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On-farm Phenotypic Characterization of Ogaden Cattle Breed in Gode District of Somali Regional State in Ethiopia

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Abstract

The study was conducted in Gode District in Somali regional state in Ethiopia to describe phenotypic characterization of the breed on its natural production environment. The interview was addressed to 126 households who keep cattle for multi-purposes. Data on qualitative and quantitative traits collected from 612 cattle for five-month. The majority of body conformation of the breed indicated that the females were dairy type while males were beef type. The major coat color was white for female but white-black shade for male population. Female population has small erect hump largely positioned cervico-thoracic whilst males have medium to large erect hump positioned thoracic. The mean height at wither, heart girth, flank girth and the body length for female were 112.66 cm, 161.20 cm, 162.10 cm and 121.28 cm, respectively while as for male were 123.18 cm, 170.91 cm, 169.20 cm and 125.16 cm, respectively. The mean daily milk yield in the study area was 2.72 kg. The mean age at calving was 53.39 months having good mothering feature. The mean age at which the males were allowed to mate was 54.87 months. Based on the findings, it was concluded that distinct phenotypic characteristics can be observed among individuals of different sex within the breed on its natural production environment. Also, the breed has distinct phenotypic characteristics with a better on-farm performance compared to some other east African zebu type.

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1. Introduction

The exploratory information provided by current on-farm phenotypic characterization of Ogaden cattle breed is essential as baseline information for understanding the cattle genetic resource and utilizing them sustainably at local, national, regional and global level in AnGR management and livestock development programs. Such baseline information is essential to establish country, regional and global priorities for the management of animal genetic resources (ESAP, 2013). Because of a lack of comprehensive information on population fragmentations or substructures and geographical distributions, many animal populations in the developing regions of the world are commonly referred to as "non-descript" and it is primarily in these regions that phenotypic characterization studies on AnGR are needed (FAO, 2012). Lacks of records to evaluate the performance of animals is one of the bottleneck to conserve and improve traits of breeds at farmer level and these would put a threat to Farm Animal Genetic Resources of Ethiopia in the future (Chencha and Kefyalew, 2012). On-station characterization of Ogaden cattle was conducted at Haramaya University research station, Ethiopia (Mummed 2012; Yesihak 2011; Mekuriaw et al. 2009). However, there was no documented information on phenotypic characterization of the breed in its natural production environment (*in situ*) where it gained its name. The objective of the study was to undertake on-farm phenotypic characterization of Ogaden cattle breed.

2. Materials and Methods

2.1. Descriptions of the Study Area

On-farm phenotypic characterization of Ogaden cattle breed was conducted in Gode district which is located South-eastern portion of the Somali regional state of Ethiopia considered as the center of Ogaden. The district was selected as sample based on its location, presence of relatively large proportion of cattle population, proximity and security of works according to the zonal administration view. The district was characterized by high temperature, erratic rainfall and totally arid lowland occupied by pastoral and irrigation based agro-pastoral population whose livelihood is mainly depend on range-livestock production.

