualitative (morphological characters) data were collected and recorded on the format adopted from the standard description list developed by FAO (2012). The standard breed descriptor list for the cattle developed by FAO (2012) was closely followed in selecting morphological variables. Quantitative traits including body length, height at withers, Heart (chest) girth, Horn length, Ear length, Tail length, pelvic width, horn length, hock circumference and muzzle circumference were measured using measuring tape. The age of the animals was estimated by dentitions and information from cattle owners. Animals with three and above permanent pair of incisor were selected for linear measurements. Qualitative and quantitative characters were recorded for each animal sampled as per the breed descriptor list of FAO (2012). Qualitative and quantitative traits were recorded on 84 matured males and 408 breeding females in the sample households owning cattle from the four districts. The sample size was fixed according to FAO (2012) guideline that suggest a sample size of about 10-30 males and 100-300 females. Physical measurements were taken only from unrelated matured animals.

Data Analysis

The qualitative phenotypic data and survey data were analyzed using statistical Package for the Social Sciences (SPSS for windows, release 25.0, 2018). Descriptive statistics and multivariate analysis were carried out. Mean comparisons were made for variables showing significant differences between sample populations using Fisher's LSD. The effect of districts and sex on linear body size measurements were analyzed using the following linear model.

$Yijk = \mu + Di + Sj + eijk$

Where: Yijk=kth observation due to ith location and jth sex

μ= overall mean

Di= effects of ith districts (location) (i; 1=Jarso, 2= Goro Gutu, 3=Tullo, 4= Oda Bultum)

Sj=effects of jth sex (j; 1=male, 2=female)

eijk= Residual random effect

Multivariate analysis

The quantitative variables from female and male animals were separately subjected to discriminant analysis (PROC DISCRIM of SAS 9.1, version 2008) and canonical discriminant analysis (SAS 9.1, version, 2008) to ascertain the existence of population level phenotypic differences in the study areas. The analysis was performed taking individual animals as a unit of classification. Index of responses of sampled population was calculated as Index = sum of [4 for 1 + 3 for rank 2+2 for rank 3 + 1 for rank 4] given for an individual trait divided by the sum of [4 for 1 + 3 for rank 2+2 for rank 3 + 1 for rank 4] summed for overall traits (Kiflay et al., 2019). The effective population size(Ne) for a randomly mated population was calculated as Ne=

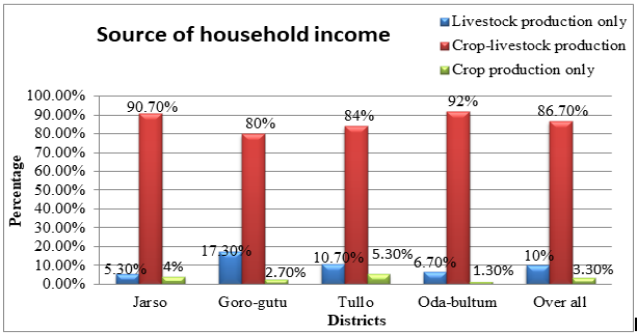
(4NmNf/Nm + Nf); where, Ne=effective population size, Nm= number of breeding males and Nf= number of breeding females. The inbreeding coefficient (ΔF) was calculated as ΔF=1/2 Ne (Falconer and Mackay, 1996).

Results and Discussion

Sources of household income

The main sources of the interviewed household in the study area are given in Figure 1. The current study showed that the major household activity in the study districts depend on both livestock and crop production. Crop-livestock productions are the main source of income contributing on average about 86.7 % of the household income in all the districts. This is due to interlinkage of both crop and livestock production for the community Livestock production alone is the second important source of income in all districts which was about 10%. Sole crop production was the least important which accounted for 3.3%. The current finding was in agreement with Dereje (2016) who reported that about 72.2% household's income to be generated from both crop and livestock in Babile district. Daniel et al. (2017) and Mohammed et al. (2016) also reported that about 96.3% and 84.07% of the household's income come from crop and livestock production in west Hararghe and Jimma zones respectively. Estefanos et al. (2014) also reported that the major income sources of respondents were crop and livestock production (51.7%), crop production, livestock production and small business 24 (20%), crop production 33 (27.5%) and only livestock production 1 (0.8%) in the high land of Hararghe.

Figure1: Source of household income in the study area.



Livestock Species Compositions

The livestock species composition of the sampled households is presented in table 1. The most essential livestock species in the study area was cattle followed by goats, sheep, donkey and chicken. In the study sites high number of cattle was observed in Oda Bultum district this was due the presence of available grazing land for cattle than Tullo and Jarso districts. Whereas the lowest number of cattle was observed in Jarso district and Tullo district. The overall mean of cattle holding per household in the study area was 6.02 herds which was lower than the report of Habtamu 7.8 herd per household in Benishangul gumuz, Andualem, 11.12±0.69 in Essera district, Dawuro Zone, Southern Ethiopia and Chali reported 11.33 cattle holding per household in Arsi highlands.

Table1: The average heads of livestock holdings per household in the study site

Districts						
	Jarso	Goro-gutu	Tullo	Oda-bultum	Overall	p-value
	(N=75)	(N=75)	(N=75)	(N=75)	(N=300)	
Species	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean± SE	
Cattle	5.05c ± 0.17	6.19ab ±0.22	6.11 b ±0.21	6.72 a ±0.23	6.02±0.11	<0.0001
Sheep	3.44±0.19	3.56±0.14	3.39±0.14	3.28±0.15	3.42±0.08	NS
Goat	5.31ab±0.18	5.52 a ± 0.24	4.95 b ±0.17	5.12ab±0.19	5.22±0.10	*
Donkey	1.01 a ±0.07	0.99 a ±0.08	0.85 ab ±0.08	0.69 b ±0.07	0.89±0.04	*
Chicken	6.99 a ±0.32	5.75 b ±0.23	7.32 a ±0.33	5.85 b ±0.28	6.48±0.15	<0.0001

N=number of respondents, NS=non-significant, *significant at (p<0.05), different superscript letters across the rows show significant differences

Qualitative traits in the Female and Male Harar cattle population

Qualitative characters of female and male Harar cattle is presented in Table 2. White grey, white, red, white and red and black were the most frequently observed coat colors in female cattle populations. In sampled male cattle population, the dominant coat color type was roan (34.5 %) followed by white grey (26.2 %), red (20.2 %), white (13.1%) and black (6%). From the sampled female population, the most commonly observed coat color patterns were plain (95%) and the remaining (5%) spotted. Males predominantly have shade/patchy coat color pattern (61.9%) and while the rest (32.1%) and (6%) possess plain and spotted coat color respectively. In the study area majority of the sample Harar cattle population body skin coat color was not pigmented in the female (94.1%) and male (92.9%) cattle, while the rest were pigmented. The muzzle (66.3%), hoof (91.1%) and eyelid (11.6 %) for female were pigmented. For male 64.3, 94 and 21.4% of the muzzle, hoof and eyelid color, respectively were pigmented.

