

Full Length Research Paper

Characterization of Begait cattle using morphometric and qualitative traits in Western Zone of Tigray, Ethiopia

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The aim of the study is to characterize Begait cattle using morphometric and qualitative traits. The breed was kept under farm and ranch management systems in Western Tigray, Ethiopia. A total of 368 Begait cattle which included 24 male Begait cattle were selected using simple random sampling method and the data were analyzed using statistical packages for social sciences and statistical analysis software. Begait cows exhibited chest girth of 152.8 ± 0.40 cm, height at withers of 129.1 ± 0.28 cm, backline length (loin length + back length) of 88.4 ± 0.26 cm and tail length of 96.2 ± 0.44 cm. Whilst Begait breeding males showed chest girth of 170.7 ± 1.35 cm, height at withers of 145.1 ± 1.18 cm, backline length of 90.0 ± 1.13 cm and tail length of 108.2 ± 1.29 cm. The skeletal measurements of Begait cattle are good indicators of the breed as a potential dual-purpose breed and the gene could be improved through selection. Humera ranch should own superior male Begait cattle for genetic improvement of the breed. The correlation was significant ($P < 0.01$) among most of the morphometric traits of Begait cows. The most frequently observed coat color patterns of Begait cows were pied (42.4%) and spotted (33.1%) whilst the body coat color types of the cows were combination of black and white (34.6%) and brown (29.7%). All males were humped and majority of Begait cows (88.1%) were humpless. Begait cows had concave face profile (72.1%) and roofo rump profile (69.2%). The information generated from this research work will be used for planning Begait cattle genetic resources management in sustainable manner for the development of Regional and National economy.

Key words: Characterization, Begait cattle, qualitative traits, morphometric traits.

INTRODUCTION

Domesticated animals contribute directly to an estimated 70% of the world's rural poor (FAO, 2015). However, the global diversity of animal genetic resources for food and agriculture is in a continual state of decline (FAO, 2014). Ethiopia has served as a gateway to domestic animals

from Asia to Africa and its diverse ecology favored diversification of animal genetic resources (CSA, 2012/2013). Ethiopian livestock contribute 30-40% of Agricultural Growth Domestic Product (GDP), 16-20% of National GDP and 14-16% of foreign exchanges.

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However, there are many challenges facing the livestock production in Ethiopia mainly shortage of feeds, diseases, poor management practices, poor genetic improvement and lack of organized marketing system (Gebregziabhare, 2010). Majority (98.2%) of the cattle populations in Ethiopia are indigenous breeds kept under extensive management system, and crossbred and exotic breeds accounted for about 1.62 and 0.18%, respectively (CSA, 2016/2017). Indigenous cattle have been naturally selected for many years towards adaptive traits, high fertility, unique product qualities, longevity and adaptation to poor quality feeds (Aynalem, 2006). However, indigenous breeds are not well characterized adequately (Workneh et al., 2004; DAGRIS, 2006) although FAO (2007) declared the first strategic priority area on characterization, inventory and monitoring of trends and associated risks of animal genetic resources. Additionally, little attention is given to conserve the diversified genetic resources (DAGRIS, 2009). The first essential step towards sustainable utilization of animal genetic resources is to identify the major breed types, establish their population size along with their geographical distribution and describe their typical qualitative and quantitative phenotypic traits (Workneh et al., 2004).

According to the reports of the Institute of Biodiversity Conservation (2004) Begait cattle are registered as one of the indigenous cattle breeds of Ethiopia. Zerabruk et al. (2007) and Abraham and Abebe (2018) reported that Begait cattle are categorized under large east African Zebu classification. Whilst, DAGRIS (2014) also reported that Begait cattle belong to the North Sudan Zebu group and are reared for milk and beef; they are maintained by the Men-Amir tribes in the lowlands of Eritrea and neighboring areas of Sudan and Ethiopia.

Most widely the morphometric traits are used to characterize the different breeds of livestock as they give the idea of body conformation (Pundir et al., 2011). On-farm phenotypic characterization of cattle breed is a primary and low cost animal genetic resource characterization as compared to the on-station characterization (FAO, 2007). Characterization, inventory and monitoring of animal genetic resources are essential to the sustainable management of animal genetic resources. Breed characteristics information is substantially important for effective planning of how and where they can best be used and developed (FAO, 2015). Phenotypic characterization information contributes to the improvement of animal genetic resources in the context of country level implementation (FAO, 2012). Specifically, Begait cattle are an important indigenous genetic resource because their heat tolerance ability and milk and beef purpose animal. Proper characterization is a prerequisite for proper conservation and utilization of Begait cattle. However, presently, morphometric and qualitative information of Begait cattle kept under on-farm and ranch conditions is flimsy except

the work of Ftiwi and Tamir (2015) kept under on-farm animals. However, Begait cattle in ranch were not included in the characterization work. Therefore, this research work was conducted to generate baseline information and know the breed standards on important morphometric and qualitative traits of Begait cattle kept under on-farm and ranch management systems in Western Zone of Tigray, Ethiopia.