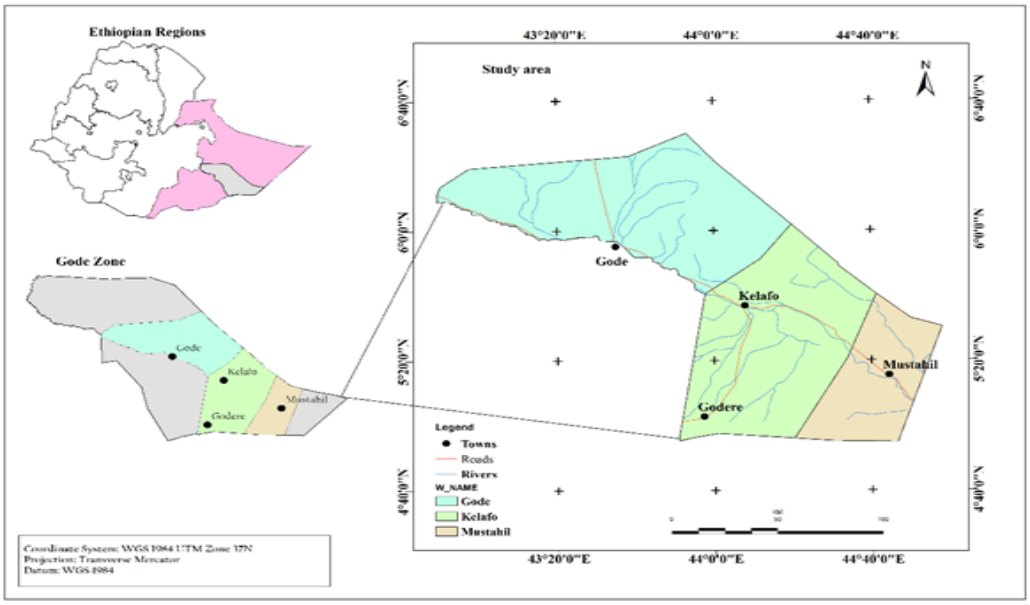

Figure 1: Map of the study area

2.2. Data Collection

126 small households who keep cattle for multi-purpose were used for interview. The selection of these households was based on the size and composition of cattle herd, experience with cattle husbandry and willingness to respond to semi-structured questionnaire developed for the purpose. Data on morphological characterization were collected in the early morning on a total of 612 cattle out of which 552 were females and the rest were 60 males. Performance data on female cattle was collected on 126 females which were selected from the total sample based on the stage of lactation ranging 3-5weeks which were on their second lactation (parity). All data were collected in dry season (mid-September, 2014 to mid-February, 2015). The studied variables were: qualitative traits, linear body measurements, adaptive traits, daily milk yield and reproductive traits. Qualitative data were: body conformation, coat color pattern, coat color, muzzle color, eyelid color, hump position, hump size, hump shape, dewlap size, backline profile, horn presence, horn orientation, and rump profile. The linear body measurements were withers height, heart girth, flank girth, body length, rump length, rump height, rump width, muzzle circumstance. Digital camera, plastic measuring tape and rope were used for qualitative traits and linear body measurements. Calibrated spring weighing balance, milking can, and record book were used to collect data on daily milk yield twice a day (in the early morning about 6:00 am and late afternoon about 6: 00 pm).

2.3. Data Analysis

Data analysis were made using SAS version 9.2, 2008. Quantitative traits were analyzed using the General Linear Model (GLM) procedures of the Statistical Analysis System. All dependent variables were analyzed separately for sex. The effect of sex was compared using Tukey at 5% level of confidence.

3. Result and Discussion

3.1. Qualitative Traits of Ogaden Cattle Breed

Table 1 shows qualitative traits of Ogaden cattle breed by sex. Majority of female cattle has triangular (dairy) body conformation (74.82%) whereas majority of male cattle has rectangular (beef) body conformation (66.67%) in the study area. Majority of female cattle has uniform coat color pattern (82.97%) whereas majority of male cattle has shaded (56.67%). Majority of female cattle has white coat color (60.69%) whereas majority of male cattle has black-white shaded (41.67%). Similarly, male cattle has thoracic hump (100%) whereas majority of female cattle have cervico-thoracic hump (91.49%) and very few females have thoracic hump (8.51%). Majority of female cattle has not pigmented eyelid color (84.96%) whereas majority of male cattle has pigmented eyelid color (53.33%). Majority of both female and male cattle have pigmented muzzle color (88.41% and 80%, respectably). Majority of female cattle has small hump size (100%) whereas majority of male cattle has medium hump size (56.67%). Majority of female cattle has medium dewlap size (51.09%) whereas majority of male cattle has large dewlap size (56.67%). Majority of both female and male cattle have erected hump (100% and 66.67%, respectably). Majority of female cattle has backline profile which was sloping up toward rump (72.46%) whereas majority of male cattle has straight backline (91.67%).

