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Phenotypic Characterization of Indigenous Cattle Populations in West Gojjam Administrative Zones, Amhara National Regional State, Ethiopia

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ABSTRACT: The study was carried out in Semen Achefer, Sekela and Jabitenan districts of Western Gojjam zone of Amhara National Regional State. The objective of the study was to carry out phenotypic characterization of local cattle population in the study under farmers' management condition in the study area. A total of 600 cattle were sampled randomly for characterization of phenotypic traits. Data were gathered through field observations and linear body measurements of sample populations. The Sampled indigenous cattle were identified by sex and district (agro ecology). The most dominant coat colour patterns in the sampled populations were plain, patchy and spotted with the most frequently observed coat colour type being light red, black and dark red. Sex of animals had $P < 0.05$, on all of the body measurements. Agro ecology also showed $p<0.05$, for most of the body measurements, except tail length, horn length, height at wither and rump height. Among leaner body measurements moderate correlations and positive relationship were shown. The prediction of body weight could be based on regression equation $y = -481.55 + 4.89x$ for male sample population and $y = -405.22 + 4.64x$ for female sample cattle population where y and x are body weight and chest girth, respectively. Most of the body measurements of cattle were affected by sex and agro- ecology. Phenotypic result of cattle populations in the study areas was varied from former finding and therefore; to put specific characteristics' of the breed, further molecular characterization is needed.

Author Keywords: Body Weight, Cattle, Characterization, Indigenous, Linear Body Measurement

Abbreviations: CSA: Central Statistical Agency; DA: Development Agent; DAGRIS: Domestic Animal Genetic Resource Information System; FAO: Food and Agricultural Organization; GLM: General Linear Model; LBM: Linear Body Measurements Masl: MetereAbove Sea Level; Mm: Milimetere; °C Degree centigrade; WAO: Woreda Agricultural Office

INTRODUCTION

Ethiopia has served as a gateway to domestic animals from Asia to Africa and its diverse ecology favored diversification of these resources [1]. The country is endowed with huge livestock resources of varied and diversified genetic pools with specific adaptations to a wide range of agro-ecologies [2, 3]. Among livestock species, cattle have significant contributions to the livelihoods of the farmers. They serve as a source of draught power for the rural farming population, supply farm families with milk, meat, manure, serve as source of cash income, and play significant role in the social and cultural values of the society. Cattle contribute nearly all the draught power for agricultural production at smallholder level in Ethiopia [4].

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 57 million, has the largest population in Africa [5]. The majority of these cattle (98.95 percent) are indigenous breeds which are kept under extensive management [1]. This is because indigenous cattle have been naturally selected for years towards adaptive traits as tolerance and resistance to diseases, high fertility, unique product qualities, longevity and adaptation to harsh environments and poor quality feeds [6]. However, a large proportion of indigenous livestock populations in the developing world have not yet been characterized or evaluated at phenotypic and genetic levels [7]. 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 [8]. Phenotypic as well as genetic characterization of indigenous livestock genetic resources provides the basis for any livestock development intervention. Clearly, sustainable utilization of local breeds is the best means of conserving these genetic resources. The first essential step towards sustainable utilization of these resources is to identify the major breed types, establish their population size as well as their geographical distribution and describe their typical qualitative and quantitative phenotypic traits [9].Recognition of breeds' potential depends on the availability of accurate and comprehensive information on their characteristics and their production and marketing environments. Such information can only be obtained through well-designed characterization studies that include pertinent and well thought-out analysis and interpretation of the data collected [10]. However, the genetic diversity and the genetic merits of most Ethiopian indigenous cattle populations are not yet well understood and exploited. Consequently, some of the indigenous cattle populations are already extinct and endangered, while the risk status of many of them is unknown [11]. 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 [12].

West Gojjam zone is one of the administration zone Amhara National regional State which has high cattle population potential and suitable weather conditions for cattle production. Even though the area has suitable environment and great potential for cattle production, there was a gap in utilizing its maximum potential and proper conservation and utilization of indigenous cattle breeds. Therefore in the study area; there was a need to conduct phenotypic characterization to solve the existing problems in the area. The objective of the study was to characterize phenotypic characteristics of local cattle population in the study area

MATERIALS AND METHODS

The study was conducted in 3 districts of West Gojjam zone of the Amhara National Regional State, Ethiopia. West Gojjamzone is one of administrative zone found in Amhara regional state and which is located on the southern border of Lake Tana. The districts included in the study sites were North Achefer, Sekela and Jabitenan (Figure 1).

