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BODY MORPHOMETRIC MEASUREMENTS IN HARMO CATTLE (RAYA-AZEBO CATLTLE) IN SOUTHERN TIGRAY OF ETHIOPIA

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ABSTRACT: Twenty-four qualitative and nine quantitative variables on a total of 251 adult cattle from two purposively selected districts were recorded to characterize Harmo cattle at its natural production environment in 2019. Effect of sampled district, sex and age on the quantitative measurements and qualitative characteristics were analyzed using General linear model (GLM) procedure and non-parametric (Chi-square) test of Statistical Analysis System (SAS 9.0) respectively. The qualitative characteristics and quantitative measurements of Harmo cattle were partially affected by district, sex and age categories. Majority of Harmo cattle were horned (100%) with lyre shaped (83.73%) upward orientation (92.46%) and wide horn spacing (≥ 30 cm) (96.03%). They also possess straight edged ear (97.22%). Harmo cattle hump was erected (98.81%), and small (88.1%) and found at cervical thoracic (78.57) position. The results also revealed that Harmo cattle were characterized by flat face (99.21%), straight back profile (88.49%), long tail (95.24%) and large dewlap (75%). Body color pattern of Harmo cattle was uniform (61.11%), spotty (26.98%) and others (11.9%). Red and light-red were the body and head color of the majority of the studied cattle populations. Beside their large horns Harmo cows also possess medium (38.8%) and large (42.4%) naval flap. Similarly, the oxen also possess medium (46.4%) and large (50%) preputial sheath. The overall measurements of body length, Heart girth, Height at withers, Pelvic width, Muzzle circumference, Ear length, Horn length, Canon bone length, Hock circumference for Harmo oxen and cows were 127.8±1.22, 146.7±1.37, 121.7±0.92, 35.5±0.45, 39.5±0.35, 21.2±0.31, 65.5±2.08, 25.0±0.30, 33.0±0.28 and 121.3±0.43, 138.9±0.48 116.5±0.32, 35.0±0.16, 36.9±0.12, 21.3±0.11, 61.8±0.73, 24.0±0.11, 31.3±0.10, respectively. These results show Harmo cattle possess long and thin body and long ear and horn in comparison with most of the Ethiopian cattle breeds. The thin body of Harmo cattle might be due to shortage of available feed in and around the breeding tract of the breed. The long ear and horn may help them to adapt the hot bushy grazing land environment and protect themselves from the enemy existed in their natural habitat.

Keywords: Biometry, Breeding, Harmo Cattle, Morphometric characterizes, Raya-Azebo.

INTRODUCTION

Ethiopia have the largest cattle population size in Africa (60.39 million heads) without counting some zones of the highly populated Regions (Afar and Somali) (CSA, 2018). Majority of the cattle population are indigenous breeds, which are found in the rural part of the country, while some exotic and crossbreds also exist mainly in the urban and peri-urban areas (Roessler et al., 2018; Abebe et al., 2020). Beside the large population size distributed widely throughout the country, farmers and pastoralists get multiple functions from their productions and services. Cattle genetic resources serve as sources of meat, milk, hide, manure, draft power and nutrient recycling (Getachew and Gashaw, 2001).

Diversity in animal genetic resource is important for current and future research and development works. Diversity allows the indigenous genetic resources to adapt and produce in a more diversified agro ecologies. Variation with in and among breeds is also one of the key inputs in genetic improvement and conservation programs (Delgado Bermejo et al., 2019). It is more likely to bring genetic improvement in a population with high variation than low variation. This increment in production and productivity will in turn help us to answer the food security problems; market requirements and nutritional gaps. Similarly, as the variation within and among breeds increase it brings a good opportunity to find adaptable breeds to the changing agro ecology due to different factors including the climate change. Therefore, to better understand the level of diversity and potential of our indigenous animal genetic resources, proper characterization works are crucial (EBI, 2016). However, in Ethiopia there is a gap of harmonizing the characterization works, keeping proper production and reproduction records and positivity towards conservation of the indigenous animal genetic resources.