Table 1: Qualitative traits of Ogaden cattle by sex

Qualitative traits		Sex				χ^2	P- value
		Female		Male			
		Freq.	%	Freq.	%		
Body conformation	Triangular/oval	413	74.82	-	-	49.09	<.0001
	In between	139	25.18	20	33.33		
	Rectangular	-	-	40	66.67		
Coat pattern	Plain/uniform	458	82.97	17	28.33	126.59	<.0001
	Patch/pied	8	1.45	5	8.33		
	Spotted	54	9.78	4	6.67		
	Shaded	32	5.80	34	56.67		
Coat color	Dark black	15	2.72	1	1.67	6.83	0.009
	Light black	6	1,09	-	-		
	White	335	60.69	1	1.67		
	Dark red	7	1.27	7	11.67		
	Light red	56	10,14	4	6.67		
	Fawn	24	4,35	9	15.00		
	Grey	17	3.08	4	6.67		
	Black-white(spotted)	35	6.34	9	15.00		
	Red-white (pied or spotted)	25	4.53	-	-		
	White-black (shaded)	29	5.25	25	41.67		
	Red –black (shaded)	3	0.54				
Muzzle color	Pigmented	488	88.41	48	80	3.51	0.06
	Not pigmented	64	11.59	12	20		
Eyelid color	Pigmented	83	15.04	32	53.33	36.40	<.0001
	Not pigmented	469	84.96	28	46.67		
Horn presence	Absent/polled	34	6.16	6	10	1.30	0.25
	Present	518	93.84	54	90		
Horn shape	Straight	439	79.53	38	63.33	7.98	0.05
	Curved	79	14.31	16	26.67		
Horn orientation	Tips pointing laterally	233	42.21	31	51.67	23.68	<.0001
	Upward	209	37.86	16	26.67		
	Forward	76	13.77	7	11.67		
Hump size	Small	552	100	-	-	603.05	<.0001
	Medium	-	-	34	56.67		
	Large	-	-	26	43.33		
Hump shape	Erect	552	100	40	66.67	189.90	<.0001
	Dropping	-	-	20	33.33		
Hump position	Thoracic	47	8.51	60	100	313.44	<.0001
	Cervico-thoracic	505	91.49	-	-	-	-
Dewlap size	Small	91	16.49	-	-	0.53	0.46
	Medium	282	51.09	29	48.33		
	Large	179	32.43	31	51.67		
Backline profile	Straight	139	25.18	55	91.67	114.43	<.0001
	Slope up toward rump	400	72.46	-	-		
	Dipped	13	2.36	3	5		
	Slope down from wither	-	-	2	3.33		
Rump profile	Flat	53	9.60	4	6.67	0.55	0.46
	Sloppy	499	90.40	56	93.33		

Frq=frequency; P<0.05 shows the significant difference

The difference in categorical traits between male and female of Ogaden cattle breed can be associated with difference in socio-economic preference to male and female practiced by the cattle owners in the study area. This agree with the report by FAO (2012) that explained that traditional populations/ local breeds which are managed by farmers and pastoralists at low selection intensity often exhibit large inter-population diversity and with the report by "The Cattle Site" that said the Boran male and female show marked dimorphism.

Female of Ogaden cattle breed were similar in their body conformation to Kennan and Butana cattle breed of Sudan, but different from Abigar cattle, Borena, N'Dama, Shuwa cattle, Gudali cattle as reported by AGTR, 2009. Also, females were comparative in their coat color, muzzle color and rump profile to Boran cattle breed, but different in their coat color from Barotse, Butana, Danakil cattle, Ghana Sanga cattle, Sahiwal, N'Dama, Sheko cattle, Shuwa cattle, Short horn Ankole, and White Fulani cattle breeds. Bulls of the breed were similar in their coat color to Boran, Ghana Shorthorns, Sokoto Gudali, Winam cattle. They were similar to Boran cattle breed found in Ethiopia, Kenya and Somalia in their body conformation, muzzle color and rump profile and Boran, Butane and Sahiwal cattle breeds based on their hump position (Mekonnen Haile-Mariam et al., 2010 and AGTR, 2009).

3.2. Quantitative Traits (Linear Body Measurement) of Ogaden Cattle Breed

Table 2 shows the mean of linear body measurement of Ogaden cattle breed by sex. For females, the mean height at wither was 112.66 cm, rump height was 121.35cm, heart girth was 161.20 cm, flank girth was 162.10 cm, the body length was 121.28 cm, rump length was 42.30 cm, rump width was 49.67 cm, muzzle circumference was 53.40 cm. For male, the mean height at wither was 123.18 cm, rump height was 125.06 cm, heart girth was 170.91 cm, flank girth was 169.20 cm, the body length was 125.16 cm, rump length was 43.83 cm, rump width was 58.18 cm, muzzle circumference was 58.88 cm. Significant differences were observed on most of linear body measurement between female and male Ogaden cattle breed.