The naval flap of the female was 32.9 % small, 51% medium and 16.1 % large. The perpetual sheath in male sample

population was 26.2% small and 67.9 % medium and 6 % large. In the study area among sampled cattle population the majority (93.3%) in the female and (100%) in the male cattle had horn, whereas 6.7% were polled in female cattle population. Out of horned female and horned male cattle population 33.2% were straight, 49.8% curved, 10.1% loose, 4% stump and 3% polled in female and 44% straight, 50% curved and 6% loose in male cattle population.

Table2: Qualitative traits description for indigenous cattle in the study area

	Female		Male		Over all	
Variables	**N**	**%**	**N**	**%**	**N**	**%**
Coat color pattern						
Plain	384	95	27	32.1	411	84.2
Shade/Patchy	0	0	52	61.9	52	10.7
Spotted	20	5	5	6	25	5.1
Coat color type						
Roan	0	0	29	34.5	29	5.9
Red	93	23	17	20.2	110	22.5
White	117	29	11	13.1	128	26.2
White gray	146	36.1	22	26.2	168	34..4
White and red	20	5	0	0	20	4.1
Black	28	6.9	5	6	33	6.8
Body coat color						
Pigmented	24	5.9	6	7.1	30	6.1
Not pigmented	380	94.1	78	92.9	458	93.9
Muzzle color						
Pigmented	268	66.3	54	64.3	322	66
Not pigmented	136	33.7	30	35.7	166	34
Eyelid color						
Pigmented	47	11.6	18	21.4	65	13.3
Not pigmented	357	88.4	66	78.6	423	86.7
Hoof color						
Pigmented	368	91.1	79	94	447	91.6
Not pigmented	36	8.9	5	6	41	8.4
Horn						
Absent	27	6.7	-	-	27	5.5
Present	377	93.3	84	100	461	94.5
Horn shape						
Straight	134	33.2	37	44	171	35
Curved	201	49.8	42	50	243	49.8
Loose	41	10.1	5	6	46	9.4
Stump	16	4	0	0	16	3.3
Polled	12	3	0	0	12	2.5
Horn orientation						

Tips pointing laterally	141	34.9	35	41.7	176	36
Up ward	236	28.4	44	52.4	280	57.4
Down ward	27	6.7	5	6	32	6.6
Ear shape						
Straight edged	404	**100**	84	100	488	100
Ear orientation						
Lateral	398	98.5	84	100	482	98.8
Drooping	6	1.5	-	-	6	1.2
Hump size						
Small	376	93.1	6	7.1	382	78.3
Medium	28	6.9	30	35.7	58	11.9
Large	0	0	48	57.2	48	9.8
Dewlap size						
Small	142	35.1	21	25	163	33.4
Medium	262	64.9	59	70.2	321	65.8
Large	0	0	4	4.8	4	0.8
Perpetual sheath (for bulls)						
Small	-	-	22	26.2	22	26.2
Medium	-	-	57	67.9	57	67.9
Large	-	-	5	6	5	6
Naval flap(for cows)						
Small	133	32.9	-	-	133	32.9
Medium	206	51	-	-	206	51
Large	65	16.1	-	-	65	16.1
Facial profile						
Straight	295	73	68	81	363	74.4
Concave	109	27	16	19	125	25.6
Tail length						
Short	28	6.9	-	-	28	5.7
Medium	134	33.2	56	66.7	190	38.9
Long	242	59.9	28	33.3	270	55.3

Quantitative Traits in male and female Harar cattle

The quantitative traits measurements of both male and female Harar cattle population in the study areas are summarized in Table 3. Phenotypic variation in all quantitative dependent variable were highly affected ($p<0.01$) by the sex of animals and districts. The result of the morphometric measurements in the current findings were higher than the report of (Fasil) body length of 110.4±0.91cm and height at withers of 120.9 ± 0.70 cm for Og aden cattle in Jijiga zone, Habtamu(2017) reported that 149.93± 0.68, 115.49±0.59,1 8.26±0.39 and 37.21±0.32 cm chest girth, body length, and pelvic width respectively for indigenous cattle breed of Benishangul gumuz, western Ethiopia and also (Endashew) indicated that 122 .1±0.9, 144.5±0.9 and 113.0±1.1cm for body length ,chest girth and height at withers respectively in Mursi cattle in the Bodi and Mursi pastoral areas of south Omo zone, south western Ethiopia.

However, the current result was lower than the report of Mulugeta (2015) 137.0± 0.10, 136.0±0.09, 168.9±0.10 and 41.5±0.06 cm height at withers, body length, chest girth and pelvic width respectively for male Begait cattle. The current study result was revealed that the majority of quantitative

characteristic of male Harar cattle population had larger than male indigenous cattle found in the different part of Ethiopia, because Hararghe people were well-known in cattle fattening, presence of good management and feeding system of cattle.

The current findings were similar with the report of Fasil (2006) for the same sex 40.67±0.34cm muzzle circumferences and slightly similar in ear length 20.76±0.25cm and tail length 88.20±0.83cm, but the horn was shorter than 15.82±0.89 cm for cattle in Awi, east and west Gojjam Zones of Amahara Region, Ethiopia. The body measurement values of female in the present study was higher than that reported by Dereje who found the average measured value for body length, chest girth, height at withers and pelvic width of female Horro cattle to be 99.42, 131.53, 107.18 and 32.39 cm, respectively and Endashaw also reported for Mursi female cattle population body length, chest girth and height at withers value of 114.9±0.8, 134.3±0.7 and 104.6±0.9 cm, respectively.