MATERIALS AND METHODS

Description of the study area

The morphometric and qualitative characterization of Begait cattle was conducted in Kafta Humera and Setit Humera districts of Western Zone of Tigray Regional State, Ethiopia; located 600 km Western of Mekelle city and 954 km North of Addis Ababa. Kafta Humera district lies at 13°40' and 14°27' N of latitude, and 36°27' and 37°32' E of longitude and has altitude range of 515 to 1863 m above sea level. The annual rainfall of the district is 449 to 1100 mm (Kafta Humera OoARD, 2015, unpublished); it is characterized by annual temperature of 33 to 41.7°C in the lowland areas and 17.5 to 22.2°C in the highland areas (Niguse and Aleme, 2015). Setit Humera is located at 14°16' N of latitude and 36°37' E of longitude and has an altitude of 611 masl. Humera Ranch of Begait Cattle Multiplication, Improvement and Conservation Center is located within the co-ordinates of 13°4'-14°27' N of latitude and 36°27'-37°32' of longitude and has an altitude of 892 masl.

Data collection and analysis

Kafta Humera and Setit Humera districts were selected as research areas purposively based on the availability of Begait cattle. Random sampling was used to select animals used to characterize the breed. The numbers and types of data collected were 17 quantitative and 19 qualitative traits of Begait cattle. In general, FAO (2012) cattle descriptor list was used as a guideline. Data collection methods followed were morphometric measurements and observations on the qualitative traits of Begait cattle. Body length measurement was taken from the thurl bone (not from the pin bone) to the point of shoulder. Backline length was measured from the center of the rump (between the hip bones) up to the base of the withers. Primary data were collected from a total of 344 adult females composed of 237 and 107 animals kept under on-farm and Humera Ranch, respectively. Moreover, 24 adult males kept under on-farm management system were included in the study. The research was undertaken in October 2015 to February of 2016.

Cattle age estimation

Age of the sample cattle was estimated by the stage of eruption of permanent pair of incisors and used owners reported animal ages. Kikule (1953) work on age changes in the teeth of zebu cattle was used as a basis. Animals of four years old and above were selected for the phenotypic characterization.

Data analysis

Data were analyzed using statistical packages for social sciences (SPSS) version 20 for the analysis of qualitative traits (<http://ibm-spss-statistics.soft32.com/>, 2012 updated) and statistical analysis software (SAS) version 9.1 for the analysis of morphometric traits (SAS, 2003). Female and male data were analyzed independently

due to their biological differences. Mean comparison method was employed to compare the morphometric traits of the female Begait cattle kept under on-farm and ranch management systems.

RESULTS

Morphological markers and characteristics of Begait cattle breed

Morphometric traits of Begait cattle

Characterization of Begait cattle using morphometric traits (mean±SE) grouped by farm type is presented in Table 1. Morphometric traits such as chest girth, height at withers, pelvic width, horn length, dewlap width and tail length of female Begait cattle were 152.8 ± 0.40 , 129.1 ± 0.28 , 38.0 ± 0.13 , 20.5 ± 0.42 , 15.0 ± 0.18 and 96.2 ± 0.44 cm, respectively. On the other hand, chest girth, height at withers, backline length, horn length, dewlap width and tail length of male breeding Begait cattle kept under on-farm management system were 170.7 ± 1.35 , 145.1 ± 1.18 , 90.0 ± 1.13 , 25.3 ± 1.76 , 19.9 ± 0.73 and 108.2 ± 1.29 cm, respectively. Male breeding Begait cattle exhibited very large sizes of chest girth, height at withers and tail length as compared to female breeding Begait cattle. Majority of the Begait cattle are grouped under short horned cattle breeds.

Table 2 presents correlation coefficients of morphometric traits of female breeding Begait cattle. Majority of the morphometric traits of female breeding Begait cattle significantly ($P < 0.01$) correlated each other. Particularly, horn length did not show correlation ($P > 0.05$) with ear length, hook circumference, navel flap width and rump length. Rump length did not correlate ($P > 0.05$) with ear length, backline length, muzzle circumference, navel flap width, neck length and teat length. In general, morphometric traits which do not have correlation will not have positive or negative influence on selection of one trait on the other.

Qualitative traits of Begait cattle

Overall, pied (42.4%) and spotted (33.1%) were the most frequent observed body color patterns of Begait cows (Table 3). The overall dominant body coat color types of cows were black and white type (34.6%) and brown (29.7%) (Figures 1, 2 and 4). Majority of cows were with glossy hair (90.4%) and with pigmented muzzle color (93%). Both sexes of Begait animals were horned, and 89 and 62.2% of the female Begait cattle were with curved horn shape and upward horn orientation, respectively. Majority of the Begait cows (88.1%) were humpless animals. Medium (63.4%) and large (35.8%) were the overall dewlap widths of Begait cows. 72.1% of Begait cows were with concave face profile. The most frequently observed backline profile of Begait cows was that the backline slopes up towards the rump (70.9%). The overall most frequently observed rump profile of

Begait cows was rooky profile (69.2%).