Table 2: Linear body measurement of Ogaden cattle breed by sex

Body measurements	Sex					
	Female			Male		
	N	Mean	SD	N	Mean	SD
Height at wither (cm)	552	112.66^{b}	7.07	60	123.18^{a}	4.57
Rump height(cm)	552	121.35^{b}	6.75	60	125.06^{a}	5.43
Heart girth(cm)	552	161.20^{b}	6.75	60	170.91^{a}	5.53
Flank girth(cm)	552	162.10^{b}	6.75	60	169.20^{a}	5.39
Horn length(cm)	518	10.75^{b}	3.85	42	8.40^{a}	2.49
Body length(cm)	552	121.28^{b}	6.75	60	125.16^{a}	5.39
Neck length(cm)	552	42.37^{a}	1.69	60	42.53^{a}	1.83
Ear length(cm)	552	25.83^{b}	3.64	60	31.11^{a}	1.20
Tail length(cm)	552	131.11^{b}	6.90	60	138.18^{a}	2.21
Rump length(cm)	552	42.30^{b}	1.66	60	43.83^{a}	0.82
Rump width(cm)	552	49.67^{b}	5.58	60	58.18^{a}	1.94
Muzzle circ.	552	53.40^{b}	5.65	60	58.88^{a}	1.54

Means with different letter are significantly different; N=number of observation; SD=standard deviation

Most quantitative traits are dependent on the type of production environment in which animals are kept (FAO, 2012). The average height at wither for female was 112.66cm, which

is greater than the reported by Alsiddig et al. (2010) for Nyalawi cattle (121.75 cm) and for Mesairi cattle of Sudan zebu (119.37 cm) and by AGTR, 2009 for Ghana sanga (112.5cm), Ghana short horn (111.5cm), N'Dama (100cm), sheko cattle (105cm), Winam cattle (109.5cm) and less than that of butana cattle (144cm), kenana (131cm), Barotse (121cm), Danakil (122.5cm), Sahiwal (120cm), Short horn Ankole group (120cm), Shuwa cattle (126.5cm), Sokoto Gudali (124cm), and White Fulani (130cm).Similarly, the average height at wither for male was 123.18 cm which is greater than Short horn Ankole group and N'Dama cattle (120cm), and Winam cattle (113.5cm), but less than reported for Butana cattle (151cm), kenana (140cm), Barotse cattle (128.5cm), Danakil (135cm), Sahiwal (136cm), Shuwa cattle (137.5cm), Sokoto Gudali (134cm). The average heart girth of the breed was greater than the reported by Alsiddig et al. (2010) for Nyalawi cattle (155.94 cm) and for Mesairi cattle of Sudan zebu (148.50 cm) and by AGTR, 2009 for Ghana Shorthorn (143cm) and Sheko cattle (136.7cm). Likewise, the average body length of the breed was greater than that of reported by AGTR, 2009Ghana Shorthorn (117cm) and Sheko cattle (102cm) but less than by Alsiddig et al. (2010) for Nyalawi cattle (134.42 cm) and for Mesairi cattle of Sudan zebu (132.89 cm). The average rump width for female and male cattle of Ogaden breed was 49.67cm and 58.18cm, respectively, which was greater than the reported by Alsiddig et al. (2010) for Nyalawi cattle (31.57 cm) and for Mesairi cattle of Sudan zebu (28.77 cm).

Figure 2: Ogaden cow in her natural environment

Figure 3: Ogaden bull in its natural environment

3.3. Adaptive Traits of Ogaden Cattle Breed

The cattle keepers have reported that their cattle show slow loss in body condition when feed scarce and slow increase when feed is adequate. The cattle keepers have recalled that cattle can consume the poorest quality feed stuff never imagined to be consumed by other cattle breed in the world (see the figure below). This can indicate the high adaptive potential of Ogaden cattle breed to low quality feed stuff.

Figure 4: Ogaden cattle breed feeding on their natural range land

In the current study, the adaptive feature of the breed shown in the Figure 4 indicates that the Ogaden cattle breed has lower maintenance requirement, higher forage efficiency, and higher resistance to environmental stress. The current study supported by the study by Okomo (2002) who reported that indigenous cattle in tropical Africa were adapted to survive and reproduce under harsh environments of the region as they possess valuable traits to utilize poor-quality feeds. Locally adapted breeds often have characteristic features (for in- stance salt tolerance) allowing them to survive in harsh conditions and thrive on the poor feed resources of those lands that are unsuitable for crop production (Leroy et al., 2016).