The study of Fasil et al. (2014) for Ogaden female indigenous cattle indicated that lower value for body length (104.1±0.50) and height at withers (113.5±0.39) than the current findings however, higher value for chest girth (149.1±0.66) and pelvic width (38.45±0.24) and Endalkachew et al. (2016) reported for Fogera female cattle higher values for heart girth (148.75±0.72cm), pelvic width (37.12±0.27cm) and height at withers (123.68±0.52cm) but lower value for body length (106.69±0.50cm). The report of Ebadu et al. (2017) for Bonga female cattle body length (110.52±0.33 cm), chest girth (135.04±0.42 cm) and height at withers (100.48±0.29) lower than the current results.

Table3: Summary of linear body measurements in male and female Harar cattle population

Effects	Ear length	Body length	Chest girth	Horn length	Tail length	Muzzle circumference
	mean± SE	mean± SE	mean± SE	mean± SE	mean± SE	mean± SE
Districts	***	***	***	***	***	***
Jarso	17.75 c ±0.29	122.45a±0.81	143.41 c ±1.12	13.52 b ±0.40	88.10 a ±0.68	37.11 cb ±0.47
Goro Gutu	18.29cb±0.33	117.64b±0.80	147.31 b ±1.28	14.86 a ±0.46	87.12 ba ±0.67	37.72 c ±0.56
Tullo	18.91 b ±0.22	120.81a±0.89	150.48 a ±1.16	13.09 b ±0.41	85.71 b ±0.77	40.43 a ±0.62
Oda Bultum	20.18 a ±0.26	118.51b±0.89	149.98 ab ±1.48	15.82 a ±0.41	82.2 c ±0.98	38.50 b ±0.63
Sex	***	***	***	***	***	***
Male	20.00 a ±0.22	125.26a±0.66	163.52 a ±1.55	12.50 b ±0.38	89.69 a ±0.96	40.67 a ±0.35
Female	18.53 b ±0.17	118.73b±0.49	144.53 b ±0.59	14.70 a ±0.24	84.98 b ±0.43	37.67 b ±0.34
Overall	18.78±0.14	119.85±0.43	147.80±0.64	14.32±0.22	85.79±0.40	38.19±0.29
CV	16.18	7.56	8.11	32.04	9.84	16.4
R2	0.107	0.11	0.295	0.075	0.099	0.078
Effects	Ear length	Body length	Chest girth	Horn length	Tail length	Muzzle circumference
	mean± SE	mean± SE	mean± SE	mean± SE	mean± SE	mean± SE
Districts	***	***	***	***	***	***
Jarso	17.75 c ±0.29	122.45a±0.81	143.41 c ±1.12	13.52 b ±0.40	88.10 a ±0.68	37.11 cb ±0.47
Goro Gutu	18.29cb±0.33	117.64b±0.80	147.31 b ±1.28	14.86 a ±0.46	87.12 ba ±0.67	37.72 c ±0.56
Tullo	18.91 b ±0.22	120.81a±0.89	150.48 a ±1.16	13.09 b ±0.41	85.71 b ±0.77	40.43 a ±0.62
Oda Bultum	20.18 a ±0.26	118.51b±0.89	149.98 ab ±1.48	15.82 a ±0.41	82.2 c ±0.98	38.50 b ±0.63
Sex	***	***	***	***	***	***
Male	20.00 a ±0.22	125.26a±0.66	163.52 a ±1.55	12.50 b ±0.38	89.69 a ±0.96	40.67 a ±0.35
Female	18.53 b ±0.17	118.73b±0.49	144.53 b ±0.59	14.70 a ±0.24	84.98 b ±0.43	37.67 b ±0.34
Overall	18.78±0.14	119.85±0.43	147.80±0.64	14.32±0.22	85.79±0.40	38.19±0.29
CV	16.18	7.56	8.11	32.04	9.84	16.4
R2	0.107	0.11	0.295	0.075	0.099	0.078

CV= Coefficients of Variation, R2=Coefficients of determination, *** highly significant at p<

Multivariate Analysis

Discriminant analysis

The validity of discriminant analysis procedure was assessed by means of reclassification of statistics for female and male sample populations (Table 5 and 7 respectively).The overall average error count estimate was 43.81 percent for all observations from all districts that mean 56.19 percent of female sample populations were correctly classi ied (table 4). This higher error rates, for instance in Goro Gutu district popula tions, indicated that greater a mixture with neighboring cattle population especially with Jarso and Oda Bultum cattle population.

The correct classi ication for female sample population into their district ranged from 42.57 to 68.32 percent in the districts studied (Table 4). From all the study districts female cattle has the highest correct classi ication in Jarso while the least correct classi ication was noted in Goro Gutu district (42.57).

Table4: Error Count Estimates for districts for female sample population in the study area

Error Count Estimates for district					
	Goro Gutu	**Jarso**	**Oda Bultum**	**Tullo**	**Total**
Rate	0.5743	0.3168	0.4554	0.4059	0.4381
Priors	0.25	0.25	0.25	0.25	

Table5: Correctly classi ied for female sample populations using discriminant analysis

From districts	**Goro Gutu**	**Jarso**	**Oda Bultum**	**Tullo**	**Total**
Goro Gutu	43(42.57)	22(21.78)	19(18.81)	17(16.83)	101(100)
Jarso	18(17.82)	69(68.32)	9(8.91)	5(4.95)	101(100)
Oda Bultum	19(18.81)	10(9.9)	55(54.46)	17(16.83)	101(100)
Tullo	16(15.84)	12(11.88)	13(12.87)	60(59.41)	101(100)
Total	96(23.76)	113(27.97)	96(23.76)	99(24.5)	404(100)

Number of observations and Percent (in bracket)

In case of male the overall average error count estimate was 17.86 percent for all observations and 82.14 percent of male samples were correctly classified (Table 6). The correct classi ication for male sample population into their district ranged from 71.43 to 90.48 percent in the districts of studied (Table 7). From the all study districts male cattle, Jarso had the least correct classi ication, whereas Goro Gutu district had the highest correct classi ication.