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Even if there are different sources of information like Domestic Animal Genetic Resources Information System (DAGRIS) of the International Livestock Research Institute (ILRI), based on the current available information from the country's focal institute for Animal Genetic Resources (Ethiopian Biodiversity Institute) and the website Domestic Animal Diversity Information System (DAD-IS) of the Food and Agriculture Organization of the United Nation (FAO), there are 28 recognized indigenous cattle breeds in Ethiopia (EBI, 2016). However, only a small number of recognized cattle breed types have a fair description of their physical appearance, indications of their level of production, reproduction and genetic attributes (Ayalew et al., 2004). With some general information, cattle of the present study area are generally referred as Raya-Azebo (Raya) cattle in the existing literature. Raya-Azebo cattle also locally known as 'Harmo' cattle breed found in Southern Tigray which is one of the cattle breeds classified under the Sanga breed group. Harmo cattle is known for its long horns and adaptation to hot environment (Zerabruk et al. 2007).

Most of the Ethiopian indigenous animal genetic resources are facing more threats including the indiscriminate crossbreeding with exotic breeds for the sake of genetic improvement for production traits (EBI, 2016). Harmo cattle is one of the breeds which is under risk due to indiscriminate crossbreeding with Holstein Frisian and interbreeding with the highland zebus. For the purpose of designing conservation and sustainable utilization program to the breed, updated information on phenotypic characterization (quantitative, qualitative and performance records) is required. Unfortunately, the information we have currently on the breed is the studies of Zerabruk et al. (2007) on few morphometric traits which is done twelve years ago. Therefore, it is important to update the results through routine characterization and inventories due to the dynamism of genetic resources (Hoffmann, 2010; Lozano-Jaramillo et al., 2019). Thus, the current study is planned to characterize the morphology and qualitative characteristics of Harmo cattle under the farmers' condition and to relate it with different production and adaptation traits.

MATERIALS AND METHODS

Description of the study areas

This study was conducted in Raya Azebo and Alamata districts of Southern Tigray Zone in Northern Ethiopia in 2019 (Figure 1). Raya Azebo is situated in latitude of 12° 39' 59.99" N and longitude of 39° 44' 59.99" E, similarly, Alamata is also situated in latitude of 12° 19' 60.00" N and longitude of 39° 29' 59.99" E. The selected study sites (three sites "Kebeles" within each district) are categorized as lowland (500 – 1500 m.a.s.l) with 20 – 30 ^{0}C and dry with mean annual rainfall 633 – 770 ml. Mixed crop-livestock production system is the main farming practices with crops being more dominant (Taddese et al., 2013; Bewket et al., 2015).