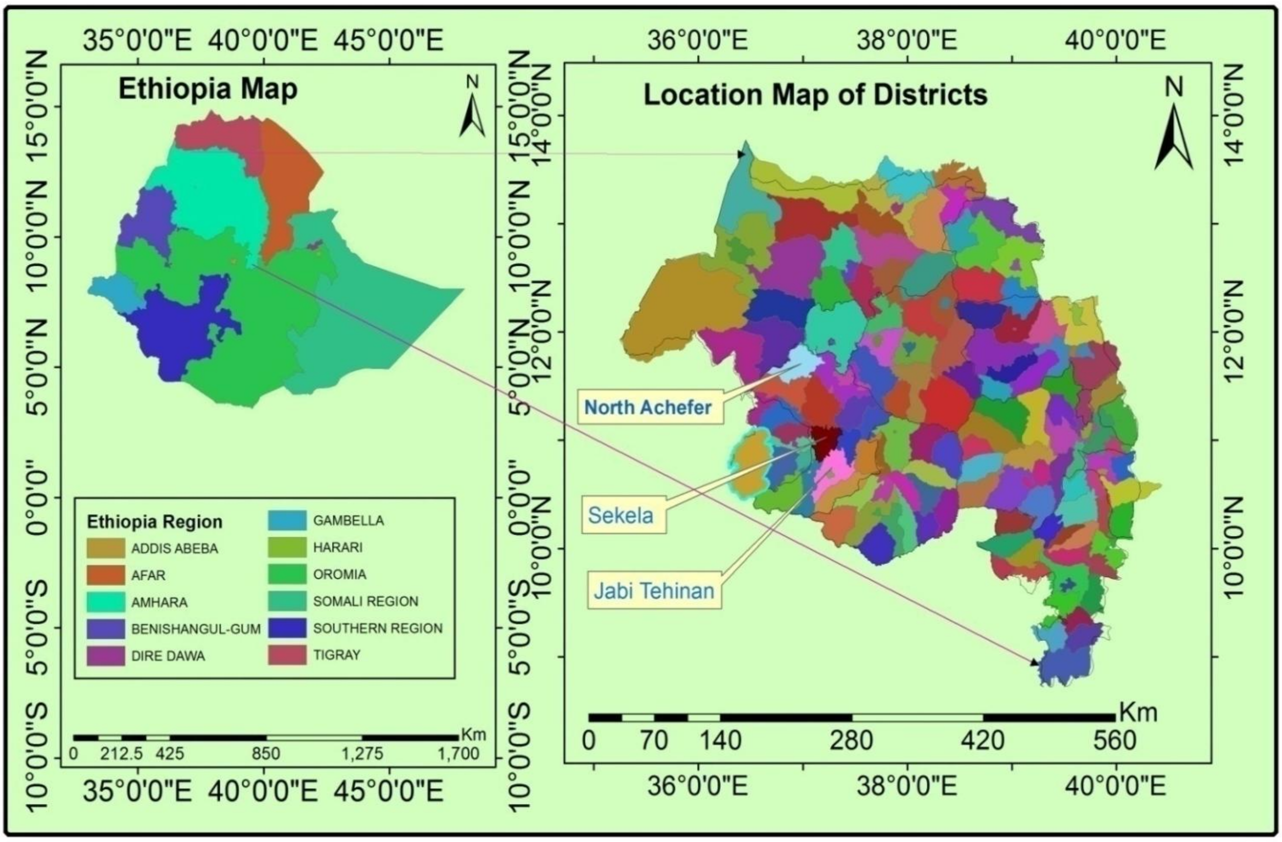

Figure 1. Map of the study area (Ethiopia; Amhara National Regional State; study districts)

Sampling Technique and Procedure

Multi-stage purposive sampling technique was employed to select the districts and kebeles for the study. Study districts were stratified based on agro ecology in to three strata; lowland, midland and highland. Three kebeles were selected from each stratum purposively based on cattle population potential and agro ecology (Table 1). Finally, 30 households (cattle owners) that have more than 2 head of cattle for interview and 67 animals (cattle) for measurement were selected randomly from each kebele. The sample size was calculated based on [13].