Table6: Error Count Estimates for districts for male sample population in the study area

Error Count Estimates for district					
	Goro Gutu	**Jarso**	**Oda Bultum**	**Tullo**	**Total**
Rate	0.0952	0.2857	0.1905	0.1429	0.1786
Priors	0.25	0.25	0.25	0.25	

Table7: Correctly classified for male sample populations using discriminant analysis

From Districts	**Goro Gutu**	**Jarso**	**Oda Bultum**	**Tullo**	**Total**
Goro Gutu	19(90.48)	1(4.76)	0(0.00)	1(4.76)	21(100.00)
Jarso	3(14.29)	15(71.43)	0(0.00)	3(14.29)	21(100.00)
Oda Bultum	1(4.76)	1(4.76)	17(80.95)	2(9.52)	21(100.00)
Tullo	0(0.00)	1(4.76)	2(9.52)	18(85.71)	21(100.00)
Total	23(27.38)	18(21.43)	19(22.62)	24(28.57)	84(100.00)

Number of observations and Percent (in bracket)

Canonical discriminant analysis

The all squared Mahalanobis' distances between districts for female cattle populations were highly significant (p<0.0001), this showing the presence of measurable differences between female populations from each districts (Table 8). The longest distance (3.77) was measured between Jarso and Tullo districts, whereas the shortest distance (1.62) was measured between Goro Gutu and Oda Bultum districts.

This shows that the sample populations from Goro Gutu and Oda Bultum districts were not more different in the group quantitative features under consideration. This is due to phenotypic similarities observed at both sites. All multivariate tests (Wilks' Lambda, Pillai's Trace, Hotelling-Lawley Trace and Roy's Greatest Root) obtained from Canonical discriminant analysis indicated differences (p<0.0001) among the districts for female sample populations (Table 9). The value of Wilks' lambda for female sample populations was 0.4785. This indicates that 52.15 percent of the variability in discriminator variables was because of the variances between populations rather than difference within populations (Table 9).

Table8: Squared Mahalanobis' distance between sites for the sample female population

From district	Goro Gutu	Jarso	Oda Bultum	Tullo
Goro Gutu	***			
Jarso	1.65	***		
Oda Bultum	1.62	3.38	***	
Tullo	1.67	3.77	1.73	***

highly significant at (p<0.0001)

The canonical discriminant analysis extracted three canonical variates for female sample populations and out of which the first two canonical variates (can1 and can2) accounted about for 86.67 percent of total variation (Table 9). The remaining one canonical variates (can3) account only for 13.33 percent of total variance. Eigen value shows the ratio b etween groups variability to within groups variability for a canon ical discriminant function. Accord-ing to (Howard and Brown, 2000) the larger Eigen value, shows the better at accounting for group differences. The higher discriminant power (Eigen value) for female sample populations were shown by canonical variate 1 than can2 and can3.

Table9: Multivariate Statistics and F Approximations for female cattle population

Statistic					Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda					0.4785	9.9	33	1149.7	<.0001
Pillai's Trace					0.6324	9.52	33	1176	<.0001
Hotelling-Lawley Trace					0.8719	10.27	33	901.59	<.0001
Roy's Greatest Root					0.5393	19.22	11	392	<.0001
Can	Eigenvalue	Difference	Proportion	Cumulative	Likelihood Ratio	F Value	Num DF	Den DF	Pr > F
1	0.5393	0.3229	0.6185	0.6185	0.4785	9.9	33	1149.7	<.0001
2	0.2164	0.1001	0.2482	0.8667	0.7365	6.46	20	782	<.0001
3	0.1162		0.1333	1	0.8959	5.06	9	392	<.0001

Table10: Multivariate Statistics and F Approximations for male cattle population

Statistic					Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda					0.103605	7.27	33	206.94	<.0001
Pillai's Trace					1.55037	7	33	216	<.0001
Hotelling-Lawley Trace					3.584076	7.48	33	155.08	<.0001
Roy's Greatest Root					1.951253	12.77	11	72	<.0001
Can	Eigenvalue	Difference	Proportion	Cumulative	Likelihood Ratio	F Value	Num DF	Den DF	Pr > F
1	1.9513	0.9649	0.5444	0.5444	0.1036	7.27	33	206.94	<.0001
2	0.9863	0.3398	0.2752	0.8196	0.3058	5.74	20	142	<.0001
3	0.6465		0.1804	1	0.6073	5.17	9	72	<.0001

In the case of male sample populations, the squared Mahalanobis' distances between the sites was higher than that of female cattle populations; this is due to small number of sample male. The shortest distance (6.41) was perceived between Goro Gutu and Jarso districts. However, the longest distance (12.15) was observed between Jarso and Oda Bultum districts (Table 11).

The distances expressed here between sample populations are due to distinct phenotypic differences between populations for quantitative traits. All multivariate tests (Wilks' Lambda, Pillai's Trace, Hotelling-Lawley Trace and Roy's Greatest Root) obtained from Canonical discriminant analysis indicated differences ($p<0.0001$) between the districts for male sample populations. The value of Wilks' lambda for male sample populations was 0.1036. This illustrates that most 89.64 percent of the variability in discriminator variables was because of the variances between populations rather than difference within populations (Table10).

Table11: Squared Mahalanobis' distance between sites for the sample male population

From district	Goro Gutu	Jarso	Oda Bultum	Tullo
Goro Gutu	***			
Jarso	6.41	***		
Oda Bultum	12.02	12.15	***	
Tullo	9.68	7.56	6.79	***

The canonical discriminant analysis extracted three canonical variates for male sample populations like as female sample populations. The first two canonical variates (can1 and can2) accounted about for 81.96 percent of total variation (Table 8). The remaining one canonical variates (can3) account only for 18.04 percent of total variance.

