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MORPHOMETRIC DIFFERENTIATION OF SELECTED INDIGENOUS CATTLE BREEDS IN NIGERIA

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SUMMARY

In Nigeria, population characteristics of selected indigenous cattle breeds have not been fully documented. Therefore, morphometric attributes of selected indigenous cattle breeds in Nigeria were assessed. Three hundred and one White Fulani (WF), 242 Red Bororo (RB), 247 Sokoto Gudali (SG), 233 Bornu Kuri (BK) and 184 Muturu cattle in the age group of 3 to $3^{1}/_{2}$ years were purposively sampled. Eighteen morphometric parameters were measured using standard procedures. Data were analysed using descriptive statistics, ANOVA at $\alpha_{0.05,}$ cluster analysis and Euclidean genetic distance. Differences existed in face length, rear leg length; wither height and rump height among the breeds.

INTRODUCTION

One of the ways of characterizing livestock breeds is to evaluate their morphostructural characteristics and determine genetic distance among contemporary populations (Metta *et al.* 2002). The initial step in characterization is identification of distinct populations using information on their geographic and ecological isolation, traditional nomenclature (traditionally, recognized populations), phenotypic distinctness and level of genetic differentiation among the population (Gizaw *et al.* 2011). Indigenous cattle breeds are important to preserve as they are well adapted to local climates, food supply and other local environmental factors, which often shows in their robustness and hardiness. Indigenous livestock resources are also strategic in the socio-economics of rural agricultural systems to ensure food security in developing countries. The selected cattle breeds are found throughout Nigeria but are most common in the northern part the country.

The wither height and rump height among these breeds differentiated them. This study is designed to unveil the phenotypic and genetic diversity among selected Nigeria indigenous cattle breeds using primary data obtained from field morphological survey to assess diversity of the selected indigenous populations in order to update published variations as well as document genetic distances between the populations.

MATERIALS AND METHODS

Data Collection. Animals were sampled from four different isolated areas where they were abundant in Nigeria. Each location was divided into clusters of ten units for easy measurements and adult animals that were within the age bracket of 3 to $3^{1}/_{2}$ years were sampled. A total of 1,207 indigenous cattle comprising 301 White Fulani 247 Sokoto Gudali, 242 Red Bororo, 233 Bornu Kuri and 184 Muturu were sampled.

Eighteen linear body measurements (cm) were taken on each sampled animal with the use of a measuring tape (Table 1). Quantitative variables measured in this study were adapted from the standard

cattle descriptor list (FAO 2002) and a final list of variables were developed and used. Documented morphological features described by (Hall 1991) were used as base line markers to ascribe sampled animals to a breed. Individuals that did not strictly conform to primary breed characters; visibly pregnant, sick and castrated animals were excluded.

Statistical Analysis. Data collected were subjected to Generalized Linear Model Analysis of Variance (ANOVA) procedure of the Statistical Analysis System (SAS 2002) and cluster analysis of Palenotological Statistics (PAST). East Square Means (x) and Standard Error (SE) associated with each linear body measurements were estimated. Genetic distances among the five breeds based on their actual morphometric variables measured were calculated using Euclidean genetic distance measure. The statistical model used for analyzing quantitative phenotypic variations among the breed populations was as follows:

$$Y_i = \mu + B_i + e_i$$

where Y_i are the observed body measurements, μ is the overall mean, B_i is the fixed effect of breed ($i = 1,2,..5$) and e_i is the standard error.

RESULTS AND DISCUSSION

Mean values of morphological variables and their SE are depicted in Table 1 for aggregated gender. Pairwise mean comparison showed significant differences for most of the morphological variables among the breeds. Morphological variables such as wither height, rump height, body length, and tail length were significantly higher ($P<0.05$) for White Fulani and Sokoto Gudali as compared with any other breeds considered in this study. Muturu breeds were significantly ($P<0.05$) larger for face length and head width than other four breeds.

The genetic distance among the cattle population ranged from 43.77 to 145.52 (Table 2). The longest genetic distance was observed between Bornu kuri and Muturu while the shortest distance was observed between Red Bororo and Bornu Kuri. The cluster analysis generated showed two main clusters having Muturu in a cluster and White Fulani, Sokoto Gudali, Bornu Kuri and Red Bororo in the other.