The cattle breed survive, produce and reproduce under poor heat stress management system in long dry season and others like stocking in the open dungy fenced area all class together (see the figure below).

Figure 5: Cattle in the yard

3.4. Daily Milk Yield of Ogaden Cattle Breed

Average milk production of Ogaden cattle is presented in Table 5. The mean daily milk yield in the study area was 2.72 ± 1.29 kg which was harvested after 1.46 ± 0.50 minutes partial suckling before milking and 2.95 ± 0.51 minutes hand milking.

Table 3: Mean daily milk yield of Ogaden cattle

Daily Milk yield	*N*	*Mean*	*SD*
Daily milk yield in (kg)	*126*	*2.72*	*1.29*
Time spent on partial suckling before milking(minutes)	*126*	*1.46*	*0.50*
Time spent on milking(minutes)	*126*	*2.95*	*0.51*

N=number of cows; SD =Standard deviation

Ogaden cattle was reported to produce relatively higher milk yield than the local breed in the region based on the estimate by weight-suckle-weight method and comparable to the yield of the zebu breed based on the estimate by hand milking (Mummed 2013). The average milk yield of cows in their natural grazing environment in the dry season in the present study were lower than the 5.14 kg of milk yield of weight-suckle-weigh reported by Mummed (2012); and by Niraj Kumar et al. (2014) who reported that the peak-yield of milk of indigenous and crossbred cattle reared under private dairy unit in and around Gondar, Ethiopia was 6.9 liters. But, it was higher than 2.09 kg estimated by hand milking by Yesihak, (2011); by Assefa et al. (2015) who explained that the milk potential of Ethiopian indigenous cattle is estimated to be 1.32 liter /cow per day and by Wondossen Ayalew and Tesfaye Feyisa (2017) who reported that the overall least squares mean of morning and evening milk yield of Guraghe highland in the follow up study were 0.99±0.02 and 0.73±0.02, respectively. The difference in milk yield might be due to the difference in season, production environment, and cow management practices.

3.5. Reproductive Traits of Ogaden Cattle Breed

Reproductive feature of Ogden cattle breed is presented in Table 8. The mean age at weaning was 9.98± 0.95 months for female whilst 9.93 ± 0.84 months for male. The mean age at first calving was 53.39 months. Abortion was very rare; mean of (0.35) in the Ogaden cattle breed. The mean of calves born was 3.84 ± 1.50 and the mean of calves weaned was 3.76 ± 0.54. The mean age at which the bulls were allowed to mate for first time was 54.87 ± 4.79 months.

Table 4: Mean reproductive performance of Ogaden cattle

Reproductive performance of Ogaden cattle	Female			Male		
	N	Mean	SD	N	Mean	SD
Age at weaning (months)	126	9.98	0.95	60	9.93	0.84
Age at first calving (months)	126	53.39	5.35	60	-	-
Number of calf born	126	3.84	1.50	60	-	-
Number of abortion	126	0.35	0.68	60	-	-
Number of calves weaned	126	3.76	0.54	60	-	-
Age the bulls allowed to mate for first time(months)	126	-		60	54.87	4.79

N= Number of observation; SD= Standard deviation

The Figure 6 in the present study shows that the breed has higher mothering ability and reproductive efficiency. The good mothering ability of the breed in the figure 6 in the present

study coincides with by Mummed (2013) which reported that the behavior of the cows reflected by allowing her calf to suckle, protecting, licking soon after parturition and allowing the calves to suckle for relatively longer minutes before milking. The mean age at first calving observed for the breed in the present study were higher than the 49 months reported by Getenet et al., (2009) at research station of Haramaya University and age at first calving reported for Kenyan Boran cattle (36.4 months) by Azage et al. (2011) and the report by Assefa et al. (2015) for Simada cattle (40.74 months). In contrast, the age at first calving of Ogaden cattle breed was lower that the reported for Fogera breeding females (59.9 months) by Damitie (2015).This could be due to the difference in management environment of the breed.

Figure 6: Cow of Ogaden cattle breed with her an hour old male calf

Figure 7: Female herd of Ogaden cattle breed in their natural habitat

Figure 8: Male herd of Ogaden Cattle breed

4. Conclusion

Distinct phenotypic characteristics can be observed among individuals of different sex within the breed on its natural production environment. It was concluded that the females have distinct phenotypic characteristics than males; indicated that separate preference to sex by cattle keepers indirectly affected phenotypic difference within Ogaden cattle breed in their natural production environment. Ogaden cattle breed can be genetically best selected for genetic improvement intervention in arid tropics. Renaudeau et al. (2012) reported that genetic selection for heat tolerance is one of the effective strategies to alleviate heat stress under hot climatic conditions. Ethiopian zebu cattle inhabit in all parts of the country and high production levels in dry environmental conditions and high temperatures have made them more appealing to the local farmers (Berhane Hagos, 2016).