Reproductive performance characteristics of Harar cattle

The reproductive performance of indigenous cattle in the study areas are summarized in (Table 12). The present findings revealed that reproductive traits of Harar cattle such as age at first mating, age at first calving, calving interval, reproductive life time of cow and total calves born per life time of cow are highly significant amongst districts($p<0.01$). The difference among districts is due to management and feeding system practiced by the farmers. The Age at first mating of female Harar cattle in present results were closely related to of 3.73±0.51 years for Horro cattle (Dereje) and 3.94±0.092 for Bonga cattle breed (Edabu). Age at fist calving of the current result is lower than 4.96±0.091 years reported for Bonga cattle (Ebadu), 4.98±0.68 years for Horro cattle (Dereje) and 4.6 years for Mursi cattle (Endashaw) and value of 4.7±1.31 for Gofa cattle (Kebede). But, the age at first calving was higher than cattle breed in Benishangul gumuz (50.2 months or 4.18 years) (Habtamu), 51.4 ±0.05 month or 4.28±0.05 year for fogera cattle breed (Assemu) and 48.04±1.28 months or 4 years for Begait cattle breed (Mulugeta), 48.9±0.259 months or 4.07 years for indigenous cows in Dawro zone (Taju (2018) and 49.8 months or 4.15 years for Simada cattle (Assefa).

Longer age at first calving might be related with poor management and breeding practice, disease problem and poor level of nutrition. Calving interval of the current study was closer to that of 1.88±0.49 year for Horro cattle breed (Dereje). The current finding of calving interval was higher than 17.10±1.05 month or1.43 years for Begait cattle (Mulugeta) , 21.18±0.70 months or 1.77 years for fogera cattle (Assemu), 1. 77±0.047 year for Bonga cattle (Ebadu) and calving interval of 1 6.0±0.141month or 1.33 year in indigenous cow in Dawro zone (Taju). Conversely, calving interval of indigenous cattle in this

finding was lower than 26.04±0.01 months or 2.17 years for Simada cattle (Assefa). Short calving interval maximizes return on production by increasing lactation numbers for a cow in its lifetime. This means that they have a greater lifetime production than if they had extended intervals (Habtamu). Hare et al. (2006) reported that the rate of genetic improvement increases with shorter calving interval time between successive generations.

Table12: Reproductive characteristics of Harar cattle

Parameters	Jarso	Goro Gutu	Tullo	OdaBultum	Overall mean± SE	CV	Pr>F
	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE			
AFMF (year)	3.77 a ±0.63	3.69 a ±0.66	3.43 b ±0.50	3.40 b ±0.57	3.57±0.61	16.54	<.0001
AFC (year)	4.27 c ±0.45	4.39 cb ±0.54	4.48 b ±0.53	4.80 a ±0.96	4.48±0.68	14.5	<.0001
CI (year)	1.47 c ±0.60	2.25 a ±0.57	1.91 b.±0.58	2.11 a ±0.65	1.94±0.67	31.09	<.0001
RLTC (year)	13.37a±3.20	11.43cb ±.2.83	12.20b±2.96	11.11c±2.68	12.03±3.0	24.31	<.0001
TCBPCLT	6.53 a ±1.89	5.16 b ±1.75	5.47 b ±1.76	6.07 a ±1.89	5.81±1.89	31.4	<.0001
RTLB (year)	5.93 a ±3.58	3.89 b ±0.92	3.68 b ±0.93	3.48 b ±0.88	4.25±2.18	45.95	<.0001

AFMF= Age at first mating of female, AFC=Age at first calving, CI=Calving interval, RLTC=Reproductive life time of cow, TCBPCLT=Total calves born per cow life time, RTLB =reproductive life time male, SE=Standard Error, CV=Coefficient of variation.

Cattle breeding practices in the study area

Mating system and sources of bull in the study area

Most of the respondents in the study area use natural mating system of pure local. Out of the sampled household 57.3 % use natural uncontrolled mating in all study districts Table 13. This is due to communal grazing practice when animals of different households graze together they mate randomly. Hoverer, some individuals allowed their cows to be mated with selected bull (32.7 %) which is consider as natural controlled mating and only 10% use artificial insemination in specific areas. The present result was supported by Ebadu who reported in Kaffa zone almost all respondents use natural mating system of pure local and up to 30.5% of respondents use controlled natural matting by selecting preferred bulls from themselves or from neighboring herds but some respondents use Artificial Insemination. The present study also agrees with the work of Malike which indicated that farmers in Ethiopia prefer natural mating as the conception rate from the AI services is not successful. According to the respondents in all study districts cattle breeding is not seasonal (100%).Therefore, calving occurs all across the year. This study confirmed that most of the farmers use natural mating system in traditionally managed cattle. Similar result was reported by Ayantu and Dereje, where most of the farmers practiced natural, unplanned and uncontrolled mating system. Keeping of male cattle only for breeding purpose was not experienced by smallholder farmers, rather they use for both breeding and drought power. Communal grazing land is the key source of breeding bulls in most part of Ethiopia (Shiferaw, Ayantu). Andarge also reported that most of the farmers use natural uncontrolled mating followed by artificial insemination in east Gojjam zone.

As indicated in Table 13, the main source of bull used for mating was from own herd (45.7%), bulls from neighboring herd (39.7%) and only (14.7%) used artificial insemination. This finding was comparable with the study of Debir who reported that 67.8% of the farmers were used bulls from their neighboring herd and 32.2% of them used from their own for mating their animals in Sidama Zone, Southern Ethiopia. However, this result disagrees with the work of Ayantu who reported that at Horro district the main source of breeding bull is neighboring herd in community grazing land.