Characterization of breeding Begait bulls was taken only from the herds of on-farm management system. 37.5 and 20.8% of Begait bulls showed spotted and patchy coat color patterns, and black and white (62.5%) and black (20.8%) (Figure 3) coat color types were observed (Table 4). Majority 83.3% of the male breeding animals were with glossy hair shininess. Pigmented muzzle color was observed in 95.8% of the bulls. All bulls were horned and most of the bulls were observed with curved horn shape (87.5%) and upward horn orientation (91.7%). As presented in Table 4, all males were humped though 41.7% of the bulls were small-humped animals. Majority of the males exhibited concave face profile (66.7%), a backline profile which slopes up towards the rump (54.2%) and rooky rump profile (83.3%).

DISCUSSION

Perry et al. (2008) reported that scrotal circumference is strongly correlated with daily sperm production and fertility rates, and the scrotal circumference of Begait bulls (32.6 ± 0.44 cm) is almost normal size. Chest girth (152.8 ± 0.40 cm), height at withers (129.1 ± 0.28 cm) and backline length (88.4 ± 0.26 cm) of female Begait cattle are the major traits, which confirmed the relevance of the breed for beef production. Additionally, the result showed in tail length (96.2 ± 0.44), teat length (5.9 ± 0.10 cm) and navel flap width (7.8 ± 0.17 cm) of adult Begait cows indicate the relevance of the breed for milk production. Female Begait cattle under on-farm condition were superior in most of the morphometric traits than female Begait cattle kept under ranch condition. Morphometric traits of a breed cannot be influenced by differences in management systems. But the differences in morphometric traits of the animals in the ranch and on-farm might be an indicator that there are sub populations under Begait cattle. Therefore, such differences need future attention and action. Majority of the cows (90.4%) were with glossy hair and it is believed that the shininess of the hair type characteristics help them reflection of sun light radiation. All morphometric traits of female breeding Begait cattle reported by Ftiwi and Tamir (2015) are in line with the present study except chest girth (159.6 ± 0.24 cm) and dewlap width (18.6 ± 0.24 cm). Additionally, height at withers (136.9 ± 0.10 cm), horn length (19.1 ± 0.07 cm), tail length (100.3 ± 0.06 cm) and preputial sheath (12.1 ± 0.04 cm) of male breeding Begait cattle reported by Ftiwi and Tamir (2015) are slightly deviated from the present measurements. The differences in chest girth and dewlap width of female breeding Begait cattle and height at withers, horn length, tail length and preputial sheath of male breeding Begait cattle might be due to differences sample size and data collection procedures. It is also noted that Gicheha et al. (2016) study on Barka cattle height at withers (125.3 ± 0.6 cm), chest girth (156.4 ± 0.7 cm) and dewlap width (18.7 ± 0.6 cm) is similar

Table 1. Morphometric traits (mean±SE) of Begait cattle by farm type and sex.

S/N	Trait	Sex	Farm type		Overall (Mean±SE)
			On-farm (Female N=237, Male N=24)	Ranch (Female N=107)	
1	Body length (BL)	Female	116.2±0.44	114.1±0.5	115.4±0.35
		Male	127.9±1.16	-	127.9±1.16
2	Chest girth (CG)	Female	154.7±0.45	152.1±0.59	152.8±0.40
		Male	170.7±1.35	-	170.7±1.35
3	Height at withers (HW)	Female	129.3±0.36	130.8±0.48	129.1±0.28
		Male	145.1±1.18	-	145.1±1.18
4	Neck length (NL)	Female	44.8±0.28	43.3±0.36	43.9±0.22
		Male	47.0±0.92	-	47.0±0.92
5	Pelvic width (PW)	Female	38.3±0.16	38.3±0.21	38.0±0.13
		Male	-	-	-
6	Rump length (RuL)	Female	21.5±0.15	21.7±0.25	21.7±0.14
		Male	-	-	-
7	Backline length (BLL)	Female	89.0±0.31	89.3±0.44	88.4±0.26
		Male	90.0±1.13	-	90.0±1.13
8	Teat length (TtL)	Female	6.3±0.12	5.7±0.15	5.9±0.10
		Male	-	-	-
9	Ear length (EL)	Female	22.8±0.11	23.2±0.17	22.8±0.10
		Male	23.3±0.37	-	23.3±0.37
10	Horn length (HL)	Female	21.8±0.54	21.8±0.72	20.5±0.42
		Male	25.3±1.76	-	25.3±1.76
11	Muzzle circumference (MC)	Female	38.1±0.14	38.2±0.17	37.8±0.11
		Male	43.3±0.40	-	43.3±0.40
12	Dewlap width (DW)	Female	15.4±0.21	15.3±0.28	15.0±0.18
		Male	19.9±0.73	-	19.9±0.73
13	Navel flap width (NF)	Female	7.9±0.21	7.8±0.29	7.8±0.17
		Male	-	-	-
14	HC	Female	33.9±0.12	34.6±0.17	34.1±0.10
		Male	36.3±0.51	-	36.3±0.51
15	Tail length (TL)	Female	97.4±0.49	95.8±0.76	96.2±0.44
		Male	108.2±1.29	-	108.2±1.29
16	Scrotal circumference (SC)	Female	-	-	-
		Male	32.6±0.44	-	32.6±0.44
17	Preputial sheath (PS)	Female	-	-	-
		Male	16.0±0.80	-	16.0±0.80

Backline length=Loin length plus back length of the animal

with the present study of female Begait cattle whilst the same authors study on height at withers (114.4±0.8 cm) and chest girth (134.65±0.9 cm) of Arado cattle is not the

same with the present study due to breed differences of the breeds. Aamir et al. (2010) study on Kenana cattle reported lower height at withers (123.57±0.20 cm) and

Table 2. Correlation coefficients of morphometric traits of female Begait cattle.