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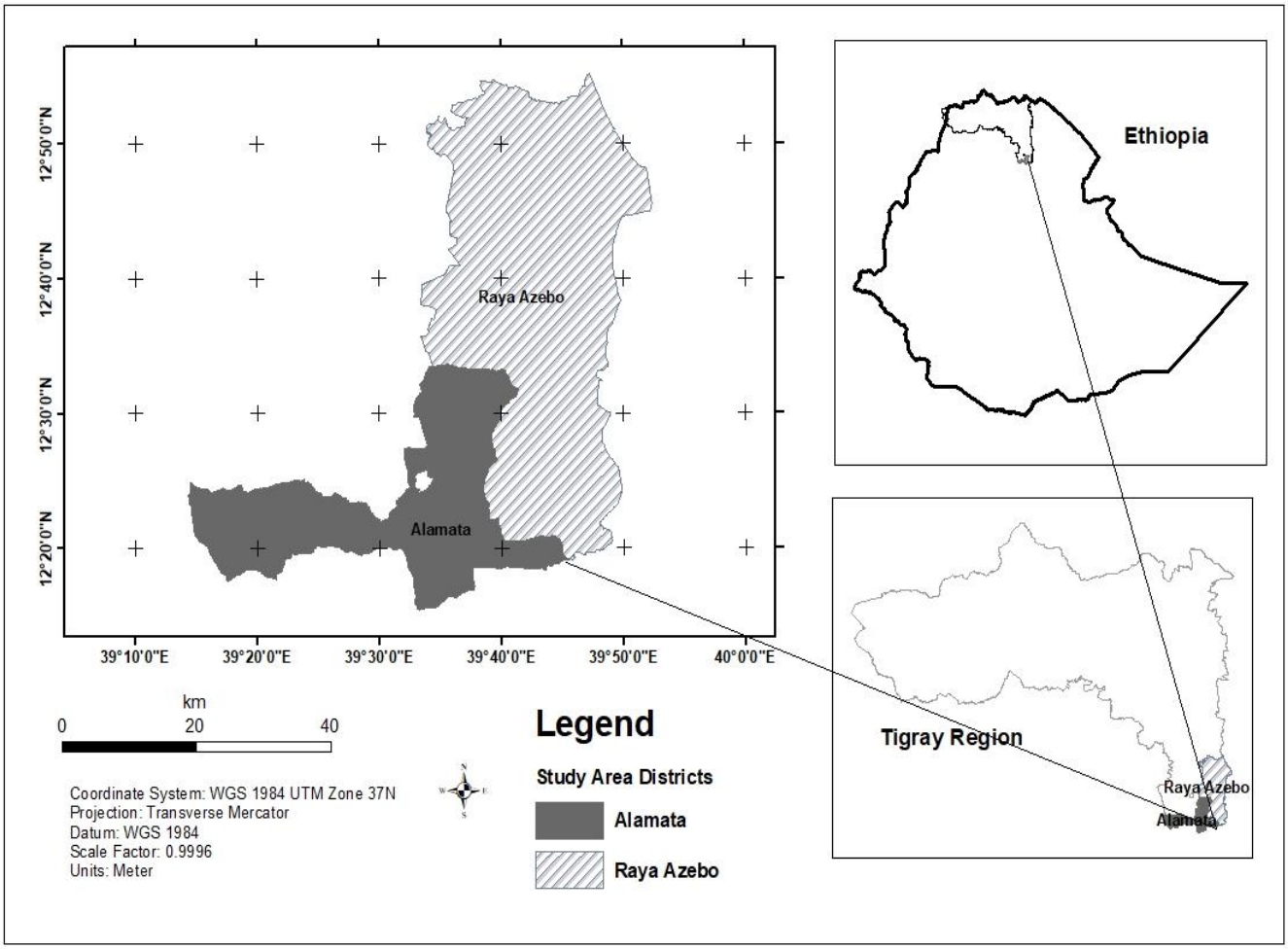

Figure 1- Map of the study areas

Site selection and sampling method

In defining sampling frame, available background information on the existence Raya cattle in the study area was captured through short pilot survey and focus group discussions done by a team of Ethiopian Biodiversity Institute researchers and livestock experts from Southern Tigray zone, Raya Azebo and Alamata districts. Additionally, the information (origin of Harmo cattle, its unique features and densely populated areas) of the earlier study done by Zerabruk et al. (2007) was also taken as an input to select study areas. For the purpose of selecting pure Harmo cattle, the cattle populations from the high and mid altitude areas within the districts were not considered, as they did not show distinct features due to the interbreeding with the highland cattle populations. Therefore, samples were not taken from high and mid-altitude areas. Six study kebeles were selected purposively taking into account the cattle population size, dominant agro-ecology, and indigenous knowledge on cattle population types. Male to female ratio (28 oxen and 223 cows) of the sampled animals were adapted from FAO guideline for Animal Genetic Resource Characterization (FAO, 2012). Animals were randomly selected from herds of representative households.

Table 1 - Sampled number of animals by district and by age and their proportion.

District /Location	Age			Total	Proportion
	3 – 5 years	6 – 7 years	≥ 8 years		
Raya Azebo	44	50	32	126	0.50
Raya Alamata	35	50	40	125	0.50
Total	79	100	72	251	1.00
Proportion	0.31	0.40	0.29	1.00	-

Data collection

Twenty-four qualitative traits (horn presence, horn spacing, horn shape, horn orientation, body color pattern, body color, head color, muzzle pigment, eyelid pigment, hoof pigment, ear shape, hump shape, hump size, hump position, udder size, teat size, face profile, back profile, rump profile, testes size, tail length, naval flap width, preputial sheath and dewlap width), and nine quantitative measurements (body length, heart girth, height at wither, pelvic width, muzzle circumference, ear length, horn length, canon bone length and hock circumference) were recorded from 251 mature