Table13: Mating system and source of bulls in the study area

Mating system	Jarso	Goro Gutu	Tullo	Oda Bultum	Over all
	N(%)	N(%)	N(%)	N(%)	N(%)
Natural controlled	27(36)	22(29.3)	25(33.5)	24(32)	98(32.7)
Natural uncontrolled	44(58.7)	48(64)	42(56)	38(50.7)	172(57.3)
Artificial insemination	4(5.3)	5(6.7)	8(10.7)	13(17.3)	30(10)
Breeding					
Seasonal	-	-	-	-	-
Not seasonal	75(100)	75(100)	75(100)	75(100)	300(100)
Source of bull					

Own bull	28(37.3)	30(40)	42(56)	37(49.7)	137(45.7)
Neighboring herd	37(49.3)	32(42.7)	26(34.7)	24(32)	119(39.7)
Artificial insemination	10(13.3)	13(17.3)	7(9.3)	14(18.7)	44(14.7)

N=number of respondent and number in the bracket percentage

3.7.2. Effective Population Size and Coefficient of Inbreeding

In the study area cattle graze on a communal grazing land and because of this reason, there would be a chance of mixing of the herds, possibility of sharing of neighboring bulls and mating between different herds. Therefore, the effective population size of mixed herd was calculated to be 926.5 and the inbreeding coefficient in combined population was estimated to be 0.05% (12). According to the report of Burrow the average inbreeding coefficient of less than 5% within a breeding program are considered low, with inbreeding levels of 5-10% generally considered more moderate levels of inbreeding and warranting more careful management. Therefore, the present finding revealed that the inbreeding coefficient of indigenous Harar cattle was very low. Inbreeding depression of economic and fitness traits and genetic variability reduction were caused by small effective population size (Nomura).The current study result was found to be higher than the recommended appropriate minimum effective population size (40) for net genetic response in cattle breeding for economic merit (Goddard and Smith).The present result was also higher than the effective population size of mixed herd 911.3 in which the inbreeding coefficient in combined populations was estimated to be 0.06% for Mursi cattle (Endashew).The minimum effective population size in order to reduce inbreeding depression and maximize gain in fitness through natural selection should be 30 to 250 (Meuwissen and Woolliams). Rate of inbreeding in the study area is below the threshold level or maximum acceptable level (0.063) (Armstrong).

Table14: Herd and Effective Population Size and Inbreeding Coefficient of Harar cattle in the study area

Herd	Nm	Nf	Ne	ΔF (%)
Combined total	330	777	926.5	0.054

Nm=Number of breeding males, Nf=Number of breeding females, Ne=effective population size, ΔF=inbreeding coefficient by percent

Cattle Fattening practice

Source and type of cattle used for fattening

Majority of farmers in the study areas acquire cattle from market (59%) followed by own production (38%) and (3%) of them obtained from their relatives Table 15. The present result was supported by the study of Guyo who reported the major source of fattening cattle in Bonke district of Gamo Gofa Zone was through purchasing from market (69.1%) followed by raising at home (24.2%). This finding was in line with the finding of Tesfaye who reported that traditional fatteners mainly use their own animal from their herds and the semi intensive and intensive fatteners purchase animals for fattening. The present result was disagreeing with the study of Belay who reported the sources of fattening cattle are culled oxen due to old age or being unproductive female from their own farm and immediate purchase for fattening purpose and Fekadu reported the sources of cattle's to be fattened were only market.

The most preferred animals for fattening are young bulls (uncastrated male) in Oda Bultum district (100%), Jarso district (94.7%) and Goro Gutu district (92%), which this was in line with the idea of the relatively shorter time needed to fatten young and uncastrated animals than castrated animals. In contrary preferred animal for fattening was matured oxen (86.6%) in Tullo district this is due to farmer's preference. According to the local elder's response in Jarso, Goro Gutu and Oda Bultum districts, castrated animals are not used for fattening. This is mainly due to very low market demand for castrated animals and the meat of castrated animals is very rough in view of farmers and buyers. According to Tesfaye the most preferred animal for fattening was old oxen (56.7%) in the traditional fattening system while young bulls (20.8%) in semi commercial and intensive fatteners which was in consistent with the current finding. This finding disagree with the study of Habtamu who reported the majority of the respondents preferred for matured bull (65.0%) and remaining proportion preferred old oxen (35%) in Gondar town.

Table15: Source, preferred and type of cattle used for fattening in the study area C

	Jarso		Goro Gutu		Tullo		Oda Bultum		Overall	
Variables	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Source of cattle fattening										
Own production	34	45.3	32	42.7	27	36	21	28	114	38

Gift from relatives	3	4	2	2.7	4	5.3	0	0	9	3
Purchased form market	38	50.7	41	54.7	44	58.7	54	72	177	59
The recommended cattle fattening										
Castrated	0	0	0	0	75	0	0	0	75	25
Non-castrated	75	100	75	100	0	0	75	100	225	75
preferred cattle										
Young bull	71	94.7	69	92	8	10.7	75	100	223	74.3
Matured oxen	0	0	0	0	65	86.7	0	0	65	21.7
Heifer	0	0	1	1.3	2	2.7	0	0	3	1
Culled cow	4	5.3	5	6.7	0	0	0	0	9	3

Frequency, duration and decision to end fattening

According to the survey result majority of the respondents in the study areas were fatten cattle once a year (72.3 %) (Table 16). The reason why once a year was lack of adequate grazing land and water shortage as stated by the focus group discussion. The duration of cattle fattening was for four months (33%), five months (26.7%), three months (22.3%) and six months (18%) as reported by the respondents in all studied districts (Table 16). The present result was in line with the study of Teshager who reported frequency of fattening was once per year (64.6%), twice per year (32.7%) and thrice per year (2.7%). Ahmed et al. (2010) noted that most of the farmers fattened cattle for 3-6 months (79.1%) and the rest fattened for a prolonged period. The current study was slightly in agreement with the work of Fekadu who indicated that farmers keep fattening cattle for two (40%), three (38.6%) and above three (21.4%) months, respectively in Gondar town.

According to the responses from the respondents in the study area decision of ending of fattening period was made by considering live weight change of the animals (79%) and the rest anticipated current and future price (21%) (Table 34). The present result was in line with the study of Shewangzaw (2016) who reported the durations for fattening to end at 3 months (83.33%), 3.5 months (13.33%) and 4 months (3.33%) and deciding finishing period of fattening cattle was based on considering rate of live weight change (56.67%), while 40% of them were anticipated current and future prices, and the rests, by calculating feeding length (3.33%). Comparable result was also reported by Getachew where fattened cattle were offered to market by considering rate of weight change (45.9%) followed by anticipated current and future prices (28.8%), feeding length and live weight change (12.8%) and calculating feeding length (11.2%) in Moretna Jiru district, North Shoa Zone. However, this finding disagree with the work of Gezu who reported cattle fattener to decide the end of finishing period by anticipated current and future (52.8%, 63.1%) price and by considering rate of live weight change (44.7% and 33.2%) and calculating feeding length (2.5% and 3.7%), respectively in lemo and soro districts, Hadya zone, Southern Ethiopia.