Table 1. Sampling Frame of Study areas

Districts	Agro-ecology of districts	Sample kebeles	Sample House holds	Sample Animals	Altitude Masl & Rain Fall
Semen Achefer	M.L	0	0	0	
	L.L	3	90	200	<1500&<800mm
Sekela	H.L	3	90	200	>2500&1200-2200mm
	M.L	0	0	0	
Jabitenan	M.L	3	90	200	1500-2500&800-1200mm
	L.L	0	0	0	
Total		9	270	600	

M.L= mid land, L.L = low land, H.L= high land

Data Collection

General information of the area, topography, climatic data and population size were obtained from secondary data from districts agricultural development offices. In each sampling site, the selected cattle owners were briefed about the importance and objectives of the study before the commencement of the actual data collection. Visual observation was made and morphological features were recorded based on breed morphological characteristics descriptor list [14, 15]. Linear body measurements were taken using a standard textile measuring tape and standard steel tape. Qualitative and quantitative traits were recorded through prepared check list from 192 mature males and 408 mature females. A total of 12 qualitative traits were examined and recorded: body hair color pattern, body hair coat color, udder size, horn presence, horn shape, horn orientation, ear orientation, hump size, navel flap (for cows), preputial sheath (for bulls), facial (head) profile and tail length.

A total of 11 quantitative traits were measured and recorded: heart girth, body length, height at withers, height at rump, pelvic width, ear length, horn length, cannon bone circumference, mouth circumference and body weight. The morphological variables recorded in this study were adapted from the standard cattle breed descriptor list [7] and extensively used in Ethiopia [15- 17]. Every animal to be measured was identified by sex and study site.

Data Management and Analysis

Qualitative and quantitative body measurement data were first entered into Excel 2007 computer software and analyzed using SPSS version 20. Qualitative data were analyzed using the frequency procedure of SPSS. While quantitative data were analyzed using the Generalized Linear Model (GLM) procedure of SAS. Sex and district (agro ecology) were fitted as fixed effects while linear body measurements were fitted as dependent variables. When analysis of variance declares significance, least square means were separated. Pearson's correlation coefficients were estimated among body weight and linear body measurements and between linear body measurements for females and males (SPSS version 20). Correlations (Pearson's correlation coefficients) between body weight and the linear measurements were computed for the population within each sex. To quantify the effect of independent variables (site and sex) on the linear body measurement (dependent variables) of the sample populations, the GLM procedure of SPSS 20 was employed. The model fitted for linear body measurements for sample populations was, $Y_{ijk} = \mu + A_i + S_j + e_{ijk}$

Where,

Y_{ijk} = Observed value of the trait of interest

μ = Overall mean

A_i = Fixed effect of ith agro ecology (sites)

S_j = Fixed effect of jth sex

e_{ijk} = Residual random effect

RESULTS AND DISCUSSION

Phenotypic Characterization

On farm phenotypic characterization of cattle breed includes all the qualitative description and morphological measurements of the animal. It is a primary and low cost animal genetic resource characterization as compared to the on-station [18].

Qualitative trait of indigenous cattle types found in Low land, High land and Mid land agro-ecologies are presented in Table 2. The most frequent color patterns observed in the study area were plain 63.17%, patchy 18.5% and spotted 18.33%. Out of the 63.17% (largest), plain coat color pattern, 39.67% light red, 21.33% black, 17% dark red, 14.33% grey and 7.67% fawn were the dominant color types (Figure 2). Comparably in Fentalle district the dominantly observed coat colour patterns for Kereyu cattle were 31.7%, 33.3% and 35 % for plain, patchy and spotty, respectively [19]. And in mursi areas frequently observed coat patterns were plain 52.0%, pied 36.0% and spotted 12.0% [20]. Light red coat colour was mostly observed in the study area Table 2 Similar to Raya Sanga [16]. In contrast to this, for Boran cattle white was dominant coat color [8], white and black frequently observed coat colour for Mursicattle breeds [20] and Grey color was the most observed forkereyu cattle breeds [19].

In the study area among the sampled cattle population the majority (96.83%) of cattle had horn, whereas, 3.17% were polled. Out of 96.83% horned cattle population 58.5% straight, 36.67% curved and 4.17% lyre were mainly observed horn shapes in the study areas. 47.5% of horns were oriented tips pointing laterally, 25.5% upwards, 25.5% forward and 1.5% down wards (Figure 3). Hump size difference were observed between male and female population in each district (Table 2 and 3).

Figure 2. Different coat colour of local cattle in Mid and Low land agro-ecologies respectively.

