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Phenotypic Characterization of the Bunaji Cattle Breed in Oyo State, Nigeria

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ABSTRACT

Nine body measurements of 859 (401 females and 458 males) Bunaji cattle of various ages (1 - >4 years) were collected over a period of 4 months (July - October) at the Bodija livestock and Akinyele international livestock markets in Ibadan, Oyo state of Nigeria. The parameters measured were head to shoulder (HTS), shoulder to tail drop (STD), body length (BLT), heart girth (HTG), height at withers (HTW), canon circumference (CCR), tail length (TLT), horn length (HLT) and ear length (ELT). Phenotypic traits such as dewlap, coat color, horn type, ear type, hump type and navel flap were also examined by visual assessment. The means and standard deviations obtained for the body measurements were 120.18 ± 7.94, 145.99 ± 14.28, 47.31 ± 6.71, 117.35 ± 12.36 and 37.08 ± 14.11 for HTW, HTG, HTS, STD and HLT respectively. The coefficient of variation of the body dimensions were high ranging from 6.60% for HTW to 39.44% for HLT. Sex of the animal had no significant ($p>0.05$) effect on the body dimensions. Correlation coefficients for the relationship between body measurements ranged from 0.06 (HTS and STD) to 0.89 (STD and BL) for the males and 0.04 (HTS and STD) to 0.89 (STD and BL) for female. The high and significant relationship ($p<0.01$) between HTW, BLT and HTG indicates that the total size of an animal is a function of length, height and circumference measurements and selection for one could lead to selection for the other resulting in animals with good beef conformation. The phenotypic traits observed indicated that Bunaji breed of cattle were predominantly white (78%) in color, while grey and pied are less common (2 and 1% respectively). Ear type was medium and erect with dewlap and penile sheath being prominent.

Key words: Phenotypic, characterization, Bunaji cattle

INTRODUCTION

Cattle are the single most important livestock species in Nigeria in terms of supply of animal protein, value and biomass. They supply meat and milk but also skin, bones, blood and horns and are used for draught. They are of great genetic diversity having long adapted to the stressful environmental conditions of poor nutrition, inclement climate and myriad of diseases. Meghen *et al.* (1994) reported that animals can be characterized based on their phenotypic and/or genetic traits. The commonly used phenotypic characters include coat color, horn (shape and size), hair, live weight and body measurements. Rege and Agyemany (1992) reported characterization based on quantitative criteria such as body measurements and other phenotypes and concluded that within population variability can be greater than between population variability. Morphometric characters are easy to monitor and they facilitate the use of ethnological characterization and at the same time institute reliable racial discriminants (Herrera *et al.,* 1996). Numerous studies have examined various body dimensions of beef cattle to describe more thoroughly biological variation and to interpret the relationship with measures of performance, productivity and carcass characteristics (Gilbert 1993). Body measurements of beef cattle are used for several purposes including; prediction of growth rate, body conditions, conformation, carcass trait and pattern of development in cattle (Wilson *et al.*, 1997 and Sharples and Dumelow, 1990). Available literature on phenotypic characterization of the Bunaji cattle breed in Nigeria are few. This study was aimed at examining the phenotypic characteristics of the Bunaji cattle breed, the most numerous cattle breed in Nigeria (RIM, 1992).

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The study is hoped to give a better understanding of the physical characteristics of the breed and also the relationship between the morphometric measurements.

MATERIALS AND METHODS

The data for the experiment were collected from Bodija and Akinyele international livestock markets located in Oyo State of Nigeria. Oyo State is located on a forest-grass land boundary on longitude $3^{o}54^{1}$E and latitude $7^{o}23^{1}$N of the equator. It is a central cattle market for Oyo State and a few neighboring states in the Southwest.

The study areas (Bodija and Akinyele stock markets) are in the derived Savanna region characterized by two well-defined seasons – wet and dry. Two opposing winds, the Northeast trade wind and southwest monsoon winds control the annual rainfall pattern. The rainfall in the region is between 1000 – 1250mm and the distribution of rain is markedly bimodal with a temporary cessation in August. The rains cover the months of April to October while the dry season is between November and March.

Data on Eight hundred and fifty nine (859) Bunaji cattle comprising 401 females and 458 males were collected between July and October. The data include phenotypic traits such as, color, sex, hump type, dewlap, Navel flap, horn type, ear type, horn length, ear length while body measurements were height at withers (HTW), horn girth (HTG), canon circumference (CCR), Body length (BLT) shoulder to tail drop (STD), tail length (TLT) and head to shoulder (HTS). Phenotypic traits were determined by visual observation. Body measurements were taken with a flexible tape and a calibrated measuring stick. In order to ensure accuracy in taking measurements, it was ensured that the animals were standing relaxed and on level ground as much as possible so as to prevent anatomical distortions which can alter the measurement.