The current study shows that Ogaden cattle breed was distinct cattle breed in East Africa. The present finding agree with the finding by Pal SK and Mummed YY (2014) who reported that Ogaden cattle breed exhibit high degree of heterozygosity values of hemoglobin variation. This is supported by FAO (2012) that reminded that some animals may belong to (relatively) homogenous groups distinguishable from neighboring populations on the basis of identifiable and stable phenotypic characteristics that warrant them being distinguished as separate breeds. The qualitative, quantitative and adaptive traits observed in the current study showed that Ogaden cattle breed was highly relative to Boran cattle breed that was recognized as Large East African Zebu. High level of similarity between Ogaden cattle breed and Boran cattle was also reported by Getinet and Adebabay (2016) who reported that a typical Boran cattle have white coat color, but mostly they have black or dark- brown shading on the neck, head, shoulders and hindquarter. Okeyo Mwai et.al. (2015) said that the genetic distinctiveness between sub-Saharan Africa cattle breeds remain largely unknown. AGTR, 2009 recalled that animals with Boran genes have a relatively low maintenance requirement. Boran cattle have developed adaptive traits of crucial importance for their survival like the ability to withstand periodic shortage and ability to digest low quality feeds (Mekonnen Haile-Mariam et al.,et al., 2010). Mbole-Kariuki et al. (2014) reported that non-significant genetic differentiation was observed in east African Shorthorn Zebu habituated adjacent geographical locations implies frequent exchanges and/or movements of animals across a geographical area. Therefore, the above facts prefer categorizing Ogaden cattle breed in to large east African Zebu group to Small East African Zebu. Thought the in- situ phenotypic characteristics of Ogaden cattle breed in the present study shows that the productive, reproductive and adaptive potential of the breed relatively similar to Boran cattle breed, for the fact that they are kept in distinct geographical location, under distinct management practices, and near complete reproductive isolation for many generations and the uses to which the cattle are put, they can be recognized as separate cattle breed and should not be assigned to previously recognized Boran cattle breed. This is supported by FAO (1999 cited in FAO, 2012) which defined a breed as either a sub-specific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within the same species or a group for which geographical and/or cultural separation from similar groups has led to acceptance of its separate identity.