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animals under the effect of district, sex and age of each sampled animal. For the purpose of analysis age groups were categorized in to three; group one 3 – 5 years, group two 6 – 7 years and group three 8 years and above as per the grouping of Tatum (2011). For the body measurements, animals were carefully handled by trained laborers and stand properly on flat grounds with parallel legs. Animals which were aggressive and did not stand properly were not measured. The measurements were carried out by two researchers: one measuring while the other recording data. On the same time, two other researchers handle the qualitative data recording. To minimize the subjective error, all the measurements were taken by the same researcher throughout the study. Quantitative measurements were taken using textile tape measurement in centimeter unit, and early in the morning before the animals were fed and watered.

Data management and analysis

Data were entered and managed using Microsoft Excel© worksheet. Outliers were corrected after running normality test procedure of Statistical Analysis Software 9.0 (SAS, 2002). Analysis of data on quantitative measurements was carried out using the General Linear Model procedure of SAS 9.0 software. Means were separated using the adjusted Tukey-Kramer test (SAS, 2002). Similarly, analysis of qualitative data was carried out using the frequency procedure (chi-square test) of SAS 9.0 software. The model used for the analysis was: $Yijk = \mu + Ai + Bj + Ck + eijk$, Where Yijk is an observation, μ is the overall mean, Ai is the fixed effect of district, Bj is the fixed effect of the sex, Ck is the fixed effect of age group and eijk is the random error attributed to the nth observation. Due to the non-significant effects of the interactions among the above factors, it was removed from the analysis and results. Traits like udder size, teat size and naval flap width were analyzed for females only by eliminating the males and fitting district and age as fixed factors while traits like testes size and preputial sheath were analyzed for males only by eliminating the females from the analysis fitting district and age as fixed factors.

RESULTS

Quantitative measurements

The overall mean, standard error (SE), standard deviation (SD), minimum, maximum and coefficients of variation (CV) of the measured quantitative traits are presented in Table 2. For all morphometric traits measured the coefficient of variation was within the range of 4.26 and 7.80. Relatively higher coefficient of variation (18.87%) was calculated for horn length implying higher variation in terms of horn length. The difference between the minimum and maximum value is sizeable in most cases. A range of 54 cm for heart girth, 37 cm for body length, 28 cm for height at withers, and a range of about 62 cm for horn length were observed. The results show there were high variations among Harmo cattle over the measured quantitative traits which is a better ground for genetic improvement due to selection.

Least square means, standard error (SE), and pairwise comparison of the measured quantitative traits under the effects of district, sex and age are presented in Table 3 and 4. Sampled district had a significant ($p<0.01$) effect on five of the total nine measured traits and it is indicated that four of the body measurements were higher for the cattle population of Alamata. Based on this, cattle population of Alamata district had larger muzzle and hock, and longer ear and horn than the cattle populations of Raya Azebo. However, the canon of the cattle from Raya Azebo was longer than those of Alamata. Similarly, sex of the cattle populations affected six out of the nine measured traits indicating oxen had longer body, height at wither, canon and heart girth measurements than the cows. Significant differences were not recorded between the two sexes in pelvic width, ear length and horn length.

The results also revealed that four out of the nine measurements were affected by age of the cattle population. Based on this, slight increment in pelvic width, muzzle circumference, ear and horn length was observed as the age of the cattle population increases.

Table 2 - Overall mean (cm), SE, SD, CV, Minimum and Maximum body measurements of Harmo cattle breed.