The measurements as described by Brown *et al.* (1983) are as follows, ear length (ELT): the distance from the tip of the ear to the base of the ear; horn length (HLT): the distance from the tip of the horn to the base of the horn; height at withers (HTW): this is the vertical distance from the floor beneath the animal to the point of the withers. It was measured with a measuring stick with a sliding arm; heart girth (HTG): this is the narrowest circumference immediately posterior to the front legs; canon circumference (CCR): this is the narrowest circumference of the canon bone; shoulder to tail drop (STD): this is the distance from the point of the shoulder to the pin bones; body length (BLT): the distance on the dorsal midline from the top of the head to the pin bones; and head to shoulder (HTS): this is the distance from the top of the head to the point of the withers.

Descriptive statistics, mean, standard deviation, standard error and coefficient of variation were obtained by the means procedure of SAS (1999). The general linear model of SAS (1999) was used to evaluate the effect of sex on the body measurements.

The Pearson correlation coefficients between all pairs of the variables were estimated using the correlation procedure of SAS (1999).

RESULTS AND DISCUSSION

Descriptive statistics as shown in Table 1 indicates high variation in the body measurements. Only canon circumference (CCR) and ear length showed narrow deviation from their means. The highest coefficient of variation (39.44%) was observed in horn length while height at withers had the lowest coefficient of variation (6.61%). The high CV for the measurements may be an indication that such body measurements have not been artificially selected for and as such, a rapid progress will be expected in selection. The means for heart girth and height at withers (145.99 cm and 120.18 cm respectively) are consistent with those of Buvanendra *et al.* (1980), who reported means of 148.4 cm and 118.1 cm for heart girth and height at withers respectively.

Least squares means and standard error of the effect of sex on the body measurements (Table 2) showed that sex had no significant ($p>0.05$) effect on body measurements, though males consistently had slightly higher values than females except for hear girth probably due to larger gut fill. This agrees with the report of Oni et al. (1990) and Mbap and Bawa (1998). The means of HTG, HTW, BLT for female animals obtained in this study were consistent with those of Tawah and Rege (1996). Hall (1999) and F.A.O. (2002) Mbap and Bawa (1998) and Payne and Wilson (1999) obtained higher values for the body measurements of the two sexes.

The interrelationship among body size variables is presented in Table 3. The relationship between the body measurements were high, positive and significant ($p<0.01$), except that between HTS and STD, HTS and TLT and HTS and ELT for the female population which were not significant while HTS and CCR for female and HTS and TLT for male and pooled population were significant. ($p<0.05$). The correlation coefficients ranged from 0.066 (HTS and STD) to 0.899 (STD and BL) for male, 0.042 (HTS and STD) to 0.899 (STD and BL) for female and 0.055 (HTS and STD) to 0.899 (STD and BL) for the pooled population. The results of this study agree with those of Buvanendran *et al.* (1980) who obtained correlation values of 0.85, 0.80 and 0.69 for HTG and HTW, HTG and BL and HTW and BL respectively in White Fulani cattle. The very high relationship between HTW and HTG indicate that height and circumference size were complementary as such selection for higher HTW will lead to a

better frame (larger heart girth) in beef cattle while the high significant ($p<0.01$) relationship between STD, HTW, BL and HTG presupposes that the total size of an animal is a function of length, height and circumference measurements. This agrees with the reports of Enevoldsen and Kristensen (1997) and Orheruata and Olutogun (1994).

Table 1. Descriptive statistics of the body measurements (cm)

Variable[1]	Mean	SD	CV (%)
HTW	120.18	7.94	6.60
HTG	145.99	14.28	9.78
HTS	47.31	6.71	13.03
STD	117.35	12.36	10.51
BLT	164.86	14.11	8.56
CCR	22.33	1.98	8.85
TLT	95.53	10.67	11.17
HLT	37.08	14.62	39.44
ELT	21.54	2.08	9.70

N = 859; [1]HTW - height at withers; CCR - canon circumference; HTG - hHearth girth; TLT - tail length; HTS - head of shoulder; HLT - horn length; STD - shoulder to tail drop; ELT - ear length; BLT - body length; CV - coefficient of variation

Table 2. Least squares means and S.E. of the effect of sex on body linear measurements

Body measurements	Male (458)	Female (401)
HTW	120.32±0.37[a]	120.00±0.39[a]
HTG	145.94±0.66[a]	146.05±0.72[a]
HTS	47.41±0.28[a]	47.20±0.32[a]
STD	117.95±0.56[a]	117.09±0.83[a]
BL	165.36±0.65[a]	164.29±0.72[a]
CC	22.47±0.09[a]	22.22±0.09[a]
TL	95.77±0.53[a]	95.32±0.50[a]
HL	37.54±0.72[a]	36.57±0.71[a]
EL	21.56±0.10[a]	21.52±0.10[a]

[a]Means with same superscript on the same row are not significant ($p>0.05$) different from each other; [1]HTW- height at withers; CC - canon circumference; HTG - heart girth; TL - tail length; HTS - head to shoulder; HL - horn length; STD - shoulder to tail drop; EL - ear length; BL - body length

The high and significant relationship between length measurements (BL and STD) indicates that any one of them will suffice for length measurement depending on ease of measurement. Head to shoulder consistently had low correlation with other dimensions indicating that its contribution towards total size of an animal might be small. The only exception is BL where the moderate correlation value (0.47) was probably due to the fact that BL measurement includes HTS.