Table16: Frequency, duration and decision of end of fattening in the study area

Jarso		**Goro**	**Gutu**	**Tullo**		**Oda**	**Bultum**	**Over all**		
Variables	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	%
Frequency of fattening per year										
Once per year	55	73.3	47	62.7	53	70.7	62	82.7	217	72.3
Two-times per year	20	26.7	28	37.3	22	29.3	13	17.3	83	27.7
Duration of fattening										
Three month	16	21.3	19	25.3	10	13.3	22	29.3	67	22.3
Four month	20	26.7	24	32	25	33.3	30	40	99	33

Five month	28	37.3	20	26.7	22	29.3	10	13.3	80	26.7
Six month	11	14.7	12	16	18	24	13	17.3	54	18
Decision of end of fattening										
Live weight change	62	82.7	53	70.7	58	77.3	64	85.3	237	79
Anticipated current and future price	13	17.3	22	29.3	17	22.9	11	14.7	63	21

Freq =frequency

3.8.3. Major feed resources used for cattle fattening

Major feed resources in the study areas are summarized in Table 17. In Ethiopia the main feed resources are natural pasture, fallow land and stubble grazing and crop residues (Belete). According to the response of the respondents from all studied districts the major feeds given for the fattening cattle include crop residues (44.3%) followed by natural pasture (31%), concentrate (14.7%) and hay (10%). Crop residues of mainly sorghum and maize Stover, wheat and barley straw were given to the fattening cattle as reported by focus group discussion. Thus, farmers were forced to use crop residues such as cereal straws, legume haulms, and maize and sorghum stovers as the main livestock feed resources in order to reduce the limitations of feed scarcity. The current result was slightly comparable with the work of Yidnekachew who reported that the major feeds for cattle fattening were crop residues, false banana, and local beverage by products in south omo zone of southern nations nationalities people region.

Table17: Major feed resource used for cattle fattening reported by the respondent

		Districts								
	Jarso	**Goro Gutu**	**Tullo**	**Oda Bultum**	**Over all**					
Feed resource	N	%	N	%	N	%	N	%	N	%
Natural pasture	22	29.3	25	33.3	19	25.3	27	36	93	31
Crop residues	41	54.7	29	38.7	33	44	30	40	133	44.3
Hay	5	6.7	17	22.7	14	18.7	8	10	44	14.7
Concentrate	7	9.3	4	5.3	9	12	10	13.3	30	10

N=number of household

Feeding practices of fattening cattle

The overall feeding methods of cattle in the study areas are cut and carry (62.7%) followed by tethering (22.7%) and herding (14.7%) (Table 16). This study revealed that herding of cattle was uncommon in all districts of the study areas because of the lack of available grazing land due to expansion of cultivation land and limited communal grazing. Similar report by Bikila and Tigist indicated that in Haramaya district majority of the respondents (73%) use cut and carry (zero grazing). According to the responses from focus group discussion, farmers do not let their fattening cattle to graze because they were frightened of damage by other animals.

Table18: Feeding practice of fattening cattle in the study area

Districts					
Feeding methods	Jarso	Goro Gutu	Tullo	Oda Bultum	Over all
	N(%)	N(%)	N(%)	N(%)	N(%)
Cut and carry/zero grazing	55(73.3)	34(45.3))	58(77.3)	41(54.7)	188(62.7)
Tethering	12(16)	26(34.7)	10(13.3)	20(26.7)	68(22.7)
Herding	8(10.7)	15(20	7(9.3)	14(18.7)	44(14.7)

N=number of respondent

Challenge of cattle fattening in the study area

Consideration of the relative significance of the different constraints for cattle production was basic priority to beginning any genetic improvement program (Mulugeta). Before starting any genetic improvement programs in any production system it is basic to identify the constraints that hinder the production and productivity of cattle (Dereje). The major challenges that faced the cattle fatteners (farmers) in the study areas are shortage of feed and water, disease and parasite problem, lack of improved forage were ranked first, second and third with index values of 0.45, 0.23 and 0.18 respectively (Table 19). This study indicated that in all districts of study areas farmers indicated lack of animal feed to be the main significant factors that limits productivity of their cattle. Feed and water shortage due to unpredictable rainfall are the major constraints to cattle fattening in all districts of the study area. This finding is in line with the issue reported by Tessema who that stated about seasonal variations in feed quality and quantity are the main limitations to animal production and cause fluctuation in productivity throughout the year, particularly in the dry seasons during which feed is limited. The current result was supported by the report of Yadeta who stated feed shortage, water scarcity and diseases were the major problems in their order of importance, ranked first (0.52), second (0.33) and the third (0.15) in Fentale and Boset districts of east Shoa zone, Oromia regional state.

Mulugeta reported for Begait cattle among the constraints feed shortage, diseases and water shortage were the most important problems ranked first, second and third with different index values, respectively. Also the present study was in agreement with Yisehak reported feed supply shortage problem was ranked first followed by animal diseases in Jimma zone, Southwestern Ethiopia and Genet reported in east Shoa zone lack of feed, water scarcity, marketing problems and animal health problems were the primary constraints to run the fattening operations in all the scale of production. Similar results were also described by Fraol reported shortage of feed (85%), animal diseases (69.2%) and lack of credit services are among the major constraints observed for fattening beef cattle in and around Waliso, Oromia regional state, Ethiopia. The absence of improved forage, lack of improved breeds of cattle, market problem, absence of credit services, inadequate veterinary services in the area and lack of extension services were also some of the constraints observed in the study area. According to report from key informants and elders feed shortage was mostly due to shrinkage of grazing land as result of cultivation, environmental degradation and increasing human population in study areas. The present finding was in line with the study of Fekadu who reported the main constraints of beef cattle production in Gondar town as prioritized by respondents were 8.6%, 50.0%,5.7%, 14.3 and 21.4% showed that local feed shortage, high cost of commercial feed, shortage of land, disease and lack of credit respectively.