Variables	Overall mean ± SE	SD	Minimum	Maximum	CV
Body length	122.0±0.42	6.65	106	143	5.45
Heart girth	139.8±0.46	7.45	114	168	5.33
Height at withers	117.1±0.31	4.98	102	130	4.26
Pelvic width	35.0±0.15	2.42	28	42	6.90
Muzzle circumference	37.2±0.13	2.01	31	44	5.41
Ear length	21.3±0.11	1.66	16	25	7.80
Horn length	62.1±0.74	11.72	30	92	18.87
Canon bone length	24.1±0.11	1.66	19	29	6.90
Hock circumference	31.5±0.10	1.55	28	35	4.91

SE = Standard Error, SD = Standard Deviation, CV = Coefficient of variation

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Table 3 - Least square means (cm) with standard error and pairwise comparison of body measurements in each district and sex category

Variables	District			Sex		
	Raya Azebo	Alamata	*p* - value	Male	Female	*p* - value
N	126	125		28	223	
BL	124.2±0.72	125.1±0.81	0.3086	127.8±1.22	121.3±0.43	<0.0001
HG	142.4±0.80	143.3±0.91	0.3049	146.7±1.37	138.9±0.48	<0.0001
HW	119.0±0.54	119.1±0.61	0.8021	121.7±0.92	116.5±0.32	<0.0001
PW	35.39±0.27	35.0±0.30	0.2376	35.5±0.45	35.0±0.16	0.2652
MC	37.91±0.21	38.9±0.23	0.0150	39.5±0.35	36.9±0.12	<0.0001
EL	21.00±0.18	21.5±0.21	0.0226	21.2±0.31	21.3±0.11	0.6493
HL	61.53±1.22	65.8±1.37	0.0024	65.5±2.08	61.8±0.73	0.0889
CBL	24.91±0.18	24.1±0.20	<0.0001	25.0±0.30	24.0±0.11	0.0024
HC	31.85±0.16	32.4±0.18	0.0016	33.0±0.28	31.3±0.10	<0.0001

N = number of observations, BL= Body length, HG = Heart girth, HW = Height at withers, PW = Pelvic width, MC = Muzzle circumference, EL = Ear length, HL = Horn length, CBL = Canon bone length, HC = Hock circumference.

Table 4 - Least square means (cm) and pairwise comparison of body measurements with standard error in each age category

Variables	Age			*p* - value
	3 – 5 years	6 – 7 years	≥ 8 years	
N	79	100	72	
Body length	123.5±0.83	124.5±0.83	126.0±0.93	0.0548
Heart girth	142.1±0.93	143.0±0.93	143.3±1.04	0.5625
Height at withers	118.6±0.62	119.4±0.62	119.2±0.70	0.4873
Pelvic width	34.3±0.31^{b}	35.6±0.31^{a}	35.8±0.34^{a}	0.0001
Muzzle circumference	37.6±0.24^{b}	38.2±0.24^{b}	38.8±0.27^{a}	0.0003
Ear length	20.9±0.21^{b}	21.5±0.21^{a}	21.3±0.23^{ab}	0.0246
Horn length	57.8±1.41^{c}	64.6±1.41^{b}	68.6±1.58^{a}	<0.0001
Canon bone length	24.5±0.21	24.4±0.21	24.6±0.23	0.7706
Hock circumference	31.9±0.19	32.1±0.19	32.4±0.21	0.1530

N = number of observations

Qualitative characteristics

The overall Harmo cattle qualitative characteristics by district, sex and age are presented under Tables 5 – 7. Majority of the cattle population were horned (100%) with lyre shaped (83.73%) upward orientation (92.46) and wide horn spacing (≥ 30 cm) (96.03%). They also possess straight edged ear (97.22%). Harmo cattle hump was erected (98.81%), and small (88.1%), and found at cervical thoracic (78.57) position. The results also revealed that Harmo cattle population had flat face (99.21%) and straight back profile (88.49%), long tail (95.24%) and large dewlap (75%). Body color pattern of Harmo cattle population was uniform (61.11%), spotty (26.98%) and others (11.9%). Red and light-red body and head color was observed on majority of the cattle. Beside their large horns Harmo cows also possess medium (38.8%) and large (42.4%) naval flap. Similarly, the oxen also possess medium (46.4%) and large (50%) preputial sheath. The qualitative characteristics of Harmo cattle were partially affected by district, sex and age categories.