Figure 3. Hump size and horn orientation of local cattle in the study areas

Table 2. Qualitative trait description of male animal in West Gojjam zone

Phenotypic variables / Districts (agro ecology)	Low land	High land	Mid land	Overall mean
	N(%)	N(%)	N(%)	N(%)
Coat color Patter				
➢ Plain	45(65.2)	26(50.0)	44(62.0)	115(59.9)
➢ Patchy	14(20.3)	12(23.1)	13(18.3)	39(20.3)
➢ Spotted	10(14.5)	14(26.9)	14(19.7)	38(19.8)
		X^2value = 60.97*		
Hair Coat color				
➢ Black	14(20.3)	8(15.4)	16(22.5)	38(19.8)
➢ Dark red	7(10.1)	11(21.2)	9(12.7)	27(14.0)
➢ Light red	36(52.2)	21(40.4)	27(38.0)	84(43.8)
➢ Fawn	3(4.3)	5(9.6)	6(8.5)	14(7.3)
➢ Grey	9(13.0)	7(13.5)	13(18.3)	29(15.1)
		X^2value = 75.3*		
Horn presence				
➢ Horned	67(97.1)	49(94.2)	69(97.2)	185(96.4)
➢ Polled	2(2.9)	3(5.8)	2(2.8)	7(3.6)
		X^2value = 165.0*		
Horn shape				
➢ Straight	47(68.1)	29(55.8)	41(57.7)	117(60.9)
➢ Curved	20(29.0)	20(38.5)	24(33.8)	64(33.3)
➢ Lyre-shape	1(1.4)	2(3.8)	6(8.9)	9(4.7)
➢ Loose	1(1.4)	1(1.90	0	2(1)
		X^2value = 180.3*		
Horn orientation				
➢ lateral	30(43.5)	21(40.4)	40(56.3)	91(47.4)
➢ Upward	22(31.9)	13(25.0)	16(22.5)	51(26.6)
➢ Downward	1(1.4)	0(0)	2(2.8)	3(1.6)
➢ Forward	16(23.2)	18(34.6)	13(18.3)	47(24.5)
		X^2value = 80.9*		
Ear orientation				
➢ Erect	0	1(1.9)	0	1(0.05)
➢ Lateral	67(97.1)	51(98.1)	70(98.6)	188(97.9)
➢ Drooping	2(2.9)	0	1(1.4)	3(1.6)
		X^2value = 360.3*		
Hump size				
➢ Small	11(15.9)	4(7.7)	14(19.7)	29(15.1)
➢ Medium	43(62.3)	17(32.7)	30(42.3)	90(46.9)
➢ Large	15(21.7)	29(55.8)	27(38.0)	61(31.8)
		X^2value = 99.4*		
Perpetual Sheath (bull)				
➢ Small	14(20.3)	12(23)	8(11.3)	34(8.3)
➢ Medium	31(44.9)	26(50.0)	37(52.1)	94(48.9)
➢ Large	24(34.8)	14(26.9)	26(36.6)	64(15.7)
		X^2value = 119.4*		
Facial (head)				
➢ Straight	60(87.0)	48(92.3)	63(88.7)	1171(89)
➢ Concave	3(4.3)	3(5.8)	3(4.2)	9(4.7)
➢ Convex	6(8.7)	1(1.9)	5(7.0)	12(6.3)
		X^2value = 268.4*		
Tail length				
➢ Short	1(1.4)	0	1(1.4)	2(0.1)
➢ Medium	2(2.9)	0	1(1.4)	3(1.6)
➢ Long	66(95.7)	52(100)	69(97.2)	187(97.4)