The significantly higher values for most of the morphometric measurements of White Fulani, Sokoto Gudali, Red Bororo and Bornu Kuri that were predominantly in the northern part of the country than Muturu that is predominantly in southern part of the country seem to be an adaptation where tallness (wither height) and large body size (heart girth and body length) are suitable for trekking long distances to water and grazing points and this is in agreement with what Nwacharo (2006) and Hall (1991) reported. These observations could be as a result of genetic and species differences. The differences in body measurements of the five cattle breeds with respect to some morphological variables indicates that the five cattle breeds were sub-divided into distinct populations perhaps due to differences in availability of feed resources, breeding practices used and inherent genetic differences (Nwambene *et al.* 2012).

Table 1. Means of body measurements (±SEM) amongst the five cattle breeds

	WF±**SEM**	SG±**SEM**	RB±**SEM**	BK±**SEM**	MU±**SEM**
FL	49.37±0.44^{b}	47.51±0.36^{c}	40.35±0.33^{c}	45.44 ±0.57^{d}	54.03±0.39^{a}
HW	22.62±0.16^{c}	22.57 ±0.15^{c}	21.21±0.14^{d}	24.11 ±0.18^{b}	28.53 ±0.68^{a}
HL	45.16 ±0.84^{a}	4.56 ±0.44^{d}	38.05 ±0.32^{b}	38.39 ±0.57^{b}	8.30 ±0.35^{c}
EL	23.86±0.52^{a}	24.17 ±0.65^{a}	24.07 ±0.52^{a}	24.17 ±0.56^{a}	14.61 ±0.24^{b}
NL	54.56±0.58^{a}	51.34 ±0.41^{b}	38.97±0.40^{c}	38.79 ±0.51^{c}	25.40 ±1.09^{d}
NC	54.71±0.51^{c}	59.08 ±0.51^{b}	76.85 ±0.32^{a}	77.75 ±0.81^{a}	60.93 ±0.18^{b}
WH	130.39±0.21^{a}	129.21 ±0.23^{a}	125.65 ±0.11^{b}	125.18 ±0.15^{b}	82.41 ±0.07^{c}
FLL	78.39±0.45^{b}	80.39 ±0.45^{b}	85.96 ±0.41^{a}	87.59 ±0.43^{a}	56.71 ±0.25^{c}
HG	83.20^{c} ±0.18^{c}	95.92 ±0.28^{b}	144.41 ±0.12^{a}	144.40 ±1.12^{a}	57.03 ±0.43^{d}
BL	116.45±0.11^{a}	116.03 ±0.08^{a}	111.17 ±0.06^{b}	112.64 ±0.41^{b}	73.55 ±0.21^{c}
RH	135.40 ±0.17^{a}	134.22 ±0.21^{a}	130.59 ±0.09^{b}	131.53 ±0.50^{b}	88.46 ±0.54^{c}
RL	30.56±1.19^{a}	30.58 ±0.26^{a}	31.03 ±0.75^{a}	30.97 ±0.21^{a}	20.89 ±0.41^{b}
RLL	105.45±0.21^{a}	105.41 ±1.01^{a}	104.64 ±0.19^{a}	105.06 ±1.17^{a}	73.93 ±0.63^{b}
TL	96.10 ±0.49^{a}	94.98 ±0.36^{a}	91.89 ±0.17^{b}	91.30 ±0.14^{b}	55.98 ±0.41^{c}
SC	25.06 ±0.43^{a}	24.75 ±0.39^{ab}	24.66 ±0.22^{ab}	24.40 ±0.08^{b}	21.86 ±0.14^{c}
HoL	50.90 ±1.11^{a}	50.05 ±0.71^{b}	50.07 ±0.47^{b}	49.41 ±0.43^{b}	32.74 ±0.35^{c}
RW	35.19 ±0.56^{a}	35.38 ±0.42^{a}	34.45 ±0.41^{b}	35.18 ±0.20^{a}	28.32 ±0.24^{c}
SW	68.02±0.52^{b}	69.59 ±0.34^{b}	80.89 ±0.46^{a}	81.85 ±0.11^{a}	63.58 ±0.22^{c}