Table 5 - Qualitative characteristics of Harmo cattle under district and sex effect

Variables	District			Sex		
	Raya Azebo	Alamata	*P*-value	Male	Female	*P*-value
Horn spacing			1.00			0.9092
Narrow	4.0	4.0		3.6	4.0	
Wide	96.0	96.0		96.4	96.0	
Horn shape			0.8645			0.7629
Curvy	15.9	16.7		14.3	16.5	
Lyre	84.1	83.3		85.7	83.5	
Horn orientation			0.2329			0.3989
Forward	5.6	9.5		3.6	8.0	
Upward	94.4	90.5		96.4	92.0	
Ear shape			0.0073			0.0067
Round edged	5.6	0.0		10.7	1.8	

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Straight edged	94.4	100		89.3	98.2	
Hump shape			0.2227			0.0003
No Hump	0.8	0		0	0.5	
Erect	99.2	98.4		92.9	99.5	
Dropping	0	1.6		7.1	0	
Hump size			0.0368			<0.0001
No Hump	0.8	0		0	0.5	
Small	92.8	83.3		71.4	90.1	
Medium	6.4	14.3		17.9	9.4	
Large	0	2.4		10.7	0	
Hump position			<0.0001			<0.0001
No Hump	0.8	0		0	0.5	
Thoracic	33.3	8.7		78.6	13.8	
Cervical thoracic	65.9	91.3		21.4	85.7	
Face profile			0.3649			0.0170
Flat	98.4	100		96.4	99.5	
Concave	0.8	0		0	0.5	
Convex	0.8	0		3.6	0	
Back profile			<0.0001			0.0176
Curved	19.8	3.2		25.0	9.8	
Straight	80.2	96.9		75.0	90.2	
Tail length			0.3995			0.2069
Short	0.8	0.00		0.00	0.45	
Medium	3.2	5.56		10.71	3.57	
Long	96.0	94.44		89.29	95.98	
Dewlap width			0.6625			0.6434
Small	0	0		0	0	
Medium	23.8	26.2		21.4	25.5	
Large	76.2	73.8		78.6	74.5	

District effect

The study shows effect of district on four out of the twenty-four qualitative traits recorded. Based on this, some round edged ear shape was found in Raya Azebo while all the cattle populations from Alamata had straight edged ear. One third of the cattle populations from Raya Azebo possess thoracic hump position while almost all the cattle from Alamata had cervical thoracic hump position. One fifth of the Raya Azebo cattle's back profile was curved while straight back profile was observed on almost all Alamata cattle populations.

Table 6 - Qualitative characteristics of Harmo cattle under age effect

Variables	Overall % (N)	Age			
		3 – 5	6 – 7	≥ 8	*P*-value
Horn spacing					0.0721
Narrow	4.0(10)	0.0	5.0	6.9	
Wide	96.0(242)	100	95	93.1	
Horn shape					0.0284
Curvy	16.3(41)	25.0	14.0	9.7	
Lyre	83.7(211)	75.0	86.0	90.3	
Horn orientation					0.0286
Forward	7.5(19)	13.7	6.0	2.8	
Upward	92.5(233)	86.3	94.0	97.2	
Ear shape					0.9796
Round edged	2.8(7)	2.50	3.0	2.8	
Straight edged	97.2(245)	97.50	97.0	97.2	
Hump shape					0.2111
No Hump	0.4(1)	0	1.0	0	
Erect	98.8(249)	97.5	99.0	100	
Dropping	0.8(2)	2.5	0	0	
Hump size					0.1849
No Hump	0.4(1)	0	1.0	0	

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Small	88(222)	81.2	89.0	94.4	
Medium	10.3(26)	16.3	9.0	5.6	
Large	1.3(3)	2.5	1.0	0	
Hump position					0.2224
No Hump	0.4(1)	0	1.0	0	
Thoracic	21(53)	28.8	18.0	16.7	
Cervical thoracic	78.6(198)	71.2	81.0	83.3	
Face profile					0.3626
Flat	99.2(250)	97.5	100	100	
Concave	0.4(1)	1.3	0	0	
Convex	0.4(1)	1.2	0	0	
Back profile					0.7988
Curved	11.5(29)	11.3	13.0	9.7	
Straight	88.5(223)	88.7	87.0	90.3	
Tail length					0.4592
Short	0.4(1)	0.00	0.00	1.39	
Medium	4.4(11)	3.75	6.00	2.78	
Long	95.2(240)	96.25	94.00	95.83	
Dewlap width					0.9383
Small	0 (0)	0	0	0	
Medium	25.0(63)	25.0	24.0	26.4	
Large	75.0(189)	75.0	76.0	73.6	