Trait	BL	CG	DW	EL	HC	HL	HW	BLL	MC	NF	NL	PW	RuL	TL	TtL
BL															
CG	0.475**														
DW	0.454**	0.517**													
EL	0.245**	0.244**	0.217**												
HC	0.405**	0.439**	0.339**	0.253**											
HL	0.228**	0.260**	0.199**	0.104 ^{NS}	0.088 ^{NS}										
HW	0.503**	0.526**	0.393**	0.352**	0.529**	0.172**									
BLL	0.387**	0.336**	0.184**	0.255**	0.273**	0.126*	0.329**								
MC	0.467**	0.614**	0.453**	0.346**	0.458**	0.338**	0.498**	0.334**							
NF	0.304**	0.290**	0.346**	0.240**	0.292**	0.090 ^{NS}	0.297**	0.199**	0.331**						
NL	0.399**	0.464**	0.404**	0.191**	0.217**	0.195**	0.295**	0.370**	0.377**	0.205**					
PW	0.505**	0.589**	0.479**	0.308**	0.424**	0.265**	0.508**	0.341**	0.553**	0.310**	0.405**				
RuL	0.127*	0.177**	0.106*	0.046 ^{NS}	0.178**	-0.016 ^{NS}	0.172**	0.013 ^{NS}	0.095 ^{NS}	0.101 ^{NS}	0.076 ^{NS}	0.137*			
TL	0.318**	0.356**	0.241**	0.344**	0.269**	0.217**	0.349**	0.368**	0.308**	0.176**	0.318**	0.353**	-0.107*		
TtL	0.483**	0.459**	0.401**	0.242**	0.298**	0.280**	0.408**	0.431**	0.496**	0.343**	0.384**	0.414**	0.077 ^{NS}	0.308**	

** =Correlation is significant at $P < 0.01$, * =Correlation is significant at $P < 0.05$, NS= Non-Significant.

pelvic width (33.81 ± 0.05 cm) than female Begait cattle. However, female Begait cattle tail length, chest girth and neck length is similar with the same authors study on Kenana cattle tail length (93.76 ± 0.35 cm), chest girth (154.07 ± 0.40 cm) and neck length (43.04 ± 0.07 cm). In general, most of the morphometric traits of Begait cattle are good indicators as they are of dairy type animals. Begait cattle can be less exposed to dystocia because of the reasonable pelvic width. The morphometric analysis of Begait cattle indicated that birth difficulty was very low because the rump profile of Begait cattle was dominantly roofy profile. Kenana cattle can be more exposed to dystocia than Begait cattle due to their narrow pelvic width.

A study on female Ogaden cattle kept at Haramaya University pasture reported by Getinet et al. (2009) were chest girth of 150.1 ± 8.20 cm,

height at withers of 115.5 cm, horn length of 8.0 cm, ear length of 19.7 cm and tail length of 71.6 cm, whereas males exhibited chest girth, height at withers, horn length, ear length and tail length of 148.2 ± 14.31 cm, 115.5 cm, 5.9 cm, 19.6 cm, and 71.9 cm, respectively. Therefore, all morphometric traits of female and male Begait cattle are higher than female and male Ogaden cattle. The deviation in morphometric traits of Ogaden cattle and Begait cattle is due to the breed, agro-ecological and management variations. Chest girth (134.3 ± 0.7 cm), height at wither (104.6 ± 0.9 cm), rump width (35.0 ± 0.3 cm), rump length (18.4 ± 0.2 cm), tail length (72.1 ± 0.5 cm) and ear length (18.9 ± 0.2 cm) of female Mursi cattle (Endashaw et al., 2015) are inferior to the present results of female Begait cattle whereas horn length (27.0 ± 0.8 cm) of Mursi cows is superior to horn length of Begait cows. This is due to the

difference in breed classification group that the Mursi cattle breed is classified under Small East African Zebu (Rege and Tawah, 1999) whereas Begait cattle are categorized under Large East African Zebu classification (Zerabruk et al. 2007; Abraham and Abebe, 2018). Furthermore, on-farm morphometric characterization of female Fogera cattle (Endalkachew et al., 2016) tail length (82.4 ± 0.70 cm), chest girth (146.0 ± 0.93 cm), body length (104.1 ± 0.93 cm), height at wither (120.8 ± 0.56), neck length (39.2 ± 0.39) and horn length (14.2 ± 0.43 cm) are inferior to the current records in female Begait cattle whereas muzzle circumference (37.7 ± 0.25 cm), ear length (23.2 ± 0.24 cm), pelvic width (35.7 ± 0.29 cm) and teat length (5.4 ± 0.13 cm) of female Fogera cattle are similar to the present records of the same sex of Begait cows. The reason might be due to Begait and Fogera cattle breeds are categorized

Table 3. Frequency occurrence of qualitative traits of female Begait cattle by farm type.