Pr. = perpetual, facial = facial profile

Table 3. Qualitative trait description of female animal in West Gojjam zone

Phenotypic variables \ Districts (agro ecology)	Low land N(%)	High land N(%)	Mid land N(%)	Overall mean N(%)
Coat color Patter				
➢ Plain	84(64.1)	87(58.8)	*93(72.1)*	264(64.7)
➢ Patchy	21(16.0)	28(18.9)	23(17.8)	72(17.96)
➢ Spotted	26(19.8)	33(22.3)	13(10.1)	97(23.8)
		X^2value = 179.3*		
Hair Coat color				
➢ Black	33(25.2)	32(21.6)	25(19.4)	90(22.0)
➢ Dark red	15(11.5)	38(25.7)	22(17.1)	75(18.4)
➢ Light red	60(45.8)	41(27.7)	53(41.1)	154(37.8)
➢ Fawn	5(3.8)	23(15.5)	4(3.1)	32(7.8)
➢ Grey	18(13.7)	14(9.5)	25(19.4)	57(13.9)
		X^2value = 103.2*		
Horn presence				
➢ Horned	128(97.7)	141(95.3)	127(98.4)	396(97.1)
➢ Polled	3(2.3)	7(4.7)	2(1.6)	12(2.9)
		***X^2value =** 165.0**		
Horn shape				
➢ Straight	79(60.3)	83(56.1)	72(55.8)	234(57.4)
➢ Curved	40(30.5)	60(40.5)	56(43.4)	156(38.2)
➢ Lyre-shape	11(8.4)	4(2.7)	1(0.8)	16(8.3)
➢ Loose	1(0.8)	1(0.7)	0	2(0.5)
		X^2value = 365.6*		
Horn orientation				
➢ lateral	66(50.4)	65(43.9)	63(48.8)	194(47.5)
➢ Upward	26(19.8)	42(28.4)	34(26.4)	102(25)
➢ Downward	2(1.5)	0	4(3.1)	6(1.5)
➢ Forward	37(28.2)	41(27.7)	28(21.7)	106(26)
		X^2value = 171.3*		
Ear orientation				
➢ Erect	0	7(4.7)	0	7(1.7)
➢ Lateral	130(99.2)	141(95.3	119(92.2)	390(95.6)
➢ Drooping	1(0.8)	0	10(7.8)	11(2.7)
		X^2value = 708.0*		
Uder Size				
➢ Small	26(19.8)	27(18.2)	26(20.2)	79(19.4)
➢ Medium	64(48.9)	85(57.4)	59(45.7)	208(50.9)
➢ Large	41(31.3)	36(24.3)	44(34.1)	121(29.7)
		X^2value = 212.6*		
Hump size				
➢ Small	122(93.1)	109(73.6)	125(96.	356(87.3)
➢ Medium	9(6.9)	35(23.6)	4(3.1)	48(11.8)
➢ Large	0	4(2.7)	0	4(0.9)
		X^2value = 537.6*		
Navel flap				
➢ Small	29(22.1)	46(31.1)	24(18.6)	99(24.6)
➢ Medium	75(57.3)	72(48.6)	71(55.0)	218(53.4)
➢ Large	27(20.6)	20(13.5)	34(26.4)	81(19.9)
		X^2value = 624.9		
Facial (head)				
➢ Straight	114(87)	143(96.6	117(90.7)	374(91.7)
➢ Concave	10(7.6)	2(1.4)	9(7.0)	21(5.1)
➢ Convex	7(5.3)	3(2.0)	3(2.3)	13(2.0)
		X^2value = 629.6*		
Tail length				
➢ Short	2(1.5)	0	1(0.8)	3(0.07)
➢ Medium	2(1.5)	12(8.1)	4(3.1)	18(4.4)
➢ Long	127(96.9	136(91.9	124(96.1)	390(95.6)
➢		***X^2value = 697.7****		

Hump size of male cattle population were 15.9% small, 62.3% medium and 21.7% large in Low land, 7.7% small, 32.7% medium and 55.8% large in High land and 19.7% small, 42.3% medium and 38% large in Mid land agro-ecology. Whereas, for cow 93.1% small and 6.9% medium in Low land, 73.6% small, 23.6% medium and 2.7 % large High land and 96.9% small and 3.1% medium in Mid land agro-ecologies.

The overall facial profile of the three districts was 90.83% straight 5% concave and 4.17% convex. Likewise, their ear orientations were 1.3% erected, 96.33% laterally oriented and 2.3% dropping oriented. A total of both male and female cattle population in the study areas having tail length of 95.67% long (blow the hocks, 3.5% medium (about the hocks) and 0.83% short (above the hocks) (Figure 4). The perpetual sheath of male sample population were 20.3% small, 44.9% medium and 34.8% large in Low land, 23.1% small, 50% medium and 26.9% large in High land and 11 .3% small, 52.1% medium and 36.6% in Low land agro-ecology.

From the total female cattle population evaluated, udder size of 19.8% them were small, 48.9% medium and 31.3% large in Low land, 18.2% small, 57.4% medium and 24.3% large in High land and 20.2% small, 45.7% medium and 34.1% large in Mid land agro-ecology (Figure 5). Similarly navel flap for cows were 22.1% small, 57.3% medium and 20.6% large in Low land, 31.1% small, 48.6% medium and 13.5% large in High land and 18.6% small, 55% medium and 26.4% large in Mid land agro-ecologys. As shown in Table 2, all of qualitative traits were significantly different among districts and this difference might be due to the agro ecological difference of the three districts.

Figure 4. Perpetual sheath and tail length of the bull in Mid land and Low land agro-ecology respectively.