Sex and age effect

The study also revealed that cattle sex affects six out of the twenty-four qualitative traits recorded. Based on this, some of the Harmo oxen had round edged ear and dropping hump shape while almost all cows had straight edged ear and erect hump shape. About one third of the oxen had medium to large hump while almost all cows possess small hump. Most oxen possess hump at the thoracic position while most cows had cervical thoracic hump position. Curved back profile was observed on one fourth of the oxen while most of the cows possess straight back profile. The results also show effect of age categories (five out of twenty-four) on the recorded qualitative traits. Based on this, horn of the cattle populations tends to be upward lyre shape as they get aged. Similarly, naval flap width, udder and teat size of the cows becomes large and long as their age progress. Harmo oxen possess small testes and medium to long preputial sheath, while, the cows had medium udder and teat size and medium to large naval flap width.

Table 7 - Body color and sex-limited characteristics of Harmo cattle under the effect of district, age and sex.

Variables	Overall % (N)	District		Age			Sex	
		Raya Azebo	Alamata	3 – 5	6 – 7	≥ 8	Male	Female
Body color pattern		P=0.7515		P=0.1069			P=0.1253	
Uniform	61.1(154)	57.9	64.3	57.5	67.0	56.9	46.4	63.0
Spotty	27.0(68)	28.6	25.3	31.2	17.0	36.1	28.6	26.7
Pied	7.1(18)	7.9	6.4	6.3	10.0	4.2	14.3	6.3
Shaded	4.8(12)	5.6	4.0	5.0	6.0	2.8	10.7	4.0
Body color		P=0.9460		P=0.6168			P=0.4588	
Red	38.9(98)	39.7	38.1	37.50	42.0	36.1	42.8	38.4
Light red	14.3(36)	12.7	15.9	11.25	17.0	13.9	3.6	15.6
Black	8.7(22)	7.1	10.3	7.50	7.0	12.5	3.6	9.4
Black + White	16.3(41)	17.5	15.1	20.00	12.0	18.1	25.0	15.2
Black + Red	7.1(18)	7.9	6.4	6.25	10.0	4.2	10.7	6.7
Red + White	11.5(29)	11.9	11.1	13.75	8.0	13.9	10.7	11.6
White	3.2(8)	3.2	3.2	3.75	4.0	1.4	3.6	3.1
Testes size		P=0.2062		P=0.2734				
Small	67.9(19)	71.4	57.1	50.0	88.9	80.0		
Medium	21.4(6)	23.8	14.3	28.6	11.1	20.0		
Large	10.7(3)	4.8	28.6	21.4	0	0		
Preputial sheath		P=0.4002		P=0.5359				

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Short	3.6(1)	4.8	0	0	11.1	0	
Medium	46.4(13)	52.4	28.6	57.1	33.3	40.0	
Long	50.00(14)	42.8	71.4	42.9	55.6	60.0	
Udder size		P=0.7393		P<0.0001			
Small	8.9(20)	7.6	10.1	22.7	4.4	1.5	
Medium	62.5(140)	64.8	60.5	68.2	75.8	38.8	
Large	28.6(64)	27.6	29.4	9.1	19.8	59.7	
Teat size		P=0.6911		P<0.0001			
Short	8.0(18)	6.7	9.2	21.2	3.3	1.5	
Medium	58.5(131)	61.0	56.3	69.7	68.1	34.3	
Long	33.5(75)	32.4	34.5	9.1	28.6	64.2	
Naval flap width		P=0.9323		P<0.0279			
Absent	3.1(7)	3.8	2.5	3.0	2.2	4.5	
Small	15.6(35)	16.2	15.1	18.2	16.5	11.9	
Medium	38.8(87)	39.1	38.7	47.0	44.0	23.9	
Large	42.4(95)	40.9	43.7	31.8	37.3	59.7	