Major trait	Trait category	Farm type		Overall percent
		On-farm (N=237)	Ranch (N=107)	
Body color pattern	Plain	6 (2.5)	2 (1.9)	8 (2.3)
	Patchy	50 (21.1)	26 (24.3)	76 (22.1)
	Pied	110 (46.4)	36 (33.6)	146 (42.4)
	Spotted	71 (30.0)	43 (40.2)	114 (33.1)
Coat color type	Brown	76 (32.1)	26 (24.3)	102 (29.7)
	Black and white	86 (36.3)	33 (30.8)	119 (34.6)
	Beige	54 (22.8)	33 (30.8)	87 (25.3)
	Black	6 (2.5)	2 (1.9)	8 (2.3)
	Red brown	8 (3.4)	1 (0.9)	9 (2.6)
	Gray (dull)	7 (3.0)	12 (11.2)	19 (5.5)
Hair shininess	Glossy	215 (90.7)	96 (89.7)	311 (90.4)
	Dull	22 (9.3)	11 (10.3)	33 (9.6)
Hair straightness	Straight	237 (100)	107 (100)	344 (100)
Muzzle color	Pigmented	214 (90.3)	106 (99.1)	320 (93)
	Not pigmented	23 (9.7)	1 (0.9)	24 (7)
Horn presence	Absent	0	0	0
	Present	237 (100)	107 (100)	344 (100)
Horn shape	Straight	24 (10.1)	10 (9.3)	34 (9.9)
	Curved	210 (88.6)	96 (89.7)	306 (89.0)
	Lyre shape	3 (1.3)	1 (0.9)	4 (1.2)
Horn color	Black	202 (85.2)	74 (69.2)	276 (80.2)
	Brown	0	1 (0.9)	1 (0.3)
	White	10 (4.2)	0	10 (2.9)
	Gray	25 (10.5)	32 (29.9)	57 (16.6)
Horn orientation	Laterally	28 (11.8)	8 (7.5)	36 (10.5)
	Upward	156 (65.8)	58 (54.2)	214 (62.2)
	Downward	8 (3.4)	10 (9.3)	18 (5.2)
	Forward	42 (17.7)	27 (25.2)	69 (20.1)
	Backward	3 (1.3)	4 (3.7)	7 (2.0)
Ear shape	Straight-edged	237 (100)	107 (100)	344 (100)
Ear orientation	Lateral	237 (100)	107 (100)	344 (100)
Hump presence	Absent	200 (84.4)	103 (96.3)	303 (88.1)
	Present	37 (15.6)	4 (3.7)	41 (11.9)
Hump size	No hump	200 (84.4)	103 (96.3)	303 (88.1)
	Small	37 (15.6)	4 (3.7)	41 (11.9)
Hump shape	No hump	200 (84.4)	103 (96.3)	303 (88.1)
	Erect	37 (15.6)	4 (3.7)	41 (11.9)
Dewlap width	Small	1 (0.4)	2 (1.9)	3 (0.9)
	Medium	129 (54.4)	61 (57)	218 (63.4)

Table 3. Contd.

	Large	107 (45.1)	44 (41.1)	123 (35.8)
Face profile	Straight	49 (20.7)	35 (32.7)	84 (24.4)
	Concave	177 (74.7)	71 (66.4)	248 (72.1)
	Convex	11 (4.6)	1 (0.9)	12 (3.5)
Backline profile	Straight	62 (26.2)	38 (35.5)	100 (29.1)
	A	175 (73.8)	69 (64.5)	244 (70.9)
Rump profile	Flat	23 (9.7)	5 (4.7)	28 (8.1)
	Sloping	51 (21.5)	27 (25.2)	78 (22.7)
	Roofy	163 (68.8)	75 (70.1)	238 (69.2)
Hoof color	Black	235 (99.2)	107 (100)	342 (99.4)
	White	1 (0.4)	0	1 (0.3)
	Grey	1 (0.4)	0	1 (0.3)

Numbers on parentheses are in percent, A=Slopes up towards the rump.



Figure 1. Photograph of Begait cattle herd with large farms at Bahre-Selam.

under Large East African Zebu classification.

A study on indigenous cattle ecotypes in Rwanda (Hirwa et al., 2017) indicated that height at wither (130.4 cm), teat length (5.4 cm) and navel flap width (6.8 cm) of female Inkuku cattle and height at wither (134.6 cm), tail length (92.1 cm) and navel flap width (8.3 cm) of female Inyambo are more or less similar with the records of female Begait cows whereas chest girth (167.6 cm),

dewlap width (19 cm) and horn length (101.2 cm) of female Inkuku cattle and chest girth (176.4 cm), dewlap width (18.8 cm) and horn length (107.7 cm) of female Inyambo cattle are superior compared to the records of female Begait cows. This variation is due to the differences in genetic makeup of the breeds and the agro-ecology where the breeds exist. However, height at wither and chest girth of female Begait cattle is superior