Table19: Major constraints of Cattle fattening ranked in the order of their importance in the study areas

Districts	Constraint	Rank 1	Rank 2	Rank 3	Index
Jarso	Feed and water shortage	52	9	2	0.39
	Lack of improved forage	10	39	32	0.24
	Disease and parasite	13	20	15	0.21
	Lack of improved breeds	0	3	7	0.1
	Market problem	0	4	19	0.06
Goro Gutu	Feed and water shortage	63	12	6	0.49
	Disease and parasite	8	35	8	0.23
	Lack of veterinary service	4	13	28	0.15
	Lack of improved breeds	0	9	14	0.07
	Lack of improved forage	0	3	9	0.03
	Market problem	0	3	10	0.04
Tullo	Feed and water shortage	49	16	3	0.4
	Lack of improved breeds	5	11	20	0.13
	Lack of extension service	0	4	17	0.06
	Lack of improved forage	0	7	6	0.04

	Disease and parasite	16	30	16	0.28
	Market problem	5	7	13	0.09
Oda Bultum	Feed and water shortage	65	11	7	0.5
	Lack of credit service	0	1	14	0.04
	Lack of improved breeds	0	21	15	0.13
	Lack of improved forage	0	9	26	0.1
	Disease and parasite	7	29	8	0.19
	Market problem	3	4	5	0.05
Over all	Feed and water shortage	229	48	18	0.45
	Lack of improved breeds	0	28	42	0.05
	Lack of improved forage	19	84	106	0.18
	Disease and parasite	44	114	47	0.23
	Market problem	8	18	47	0.06
	Lack of veterinary service	0	3	9	0.008
	Lack of extension service	0	4	17	0.013
	Lack of credit service	0	1	14	0.009

Conclusion

Generally, phenotypic qualitative characters of the Harar cattle populations are alike, while their quantitative characters in the four districts revealed that cattle populations of Goro Gutu and Oda Bultum are closer than that of Jarso and Tullo which could be because of proximities. The linear body measurement results showed that Harar cattle are larger in size compared to other cattle like Gamo-gofa cattle Arsi cattle and Mursi cattle. Production system characterization revealed that cattle are mainly used for fattening purpose. Major constraints of the cattle productions were shortage of feeds, scarcity of water, problems of diseases and parasites and lack of improved forages.

References

1. Ahmed T, Hashem MA, Khan M, Rahman MF, Hossain MM (2010) Factors related to small scale cattle fattening in rural areas of Bangladesh. Bangladesh J Ani Sci 39: 116-124.
2. Andarge Zewdu, Kefyalew Alemayehu and Zewdu Wondifraw, 2018. Breeding Practices and Farmers Trait Preferences on Indigenous Dairy Cattle Production in East Gojjam Zone, Ethiopia. Asian Journal of Agriculture and Food Sciences (ISSN: 2321 – 1571) Volume 06 – Issue 01, February 2018.
3. AndualemTonamo, BerhanTamir, Gebeyehu Goshu and Ermias Belete, 2015.Characterization of cattle husbandry practices in Essera Woreda, Dawuro Zone, and Southern Ethiopia. African j agri res 10(34):3421-3435.
4. Assemu Tesfa,Dilip Kumar,Solomon Abagaz, Getinet Mekuriaw (2016). Evaluations of Reproductive Performances of Fogera Cattle Breed in Selected Districts of Amhara Region, Ethiopia. International J Phar Med Biolo Sci 5(1):52.
5. Armstrong, J.B., 2006. Inbreeding: Why we will not do it? Accessed on, 2008 from
6. Assefa Getie, Mussie Hilemelekot, Mengistie Taye, Zewdu Wuletaw and Assemu Tesfa ,2015. survey on breeding practice, and productive performance of Simada cattle in Tach Gayint District, Ethiopia. J Life Sci Biom, 5(6), pp.171-180.
7. Ayantu Mekonnen,Ayenale Haile, Taddele Dessie and Yosef Mekasha,2012.On farm characterization of Horro cattle breed production systems in western Oromia, Ethiopia. Livestock Research for Rural Developme nt. Volume 24,Article #100. Aynalem Haile,2006. Genetic and economic analysis of Ethiopian Boran cattle and their crosses with Holstein Friesian in central Ethiopia. PhD thesis. National dairy research institute (I.C.A.R) karnal-132001 (Haryana), India.197 p.
8. Belay Duguma (2013). Smallholder livestock production and marketing systems in the Haramaya district, Eastern Ethiopia. Basic Research J Agri Scie, 2 (6): 122-129.
9. Belete Anteneh, Azage Tegegne, Fekadu Beyene and Berhanu Gebremedhin, 2010.Cattle milk and meat production and marketing systems and opportunities for market orientationin Fogera woreda, Amhara region, Ethiopia. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 19. ILRI (International Livestock Research Institute), Nairobi, Kenya. 65 pp.
10. Belete Shenkute, 2009. Production and Marketing Systems of Small Ruminants in Goma District of Jimma Zone, Western

Ethiopia. MSc. thesis Submitted to School of Graduate Studies. Hawassa University, Awassa, Ethiopia. 144p.

11. Bezahegn Abebe,2014. Small Scale Beef Cattle Fattening Practices on farm Performance Evaluation and Opportunities for Market Orientation in Western Hararghe Zone, Chiro District. Haramaya University, Haramaya, Ethiopia.
12. Bikila Negasa and Tigist Sisay, 2016. Assessment of livestock feed resources and feeding systems in Haramaya district, Eastern Ethiopia. Int J Live Pro 7(11), pp.106-112.
13. Burrow, H.M, (1993). Effects of Inbreeding in Beef Cattle, Animal Breeding Abstracts Vol. 61 No.11.
14. Chali Yimamu. 2014.In situ phenotypic characterization and production System study of Arsi cattle type in Arsi highland of Oromia Region, Ethiopia MSc Thesis, Haramaya University, Haramaya, Ethiopia.