Figure 5. Udder size and naval flap of cow respectively in High land agro-ecology

Table 4. Body measurements (cm) of adult local cattle population in the study area (LSM±SE)

Variables	MC		HL		EL		HW		BL	
	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE
Over all	600	38.9±0.07	600	22.84±0.42	600	19.83±0.06	600	114.5±0.24	600	115.41±0.24
Agro-ecology	--	*		NS		*		NS		*
Low land	200	38.3±0.12	200	22.4±0.66	200	19.4±0.09	200	115±0.4	200	116.7±0.3
High land	200	39.2±0.12	200	22.6±69	200	19.8±0.1	200	114±0.4	200	114.4±0.3
Mid land	200	39.2±0.12	200	23.5±0.67	200	20.2±0.09	200	114.5±0.4	200	115±0.3
Sex	--	*		*		*		*		*
Male	192	40.07±0.12	192	23.9±0.7	192	20.2±0.1	192	116.2±0.4	192	117.06±0.3
female	408	38.8±0.08	408	21.8±0.5	408	19.5±0.07	408	112.8±0.3	408	113.7±0.2

NS= Non significant; N = number of household; LMS =least square mean; SE = standard error

Table 4. (Continued)

Variables	HG		PW		TL		RH		CBC		*BW*
	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE	N(LSM±SE)
Over all	600	146.04±0.27	600	36.5±0.09	600	78.6±0.22	600	115.8±0.25	600	20.3±0.06	*600 (266.8±2.3)*
Agro- ecology	--	*		*		NS		NS		*	*
Low land	200	144.8±0.43	200	36.3±0.14	200	78.8±0.35	200	115.8±0.42	200	20.3±0.09	*200 (260*±2.18)
High land	200	147.2±0.4	200	36.4±0.15	200	79±0.4	200	115.8±0.43	200	20±0.09	*200 (272.2*±2.4)
Mid land	200	146.±0.44	200	37±0.14	200	78.1±0.35	200	115.9±0.4	200	20.5±0.09	*200 (268.3*±2.2)
Sex	--	*		*		*		*		*	*
Male	192	151.8±0.44	192	37.08±0.15	192	79.6±0.36	192	117.2±0.14	192	21.14±0.09	*192 (300.7*±4.3)
female	408	140.3±0.30	408	35.98±0.1	408	77.7±0.24	408	114.5±28	408	19.5±0.06	408 (243.6±2.3)

NS= Non significant; N = number of household; LMS =least square mean; SE = standard error

Table 5. Coefficient of correlations between body weight and linear body measurements (Above diagonal for male and below diagonal for female)

	MC	HL	EL	HW	BL	HG	PW	TL	RH	CBC	BW
MC		0.210**	0.304**	0.479**	0.259**	0.566**	0.309**	0.368**	0.293**	0.567**	0.564**
HL	0.215**		0.002^{ns}	0.212**	0.332**	0.116^{ns}	0.100^{ns}	0.163*	0.117^{ns}	0.409**	0.123^{ns}
EL	0.440**	0.047		0.187**	0.169^{ns}	0.406**	0.377**	0.316**	0.125^{ns}	0.318**	0.393**
HW	0.198**	0.101**	0.117**		0.530**	0.431**	0.290**	0.337**	0.537**	0.462**	0.439**
BL	0.310**	0.172**	0.171**	0.276**		0.330**	0.303**	0.283**	0.303**	0.415**	0.339**
HG	0.452**	0.057^{ns}	0.244**	0.275**	0.385**		0.547**	0.497**	0.324**	0.510**	0.984**
PW	0.393**	0.136**	0.482**	0.187**	0.238**	0.301**		0.370**	0.245**	0.368**	0.547**
TL	0.366**	0.215**	0.268**	0.278**	0.314**	0.477**	0.355**		0.324**	0.382**	0.496**
RH	0.386**	0.176**	0.162**	0.588**	0.480**	0.509**	0.222**	0.436**		0.368**	0.322**
CBC	0.413**	0.069^{ns}	0.282**	0.285**	0.445**	0.430**	0.278**	0.304**	0.397**		0.504**
BW	0.439**	0.066^{ns}	0.235**	0.278**	0.379**	0.994**	0.293**	0.467**	0.507**	0.423**	

^{ns} non- significance; MC= Mouth Circumference, HL= Horn Length, EL= Ear Length, HW= Height at Wither, RH= Rump Height, BL= Body Length, HG= Heart Girth, PW= Pelvic Width, TL= Tail length, RH= Rump height and CBC= Cannon bone circumference