Figure 2. Photograph of Begait cattle herds with smallholder farmers at Rawian watering point area.

to height at wither (115.57 cm) and chest girth (147.17 cm) of Jabres cattle of Indonesia (Adinata et al., 2016). Female Pabna cattle of Bangladesh in a research station (Talukder et al., 2017) exhibited chest girth (151.1 cm) is similar to female Begait cattle whereas height at wither (118.1 cm) and tail length (83.3 cm) of female Pabna cattle is not in line with the records in female Begait cattle. The morphometric traits of male and female Begait cattle are superior to the morphometric traits of male and female (Ebadu et al., 2017) Bonga cattle. This is because the reported (Ebadu et al., 2017) body length (114.79 ± 1.99 , 110.52 ± 0.33), height at wither (105.04 ± 0.75 , 100.48 ± 0.29), chest girth (141.24 ± 2.16 , 135.04 ± 0.42), ear length (16.49 ± 0.20 , 16.55 ± 0.10) and muzzle circumference (40.63 ± 0.30 , 37.83 ± 0.11) of male and female Bonga cattle, respectively, are lower records than both sexes of Begait cattle. Morphometric characterization of Khillar cattle of India was reported by Katkade et al. (2017). Horn length (55.85 ± 2.22 cm), ear length (26.37 ± 0.07 cm), tail length (111.29 ± 0.77 cm) and chest girth (163.62 cm) of Khillar cows are superior to the same traits of Begait cows. Khillar bulls are also superior to Begait bulls in Horn length (59.22 ± 0.30 cm), tail length (114.08 ± 1.05 cm) and chest girth (186.35 cm). But height at wither of Begait cows and Bulls are superior to height at wither of Khillar cows (124.26 cm) and bulls (140.10 cm). Shahjahan (2018) reported on hump presence and daily milk yields of Holstein Friesian crossbreds. Shahjahan (2018) found that humpless cows produced 15.89 ± 1.16 litres of daily milk yield/cow whereas humped

cows produced 4.8 ± 0.58 litres. This might be evidence that Begait cattle are milk animals because the present study indicated that 88.1% of Begait cows were humpless animals.

The present information on hump and horn presences, horn orientation and ear orientation of Begait females do not agree with Fitwi and Tamir (2015)'s report on the same breed. Fitwi and Tamir (2015) reported an ear orientation of 97.9% of females, 96.2% of males exhibited dropping ear and some males showed dropping hump (34.6%). The deviation in the traits of the same breed might be due to the subjective behavior of data collection method followed. Aamir et al. (2010) reported that the predominant coat color type of Kenana cattle was white (57.3%) whereas the predominant coat color type of female and male Begait cattle was black and white which accounted 34.6 and 62.5%, respectively. Kenana cattle are considered as one of the best milkers in Africa (Bennett et al., 1954; Fengaly, 1980; Mason and Maule, 1960; Osman, 1972).

CONCLUSION AND RECOMMENDATION

Based on the Begait cattle descriptor characters, there exists within breed diversity and can be utilized in genetic improvement for the traits of interest. Skeletal measurements of livestock are highly heritable. Hence, there will be quick genetic improvement of Begait cattle. The morphometric analysis of Begait cattle indicated that



Figure 3. Photographs of male breeding Begait cattle.



Figure 4. Photograph of Begait cattle of small scale farms in Bereket (Kafta Humera district) watering point.

Table 4. On-farm frequency occurrence of qualitative traits of male Begait cattle (N=24).

Major trait	Trait categories	Percent (N)
Body color pattern	Plain	6 (25)
	Patchy	5 (20.8)
	Pied	4 (16.7)
	Spotted	9 (37.5)
Body coat color type	Brown	2 (8.3)
	Black and white	15 (62.5)
	Beige	2 (8.3)
	Black	5 (20.8)
Hair shininess	Glossy	20 (83.3)
	Dull	4 (16.7)
Hair straightness	Straight	24 (100)
Muzzle color	Pigmented	23 (95.8)
	Not pigment.	1 (4.2)
Horn presence	Absent	0

Table 4. Contd.

	Present	24 (100)
Horn shape	Straight	3 (12.5)
	Curved	21 (87.5)
Horn color	Black	18 (75)
	White	3 (12.5)
	Gray	3 (12.5)
Horn orientation	Laterally	2 (8.3)
	Upward	22 (91.7)
Ear shape	Straight-edged	24 (100)
Ear orientation	Lateral	24 (100)
Hump presence	Absent	0
	Present	24 (100)
Hump size	Small	10 (41.7)
	Medium	8 (33.3)
	Large	6 (25)
Hump shape	Erect	24 (100)
Dewlap width	Large	24 (100)
Face profile	Straight	4 (16.7)
	Concave	16 (66.7)
	Convex	4 (16.7)
Backline profile	Straight	11 (45.8)
	A	13 (54.2)
Rump profile	Flat	4 (16.7)
	Roofy	20 (83.3)
Hoof color	Black	24 (100)

birth difficulty was very low because the rump profile of Begait cattle was dominantly roofy profile. It was also noted that the morphometric analysis of Begait cattle indicated that the breed has large body frame and diversity compared to other indigenous and some exotic breeds. The morphometric traits of Begait cattle largely declare that the body conformation of the breed suits for dairy cattle production. Additionally, Begait cattle can be used for beef and this breed looks reasonable to use as a dual-purpose breed. However, female Begait cattle in ranch are more inferior in most of the morphometric traits than female Begait cattle kept under on-farm condition. Therefore, Humera ranch should practice intensive culling and keep superior Begait cattle breed. Moreover, Begait cattle breeders' classification of the breed in to sub populations (Refein, Bowadir and Dewhin) should be further characterized in the future.