DISCUSSION

Quantitative measurements

Oxen were dominant over cows on most of the measurements, which follow the Rensch's rule (Rensch, 1950) where the males of a particular species are usually larger than the females. The differences between the oxen and cows may be further ascribed to the testosterone hormones secreted within the oxen which leads to enhancement of muscle mass and skeletal development (Baneh and Hafezian, 2009). The sexual dimorphism of the animals may be ascribed to the differences in the endocrine system of the two sexes; estrogen hormone has a limited effect for growth in females (Chriha & Ghadri, 2001; Baneh and Hafezian, 2009). The results were in line with the results of Genzebu et al. (2012) on Arado cattle and Endashaw et al. (2015) on Mursi cattle who reported that oxen were larger than cows. Similarly, dominance of bucks over does were reported in Ethiopia (Mustefa et al., 2019).

Figure 2- Harmo Oxe (left). Harmo Cow (right)

Even if, Raya Azebo (Figure 2) was the reported origin of Harmo cattle populations, most of the quantitative measurement results show cattle populations from Alamata district were larger than those of Raya Azebo. This might be due to the long term interbreeding with the Ethiopian highland breeds. These results were also in line with the results of Endashaw et al. (2015) on Mursi cattle who reported differences within the same cattle breed among different districts. Age differences count a little on the observed differences in quantitative measurements which might be due to the nature of the sampling (selecting adult animals only), however, increment in horn length was observed as the animals get aged.

Harmo cattle breed had longer and tall body than Horro, Sheko, Arado and Ogaden cattle breeds however some other cattle breed like Begait possess longer and taller body than Harmo cattle (Takele et al., 2007; Dessalegn et al., 2012; Fasil et al., 2014 and Mulugeta, 2015). Hearth girth measurements of Harmo breed was lower than Ogaden, Arsi and Begait cattle breeds. However, Harmo cattle were one of the Ethiopian indigenous cattle genetic resources which

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possess large horns and ears. These results also show Harmo cattle breed possess long and thin body, and long ear and horn in comparison to most of the Ethiopian cattle breeds. The thin body of Harmo cattle might be due to shortage of available feed in and around the breeding tract of the breed. The long ear and horn may help them to adapt the hot bushy grazing land environment and protect themselves from the enemy existed in their natural habitat.

Qualitative characteristics

Too much significant differences in qualitative characteristics was not observed among the two sampling districts and the three age categories, which shows how unique characteristics the cattle populations from the different district and age categories share. These results are in line with the results of Endashaw et al. (2015) who observed similar qualitative characteristics among the different sampling location within the Mursi cattle breed. On the other hand, some effects of sex on the qualitative characteristics was observed which might be due to the sexual dimorphism which follow the Rensch's rule (Rensch, 1950).

Conclusion

Harmo (Raya-Azebo) cattle populations were characterized in 2019 based on FAO guidelines to update the available information for in-situ conservation purpose. Accordingly, two districts were covered; Raya Azebo and Alamata. Sizable variations were recorded among the sampled animals, which may help the further in-situ conservation and genetic improvement program. Partial effects of district, sex and age were observed. Based on these results, the cattle population from Alamata district were partially dominant over their Raya Azebo counterparts in some quantitative variables. Similarly, males were dominant over females in most of the studied variables. On the other hand, slight increment in the quantitative variables were recorded as the age of the cattle increases. The overall results show Harmo cattle possess long and thin body, and long ear and horn in comparison with most of the Ethiopian cattle breeds. The thin body of Harmo cattle might be due to shortage of available feed in and around the breeding tract of the breed. The long ear and horn may help them to adapt the hot bushy grazing land environment and protect themselves from the enemy existed in their natural habitat.

DECLARATIONS

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Authors' Contribution

All authors contributed to the study conception and design. AM, TB, AM, and MH collect data. Amine Mustefa contribute on data analysis and the write up of the manuscript. AH and AA review the manuscript. All authors read and approved the final manuscript.

Conflict of interests

The authors have not declared any conflict of interests.

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