Morphological measure of adult cattle population

The quantitative measures of some phenotypic traits of local cattle population are summarized in (Table 4). The overall least squares means and standard error values of mouth circumference, horn length, ear length, height at wither, body length, heart girth, pelvic width, tail length, rump height and cannon bone circumference were 38.9±0.07cm, 22.8±0.42cm, 19.83±0.06 cm,114.5±0.2cm, 115.4± 0.2cm, 146±0.27cm, 36.5±0.09cm, 78.6±0.22cm, 115.8±0.25cm and 20.3±0.6 cm, respectively. All phenotypic measurements listed on the above were significantly different ($P<0.05$) between male and female cattle. Most body measurements of cattle like heart girth, body length, pelvic width, ear length, cannon bone circumference, mouth circumference and body weight were also significant difference ($P<0.05$) among Low Land, High Land and Mid Land locations. The possible reason for the difference may be agro ecological difference among districts. But horn length, tail length, height at whither and rump height were did not shows significant difference ($P<0.05$) among the three agro ecologies. Body length, chest girth, and wither height of the male cattle were measured to be 117.6±0.3, 151.8±0.44, and 116.25±0.4 cm, respectively. These measurements were found lower than body measurements reported on the same sex for Boran cattle breeds [8], Mursi cattle breeds [20] and for Wollocattle [16] except heart girth. But heart girth of this result was aligned with that reported [16] for Wollo cattle breed. Like other local zebu cattle populations, the male and female of this result showed significantly different for most of morphological measurements and all linear measurement male value greater than female's. Different reports revealed that the mean value of on-farm morphological traits measurement on local male and female cattle result that males are usually greater than their counter female groups [21, 22, and 19]. Therefore cattle populations in the study areas were varied with qualitative and quantitative traits from former findings of Fasil and Dereje [17, 16] respectively and there was no sufficient evidence to classify either of them.

Correlation between Body Weight and Linear Body Measurements

Pearson's correlation coefficient between body weight and linear body measurements for male and female were calculated and presented in the (Table 5). In males all of linear body measurements have positive association with body weight and strong association was found between body weight and chest girth ($r=0.984$), whereas mouth circumference ($r=0.56$), tail length ($r=0.5$), pelvic width ($r=0.55$) and cannon bone circumference ($r=0.5$) had moderate correlation with body weight. Wither height ($r=0.44$), body length ($r=0.34$), rump height ($r=0.32$) and ear length ($r=0.39$) showed mild correlation with body weight. But horn length for both sex male ($r=0.12$) and female ($r=0.002$) did not showed significant correlation with body weight. These linear body measurements that showed moderate and mild correlation were may not significantly affected by the change in body weight; hence, they are not more important in prediction of live body weight of the animal. In females also all of linear body measurements have positive association with body weight and strong association was found between heart girth and body weight. Rump height showed moderate correlation ($r=0.50$), with body weight. Height at wither ($r=0.28$), body length ($r=0.38$), mouth circumference ($r=0.44$), tail length ($r=0.48$), pelvic width ($r=0.29$) and cannon bone circumference ($r=0.42$)were showed mild correlation, whereas ear length ($r=0.24$) had weak correlation with body weight. Generally as the result of correlation showed heart girth (chest girth) was the most important than other linear body measurement for both male and female to estimate body weight.

Estimated Mature Body Weight of the Sample Population by sex

The estimated average mature body weight as used conversion of from heart girth were 300.7±4.3 for male and 243.6± 2.3 kg for female with at rang of (214-388 kg) for male and (164-381kg) for female. These Variations were observed among individuals which were compared to other local cattle [19] ranging from 196.9 to 333.6 for females and from 178.1 to 428.2 kg for males. Based on the estimated body weight of the individual animals the following linear regression equations (body weight on heart girth) were developed separately for both sexes.

$Ym = -481.55 + 4.89x$ for bulls and

$Yf = -405.22 + 4.64x$ for cows

Where:

Yf = estimated body weight of mature female cattle (kg)

Ym= estimated body weight of mature male cattle (kg)

x = heart girth.

CONCLUSIONS AND RECOMMENDATIONS

The most dominant coat colour pattern was plain and frequently observed coat colour type being light red. The majority of cattle were possessed horn with straight shape and tips pointing lateral orientation. Sample population of bulls had medium hump size and perpetual sheath whereas cows possessed medium udder size and naval flap. Sex of animals had significant effect (P<0.05) on body weight and all of the body measurements. District (agro ecology) also had significant effect on body weight and all of the body measurements except height at whither, horn length, tail length and rump height (P<0.05). Among the body measurements of sample population moderate and significant (P<0.05) positive correlation was found. Chest girth was the most important linear body measurement to estimate body weight.

Overall, cattle populations in the study areas were varied from former local cattle bred that were identified in Gojjam and Wollo areas. Therefore further characterization of local cattle in the study area at molecular level should is duly required.