The high correlation between HTW, HTG, BLT and STD obtained in this study and other studies indicate that selection for increase in any of these linear measurements will significantly influence others positively ultimately resulting in an improved beef conformation.

Some qualitative traits of the Bunaji cattle as observed on the field are described in Table 4. Dewlap was prominent in both sexes. This agrees with the reports of Payne and Wilson (1999) and Tawah and Rege (1997). Coat color was predominantly white though colors like black, brown, pied, cream and grey were observed among the animals. 78% of the animals were white, 12% black, and 6% brown while 4% were shared by cream, grey and pied. Tawah and Rege (1996), Mbap and Bawa (1998), and Payne and Wilson (1999) reported white coat color as the most predominant in Bunaji cattle. Ear type was erect in both sexes while hump type was thoracic and well developed in males than females. Tawah and Rege (1996) also reported hump type to be thoracic in both sexes.

Navel flap or penile sheath was prominent in males but narrow in females. This does not agree with the findings of Mbap and Bawa (1998) who reported narrow navel flap in both sexes but it agree with the report of Payne and Wilson (1999) and Tawah and Rege (1996). Horn was medium to long, fine, lyre shaped and turned upwards in females while in male they were medium to long and fine. This agrees with the reports of Mbap and Bawa (1998), Tawah and Rege (1996) and Payne and Wilson (1999) in literature.

Table 3. Pearson correlation coefficients between body linear measurements of Bunaji cattle for male, female and pooled population

	Sex	HTG	HTS	STD	BL	CC	TL	HL	EL
HTW	M	0.858**	0.236**	0.808**	0.807**	0.699**	0.652**	0.546**	0.536**
	F	0.840**	0.178**	0.819**	0.800**	0.668**	0.632**	0.551**	0.441**
	P	0.849**	0.209**	0.813**	0.813**	0.683**	0.642**	0.549**	0.493**
HTG	M		0.221**	0.788**	0.783**	0.779**	0.619**	0.507**	0.445**
	F		0.215**	0.794**	0.794**	0.693**	0.596**	0.473**	0.350**
	P		0.218**	0.790**	0.788**	0.738**	0.608**	0.491**	0.401**
HTS	M			0.066^{NS}	0.495**	0.183**	0.105*	0.187**	0.145**
	F			0.042^{NS}	0.474**	0.101*	0.060^{NS}	0.220**	0.097^{NS}
	P			0.055^{NS}	0.485**	0.143**	0.083**	0.203**	0.122**
STD	M				0.899**	0.654**	0.648**	0.512**	0.454**
	F				0.899**	0.617**	0.637**	0.516**	0.401**
	P				0.899**	0.632**	0.641**	0.513**	0.428**
BL	M					0.650**	0.610**	0.529**	0.460**
	F					0.588**	0.588**	0.549**	0.395**
	P					0.616**	0.598**	0.538**	0.428**
CC	M						0.520**	0.321**	0.435**
	F						0.500**	0.278**	0.368**
	P						0.511**	0.299**	0.404**
TL	M							0.457**	0.337**
	F							0.394**	0.330**
	P							0.427**	0.333**
HL	M								0.227**
	F								0.295**
	P								0.256**

^{xx}p<0.01; ^{X}p<0.05; ^{NS} = not significant; [1]HTW- height at withers; CC - canon circumference; HTG - heart girth; TL - tail length; HTS - head to shoulder; HL - horn length; STD - shoulder to tail drop; EL - ear length; BL - body length

Table 4. Description of some phenotypic characteristics observed in the animals (n = 859)

Trait	Description
Dewlap	Prominent in both sexes though not as large as those of the Sokoto Gudali
Coat color	Predominantly white though colors like black, brown, pied cream and grey were observed
Ear type	Medium and erect in both sexes
Navel flap/penile sheath	Prominent in male but narrow in females
Hump type	Thoracic and well developed in males compared to the females
Horn type	Medium to long in length, and fine in both sexes and lyre shaped and turned upwards in females

CONCLUSION

From this study, it can be concluded that sex had no significant influence on body measurements as such prediction equation for estimation of weight for one sex can be used for the other. Height at withers, HTG and BLT

or STD describes the conformation of an animal in terms of height, length and circumference. The very high and significant relationship between STD and BLT indicates that any one of them could be used as length measurement depending on which is easier to measure. The high and significant relationship between HTG, BLT, HTW and STD shows that selecting for any one of these measurements could increase the others.

Finally, on the field, Bunaji cattle can be differentiated easily from other breeds by reference to horn (size and shape), coat colour, nature of the hump, dewlap, navel flap, and ear type.

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