Morphological markers characterization of Begait cattle indicated that the breed exhibited different body coat color patterns and types. The different body coat color patterns and types of Begait cattle are also indicators of the breed for the existence of subpopulations. Overall analysis revealed that the most frequently observed body coat color patterns of Begait cows were spotted and pied whereas the predominant coat color types of Begait cows were black and white and brown. Therefore, further characterization of the subpopulations should be conducted, and standard selection criteria/breeding goal traits, development objectives and strategies should be developed for each subpopulation for their sustainable breeding, utilization and conservation. It should be noted that directional selection towards particular goal traits be practiced in Begait cattle breeding. Holstein Friesian, Bonsmara and Ogaden cattle are some of the good

exemplary breeds because each breed has almost single and unique coat color patterns and/or body coat color types.

Furthermore, the different body coat color patterns and types and morphometric variation of Begait cattle kept under on-farm and ranch conditions should be further characterized through molecular study to prove whether the breed has different strains and/or gene admixtures with other common indigenous breeds found near the natural location of Begait cattle or not.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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REFERENCES

- Aamir HM, Babiker SA, Youssif GM, Hassan YA (2010). Phenotypic Characterization of Sudanese Kenana Cattle. *Research Journal of Animal and Veterinary Sciences* 5:43-47.
- Abraham A, Abebe H (2018). Ethiopian Indigenous Cattle breed's Diversity, Distribution, Purpose of Keeping, and Their Potential threats. *Journal of Biological Innovations* 7(5):70-789.
- Adinata Y, Aryogi PD, Luthfi M, Rasyid A, Krishna NH (2016). Phenotypic Characterization of Jawa Brebes (Jabres) Cattle. In *Proceedings of International Seminar on Livestock Production and Veterinary Technology* (pp. 24-29). DOI: <http://dx.doi.org/10.14334/Proc.Intsem.LPVT-2016-p.24-29>.
- Aynalem H (2006). Genetic and economic analysis of Ethiopian Boran cattle and their crosses with Holstein Friesian in central Ethiopia. PhD dissertation. National dairy research institute (ICAR) Karnal-132001 (Haryana), India. 197p.
- Bennett SCG, Johan ER, Hewison JW (1954). *Animal husbandry. Agriculture in the Sudan*, in J.D. Tohill, Education, pp. 633-667, Oxford University press, U.K.
- CSA (2012/13). *Agricultural sample survey. Report on livestock and livestock characteristics of Ethiopia. Private Peasant Holdings. Statistical Bulletin 570*, Addis Ababa, Ethiopia, April, 2013.
- CSA. (2016/17). *Agricultural sample survey of Ethiopia in 2016/17 [2009 E.C.]*, volume-2: Report on livestock and livestock characteristics (private peasant holdings). Statistical bulletin-585, April 2017, Addis Ababa, Ethiopia.
- DAGRIS (2006). *Domestic Animal Genetic Resource Information System (DAGRIS)* (eds. J.E.O.Rege, W.Ayalew, E.Getahun, O.Hanotte and T.Dassei). International Livestock Institute. Addis Ababa. Ethiopia.
- Domestic Animals Genetic Resources Information System (DAGRIS), (2009). <http://dagrils.ilri.cgiar.org/display.asp>.
- Domestic Animals Genetic Resources Information System (DAGRIS), (2014). www.cdais.org.cn/DAGRIS/cattle/.
- Ebadu A, Tegbaru G, Dawit H, Chernet R, Bereket Z, Metsafe M (2017). Phenotypic characterization and production system of Bonga cattle in its production environment of Kaffa Zone, Southwest Ethiopia. *Sky Journal of Agricultural Research* 6(4):062-072.
- Endalakachew G, Kefyalew A, Solomon A, Damitie K (2016). Phenotypic characterization, population structure, breeding management and recommend breeding strategy for Fogera cattle (*Bos indicus*) in Northwestern Amhara, Ethiopia. *Animal Genetic Resources* 58:13-29.
- Endashaw T, Tadelle D, Aynalem H, Wudyalew M, Okeyo M (2015). On-farm phenotypic characterization of Mursi cattle in its production environment in South Omo Zone, Southwest Ethiopia. *Animal Genetic Resources* 57:15-24.
- Food and Agriculture Organization of the United Nations (2007). *The State of the World's Animal Genetic Resources for Food and Agriculture-in brief*, edited by Dafydd Pilling & Barbara Rischkowsky. Rome.
- Food and Agriculture Organization of the United Nations (2007). *Global Plan of Action for Animal Genetic Resources and the Interlaken Declaration. Commission on Genetic Resources for Food and Agriculture, Adopted by the International Technical Conference on Animal Genetic Resources for Food and Agriculture Interlaken, Switzerland, 3-7 September 2007*, Food and Agriculture Organization of the United Nations, Rome.