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REFERENCES

1. CSA (Central Statistical Agency). 2013. Agricultural Sample Survey 2012/2013, Volume II Report on Conservation of Animal Genetic Resources. Commission on Genetic Resources for food and Agriculture5th Session, Rome, 28-30 January 2009.
2. Roessler R, Drucker A G, Scarpa R, Markemann A, Lemke U, Thuy LT and Valle Zárate A. 2008. Using choice experiments to assess smallholder farmers' preferences for pig breeding traits. Roles of Livestock in Major Production System)
3. GemedaDuguma, Mirkena T, Haile A, Iñiguez L, Okeyo AM, Tibbo, M, Rischkowsky B, Sölkner J, Wurzinger, M. 2010. Participatory approaches to investigate breeding objectives of livestock keepers. *Livest Res Rural Dev*. Volume 22, Article 64. Retrieved April 5, 2010.
4. Tefera M. 2011. Oxenization Versus Tractorization: Options and Constraints for Ethiopian Framing System Ethiopia. International Journal of Sustainable Agriculture 3 (1): 11-20, 2011, ISSN 2079-2107.
5. CSA (Central Statistical Agency). 2015. Agricultural sample survey report on livestock and livestock characteristics. Centeral statical agency federal democratic repoplic of Ethiopia; AdisAbeba. Volume2: pp 194.
6. 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.
7. DAGRIS. 2006. Domestic Animal Genetic resource Information system. DAGRIS (eds.J.E.O.RegeW.Ayalew,. E.Getahun.O.Hanotteand T.Dassei). International Livestock Institution. Addis Abeba. Ethiopia.
8. Tekle S, Dessie T and Kebede K. 2011. on-farm characterization of boran cattle breed in the production systems in Dire district of Borana Zone, Oromia Region, Ethiopia.
9. Ayalew W, Getahun E, Tibbo M, Mamo Y and Rege J.E.O. 2004. Current State of Knowledge on Characterisation of Farm Animal Genetic Resources in Ethiopia. pp. 1-21 In: Proceedings of the 11th Annual Conference of the Ethiopian Society of Animal Production (ESAP), 28-30 August 2003. Addis Ababa, Ethiopia.
10. FAO. 2014. Access and Benefit-sharing of Animal Genetic Resources Using the Nagoya Protocol as a Framework for the Conservation and Sustainable Use of Locally Adapted Livestock Breeds by Ilse Koehler-Rollefson.
11. Edea Z, Dadi H, Wook Kim S, Dessie T and Kwan-SukKim. 2012. Comparison of SNP Variation and Distribution in Indigenous Ethiopian and Korean Cattleb Populations. P: 1-4.
12. Rowlands J, Nieves C, Hanotte O, Ayalew W. 2006. Cattle breed distributions across districts as determined from cluster analysis of phenotypic data collected in the Oromiya region, Ethiopia. In 8th World Congress on Genetics Applied to Livestock Production, August 13-18, 2006, Belo Horizonte, MG, Brasil.
13. Kothari CR. 2004. *Research Methodology: Methods and Techniques.* 2nded. New Delhi, Wisley Eastern.

14. FAO. 2012. Characterization and value addition to local breeds and their product in near east north Africa. Food and agriculture organization of the United Nations. Rome.
15. Wuletaw Z. 2004. Survey of indigenous cattle genetic resources, husbandry practices and cattle breeding objectives in North Gondar, Ethiopia. MSc thesis, Alemaya University, Dire Dawa, Ethiopia.
16. Tadesse D. 2005. On-farm phenotypic characterization of cattle genetic resources and their production systems in south and north Wollo Zones of Amhara Region, North Eastern Ethiopia, MSc Thesis, Alemaya University, Dire Dawa, Ethiopia. pp. 125.
17. Getachew F and Ayalew W. 2014. On-Farm Phenotypic Characterization of indigenous Cattle population in Awi, East and West Gojjam Zones of Amhara Region, Ethiopia. Research Journal of Agriculture and Environmental Management. 3(4): 227-237, April, 2014.
18. FAO. 2007. The State of the World's Animal Genetic Resources for Food and Agriculture. Commission on Genetic Resources for Food and Agriculture Organization of the United Nations, Rome.
19. Garoma Sh, 2006. In-situ Phenotypic Characterization of Kereyu cattle type in Fentale district of Oromia Region, Ethiopia. M.Sc. Thesis. School of Graduate Studies. Haramaya University.
20. Terefe E, Dessie T, Haile A, Mulatu W and Mwai O. 2012. Characterization of Mursi Cattle Breed In Its Production Environment, InSalamago Wereda, South-West Ethiopia. M.Sc. Thesis, Alemaya University, Ethiopia.
21. Taye T. 2005. On-Farm Phenotypic Characterization of Sheko Breed of Cattle and Their Habitat in Bench Maji zone, Ethiopia. MSc Thesis. Alemaya University, Ethiopia.
22. Mekuria G. 2005. On- station *ex-situ* characterization of Ogaden cattle breed at Alemaya University. MSc thesis, Alemaya University, Dire Dawa, Ethiopia.