References

1. Alsiddig, M.A, Babiker. S.A., Galal, M.Y. and Mohammed A.M 2010. Phenotypic Characterization Of Sudan Zebu Cattle (Baggara Type)
2. Animal Genetics Training Resource (AGRT). 2009. Revisited, Zebu cattle breed web site (http: //agtr. Ilri.cgiar.org/index.php?) Accessed on 14 Apr 2018.
3. Assefa Getie, Mussie Hilemelekot, Mengistie Taye, Zewdu Wuletaw and Assemu Tesfa 2015. A Survey On Breeding Practice, And Productive Performance Of Simada Cattle In Tach Gayint District, Ethiopia. *Journal Of Life Science And Biomedicine*. 5(6): 171-180.
4. Azage Tegegne Aynalem Haile, Workneh Ayalew, Noah Kebede and Tadelle Dessie, 2011. Breeding strategy to improve Ethiopian Boran cattle for meat and milk production. International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia
5. Berhane Hagos 2016. Ethiopian Cattle Genetic Resource and Unique Characteristics Under A Rapidly Changing Production Environment-A Review.
6. ChenchaChebo and KefyalewAlemayehu. 2012. Trends of cattle genetic improvement programs in Ethiopia: *Challenges and opportunities*. Bahir Dar University, Ethiopia.
7. D Renaudeau; Anne Collin; Shlomo Yahav; Robert J Collier, 2012. Adaptation to Hot Climate and Strategies to Alleviate Heat Stress in Livestock Production. Doi: 10.1017/S1751731111002448. Source: Pubmed
8. Damitie Kebede, Kefyalew Alemayehu And Endalkachew Girma, 2015. Reproductive And Productive Performance of Fogera Cattle In Lake Tana Watershed, North Western Amhara, Ethiopia. Journal of Reproduction And Infertility 6 (2): 56-62, 2015 Issn 2079-2166.
9. Ethiopian Society of Animal Production (ESAP). 2013. *Farm Animal biodiversity in Ethiopia*: Status and prospects*: ESAP-Proceedings 21Proc.*
10. FAO 2012: Phenotypic Characterization of Animal Genetic Resources. *Animal Production and Health*: *Guideline: No.11*.Rome.
11. Getinet Mekuriaw and Adebabay Kebede. 2016. A Review on Indigenous Cattle Genetic Resources In Ethiopia: *Adaptation, Status and Survival. Science line Publication Issn* 2251-9939
12. Gregoire Leroy; Roswitha Baumung; Paul Boettcher; Badi Besbes; Irene Hoffmann, 2016. Animal Genetic Resources Diversity And Ecosystem Services.
13. M N Mbole-Kariuki, T Sonstegard, A Orth, S M Thumbi, B M De C Bronsvoort, H Kiara, P Toye, I Conradie, A Jennings, K Coetzer, M E J Woolhouse, O Hanotte & M Tapio, 2014. Genome-Wide Analysis Reveals The Ancient And Recent Admixture History Of East African Shorthorn Zebu From Western Kenya.
14. Margaret Okomo. 2002.Characterization of genetic diversity in indigenous cattle of East Africa: Use of microsatellite DNA techniques .International Livestock Research Institute (ILRI), Nairobi, Kenya
15. Mekonnen Haile-Mariam, Birgitta Malmfors and Jan Philipsson. 2010. Boran: Indigenous African Cattle with Potential
16. Mekuriaw G, Ayalew W, Hegde PB, 2009. Growth and Reproductive performance of Ogaden cattle at Haramaya University, Ethiopia. EJAP. 9(1):13–38.
17. Mummed Yy (2012) Milk Yield Estimation Of Ogaden Cattle Breed Based on Methods Of Weigh–Suckle Weigh And Calves' Growth.
18. Mummed YY. 2012. Milk yield estimation of Ogaden cattle breed based on methods of weigh–suckle–weigh and calves' growth. *Tropical Animal Health and Prod*. 44:785–790. doi: 10.1007/s11250-011-9968-0
19. Mummed, Yesihak Yususf 2013. Correlation between milk suckled and growth of calves of ogaden cattle at one, three and six months of age, east Ethiopia. *SpringerPlus* : 2:302 doi:10.1186/2193-1801-2-302.
20. Niraj Kumar; Alemayehu Eshetie; Abreha Tesfaye Genzebu; Hailelule Aleme Yizengawproductive Performance Of Indigenous And Hf Crossbred Dairy Cows In Gondar, Ethiopia. Veterinary World 7(3):177-181. Doi: 10.14202/Vetworld.2014.177-181

21. Okeyo Mwai, Olivier Hanotte, Young-Jun Kwon, And Seoae Cho 2015. African Indigenous Cattle: Unique Genetic Resources In A Rapidly Changing World. Asian-Australas J Anim Sci.; 28(7): 911–921.Doi: 10.5713/Ajas.15.0002r
22. Pal SK and Mummed YY. 2014. Investigation of hemoglobin polymorphism in Ogaden cattle, *Veterinary World* 7(4): 229-233.
23. Statistical Analysis system (SAS) 2008 version 9.2
24. The Cattle Site, 2000-2014 – Cattle Health, Welfare and Diseases News 5m Publishing, Benchmark House, 8 Smithy Wood Drive, Sheffield, S35 1QN, England (Accessed on 14 Apr 2018).
25. Wondossen Ayalew and Tesfaye Feyisa 2017. Productive and Reproductive Performances Of Local Cows In Guraghe Zone, South West Ethiopia.
26. Yesihak YM. 2011. Milk yield of Ogaden Cattle at Haramaya University, Eastern Ethiopia.
27. YesihakYususf Mummed. 2013. Milk yield estimation of Ogaden cattle breed on method of weigh-suckle-weigh and calves' gowrth. School of Animal and Range Science, Haramaya University, Eastern Ethiopia.

Related web sites

www.irli.org/infoserv/webpub/fulldocs/zebu cattle/2.background.html); IRLI.
www. *Boran Cattle. Cattle Breeds. Oklahoma State University*

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