- Food and Agriculture Organization of the United Nations (2012). Phenotypic characterization of animal genetic resources. *FAO Animal Production and Health Guidelines No. 11*. Rome.
- Food and Agriculture Organization of the United Nations (2014). Characterization and value addition to local breeds and their products in the Near East and North Africa. *Regional Workshop, Rabat, Morocco, 19-21 November 2012. Animal Production and Health Report No. 3*. Rome.
- Food and Agriculture Organization of the United Nations (2015). *The Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture*, edited by B.D. Scherf & D. Pilling. FAO Commission on Genetic Resources for Food and Agriculture Assessments. Rome (available at <http://www.fao.org/3/a-i4787e/index.html>).
- Fengaly OAI (1980). Reproduction and milk yield of Kenana and Butana cattle herds in the Sudan. MSc. Thesis, University of Khartoum, Sudan.
- Ftiwi M, Tamir B (2015). On-Farm Phenotypic Characterization of Indigenous Begait Cattle in Western Tigray, Northern Ethiopia. *Journal of Animal Production Advances* 5(7):718-732.
- Gebregziabhare B (2010). An over view of the role of Ethiopian livestock in livelihood and Food safety. Ministry of Agriculture and Rural development of Ethiopia; Presented on dialogue on livestock, food security and sustainability, a side event on the session of 22nd FAO, Rome. 2p.
- Getinet M, Workneh A, Hegde PB (2009). Growth and Reproductive performance of Ogaden cattle. MSc. Thesis, Haramaya University, Haramaya, Ethiopia.
- Gicheha MG, Goitom S, Teclehimanot G (2016). Research Application Summary: Morphological characteristics of indigenous cattle in Eritrea. RUFORUM Working Document Series (ISSN 1607-9345) No. 14(2):787-791. Fifth RUFORUM Biennial Regional Conference, 17-21 October 2016, Cape Town, South Africa, Available at: <http://repository.ruforum.org>.
- Hirwa CD, Kugonza DR, Murekezi T, Rwemarika JD, Kayitesi A, Musemakweri A, Shabayiro JP, Shumbusho F, Manzi M, Safari T (2017). Management and phenotypic features of indigenous cattle in Rwanda. *International Journal of Livestock Production* 8(7):95-112.
- IBC (Institute of Biodiversity Conservation) (2004). *The State of Ethiopia's Farm Animal Genetic Resources: Country Report. A Contribution to the First Report on the State of the World's Animal Genetic Resources*, Addis Ababa, Ethiopia.
- Katkade BS, Adgale AA, Khade SB, Chopade MM, Komatwar SJ (2017). Physical and Morphometric Characteristics of Khillar Breed of Cattle. *International Journal of Current Microbiology and Applied Sciences* 6(9):513-518.
- Kikule SB (1953). Age changes in the teeth of zebu cattle. *East African Agricultural Journal* 19(2):86-88.
- Mason IL, Maule JP (1960). *The indigenous livestock of Eastern and South Africa. Common wealth Agricultural Bureaux. Animal breed. Genet. Tech Common*, Farnham, Royal. Bucks, England.
- Niguse A, Aleme A (2015). Modeling the Impact of Climate Change on Production of Sesame in Western Zone of Tigray, Northern Ethiopia.

- Journal of Climatol Weather Forecasting 3:150.
- Osman AH (1972). Studies in Sudanese indigenous cattle. *Tropical Agriculture (Trinidad)* 94:143-147.
- Pundir RK, Singh PK, Singh KP, Dangi PS (2011). Factor analysis of biometric traits of Kankrej cows to explain body conformation. *Asian Australas Journal of Animal Science* 24:449-456.
- Rege JEO, Tawah CL (1999). The state of African cattle genetic resources II. Geographical distribution, characteristics and uses of present-day breeds and strains. *Animal Genetics Resources Information Bulletin* 26:1-25.
- Talukder MAI, Shahjahan M, Islam MS, Munira S (2017). Diversity in morphology and pigmentation patterns of local Pabna cattle in Bangladesh. *Agriculture, Livestock and Fisheries* 4(3):201-208.
- Shahjahan Md (2018). Development of breeding strategy based on body coloration and phenotype in Holstein Friesian crossbreds for sustainable milk production. *Fundamental and Applied Agriculture* 3(2):498-504.
- Workneh A, Ephrem G, Markos T, Yetnayet M, Rege JEO (2004). Farm Animal Biodiversity in Ethiopia: Status and Prospects, Current State of Knowledge on Characterization of Farm Animal Genetic Resources in Ethiopia. Proceedings of the 11th Annual conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia, August 28-30, 2003. ESAP, Addis Ababa. 441pp.
- Zerabruk M, Vangeo M, Haile M (2007). The status of cattle genetic resources in north Ethiopia: on-farm characterization of six major cattle breeds. *Animal Genetics Resource Information Bulletin* 40:15-32.