Means with same superscript are not significantly different (P>0.05). SEM = Standard Error Mean
WF =White Fulani, SG = Sokoto Gudali, RB = Red Bororo, BK = Bornu Kuri, MU = Muturu
FL = Face Length, Head Width = HW, Horn Length = HL, Ear Length = ER, Neck Length =NL, Neck Circumference = NC, Wither Height = WH, Foreleg Length = FLL, Hearth Girth = HG, Body Length = BL, Rump Height = RH, Rump Length = RL, Rearleg Length = RLL, Tail Length =TL, Shin Circumference = SC, Hock Length = HoL, Rump Width = RW, Shoulder Width = SW

Table 2. Euclidean genetic distance estimate based on actual measured morphometric variables

	White Fulani	Sokoto Gudali	Red Bororo	Bornu Kuri	Muturu
Sokoto Gudali	54.36	-			
Red Bororo	70.44	65.63	-		
Bornu Kuri	54.54	54.54	43.77	-	
Muturu	114.87	83.86	136	145.52	-

A shorter genetic distance obtained between White Fulani and Sokoto Gudali suggests a close genetic relationship between the breeds while the longer genetic distance was observed between White Fulani and Muturu is an indication that an appreciable heterosis especially with regard to most body measurements which are of economic importance can be obtained by crossing any of the two breeds. The phylogenetic tree separated the five cattle breeds into two main clusters. In addition, the close genetic relationship between the breeds may also be attributed to similarity in ecological zones and production systems as well as the incidents of cross border livestock rustling contributing to the migration and movement of livestock and subsequent interbreeding between such livestock, this in agreement with had been reported by (Nwacharo *et al.* 2006). There were clear disparities in the wither height and body length of the five breeds. White Fulani was found superior to any of the other four breeds studied. Genetic distance based on morphological indices among the breeds as revealed by the cluster analysis showed that the breeds were genetically distinct.

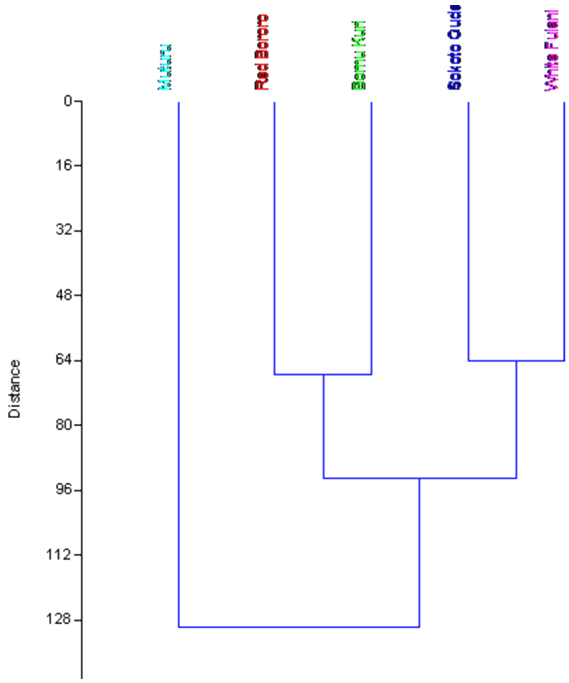

Figure 1. Dendogram showing genetic relationship among five indigenous cattle from Nigeria

CONCLUSIONS

Morphometric attributes are very good tools in differentiating cattle on the basis breeds. The closer genetic relationship among White Fulani, Sokoto Gudali, Red Bororo and Bornu Kuri five cattle breeds may be attributed to possible interbreeding among these populations that were predominantly abundant in the northern part of the country forming homogeneous population separated by no physical geographic boundaries.

REFERENCES

FAO. (2012). FAO Animal production and Health Guidelines No. 11, Rome.
Gizaw S., Komen H., Hanotte O., Van Arendonk J.A.P: Kemp S., Aynalem H. Mwai Ol and Dessie, T. (2011) ILRI Research Report No. 27. Nairobi, Kenya. ILRI.
Hall S.J.G. (1991) *Anim. Prod. (UK)* **53***:* 61.
Metta M., Kanginakudru S., Gudiseva N. and Nagaraju, J. (2004) *BMC Genetics* **5***:*16.
Mwacharo J.M., Okeyo A.M., Kamande G.K. and Rege J.E.O. (2006) *Trop. Anim. Health Prod.* **38***:* 65.
Mwambene P.L., Katule A.M. Chenyambuga S.W. and Mwakilembe P.A.A. (2012) *AGRI.* **51**: 51.
SAS. (2002). User's guide: Statistic. SAS institute Inc. Cary, North Carolina, USA.