PRE-AND POST-WEANING PHENOTYPIC RELATIONSHIP BETWEEN SOME N'DAMA CATTLE LINEAR MEASUREMENTS IN THE TROPICS

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ABSTRACT

Data collected on 1438 male and 1492 female pure bred N'Dama calves calved between 1948 and 1961 at Fashola Stock farm were used to study the relationship between five N'Dama cattle linear measurements at pre and post weaning ages. The measurements were Head to Shoulder (HDS); Shoulder to tail drop (STD); Height at withers (HTW); Heart girth (HGT) and Body length (BLT). All measurements had positive values which ranged from 0.2 - 91 except HTW and HDS which had a negative value (-02) in males at yearling age. There was a predominance of positive and highly significant relationship ($P < 0.01$) between height measurement (HTW) and circumference measurement (HGT) which ranged from .04 - .76 with pre weaning measurements having higher values (.69 - .76) in both sexes. High and positive correlation values were also observed between length measurements (HDS, STD and BLT) which therefore shows that only one of such measurements is sufficient for length measurement. Generally measurements taken at pre weaning had higher correlation values than those taken at post weaning.

Key Words: Pre and post weaning; N'Dama, linear measurements, tropics.

INTRODUCTION

N'Dama Cattle is one of the trypanotolerant cattle breeds in Nigeria. Its improvement needs no emphasis. In order to obtain a better understanding of the composition and developmental patterns of the breed, information on phenotypic characterisation will be useful. Monitoring of changes that may occur in their developmental pattern can aid in

guiding a breeding programme.

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 (Kidwell, 1955; Tallis *et al*, 1959; Brown *et al*, 1973; 1982 Walker 1973; Hammack 1974; Nwosu *et al* 1985; Verma and Hussain 1985; Gilbert *et al* 1993). Because of the multitude of different body measurements available, several researchers used multivariate techniques to simultaneously examine the relationships among body measurements and production traits. A related procedure, canonical discriminant analysis, has been used to examine the between class variation in a system of body measurements as part of an analysis of feeder calf grades and muscling scores but none has been specifically on the relationship that exists between these linear measurements. This study therefore aims at determining the relationship that exists amongst some N'Dama Cattle linear measurements taken at pre and post weaning ages. Such result will determine the most useful measure that would have a high and positive relationship with other measurements that depict the size and shape of the animal such that selection of such measurement will mean selection for other measurements that are highly and positively correlated to such measurement and hence animals with better conformation will be produced.

MATERIALS AND METHODS

The data used for this study were collected from the herd book of Fashola Stock Farm near Oyo in Oyo State. The farm is located on latitude $7^{\circ} 54' N$ and longitude $3^{\circ} 43' E$ in the derived savannah ecological zone. The annual rainfall pattern is controlled by two opposing

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winds, the North-east trade wind and the South-West monsoon winds. It has an average rainfall of 104.5mm with mean temperature and relative humidity of 28.29°C and 67.6% respectively. The rainy period covers the month of April through October while the dry period covers November to March. The number of rainy days varies considerably within months and between years. The amount and distribution of rainfall determines the availability of both forage and water to the animals.

The farm has a grazing land of grass-legume mixture divided into 107 paddocks which are rotationally grazed by animals. The grasses are Elephant grass (*Pennisetum purpureum*), Guinea grass (*Panicum maximum*), Giant star grass (*Cynodon plectostachyus*), Gamba grass (*Andropogon pubescens*) while the legumes are Calopo (*Calopogonium mucunoides*) and stylo (*Stylosanthes gracilis*).

The animals were maintained on paddocks according to sex, age and size. Unrestricted grazing was allowed under the supervision of herdsmen. Stud bulls, cows due for calving in less than six weeks and unthrifty animals were given 0.8kg concentrate feed made up of 12% protein daily in addition to what they could get from the paddocks. Young calves were allowed to run around with their dams until weaned (6-8 months). Routine management operations were carried out.

Data Collection and Analysis.

The data collected were from 1438 male and 1492 female pure bred N'Dama calves calved between 1948 and 1961. The data included five linear measurements. Head to shoulder (HDS); shoulder to taildrop (STD); height at withers (HTW); heart girth (HGT) and body length (BLT) taken at birth and 6 months for pre-weaning ages, 12, 18, 24 and 30 months of age for post weaning ages. The description of the measurements are as follows:

Head to Shoulder:- The distance from the nose to the point of the shoulder

Shoulder to Taildrop:- The distance from the point of shoulder to pin bone.

Height at Withers:- Measured on the dorsal midline at the highest point on the withers.

Heart Girth:- Body circumference immediately posterior to the front leg.

Body Length:- The average of left and right-side measurements of the distance between the nose and the pin bone.

The data set, were analysed using the Pearson Correlation Module according to SPSS (1986) procedure.

RESULTS AND DISCUSSION

Tables 1 and 2 show the mean and standard error of means of the five linear measurements of N'Dama Cattle at pre-weaning and post weaning ages respectively. The mean value for male and female N'Dama Cattle linear body measurements increased with age in a similar manner from birth to 30 months of age but with the highest increase occurring during pre weaning period. The least increase was between 24 and 30 months at post weaning. Although such increase in the measurements with age is expected as the animal is developing but the developmental rate indicates that the highest development was at pre weaning which was almost twice that between weaning and yearling ages. This suggests that the size of an animal at maturity will be dependent upon the developmental rate and the relationship between various linear body measurements at pre weaning ages.

The phenotypic correlation values between the various body measurements of N'Dama cattle at pre weaning and post weaning are presented in tables 3 and 4 respectively. The values were all positive and ranged from 0.03 to 0.91 except at 12 months in post weaning where HTW and HDS was negative (-0.02). Over half of the correlation values at both pre-weaning and post weaning were more than 0.50.

At pre-weaning ages the relationship between HTW and HGT with other measurements were highly significant while at post weaning they were highly significant with some measurements. The values obtained for

such relationship were not as high as those recorded at pre weaning ages. At post weaning ages, HTW and HGT had no significant relationship with HDS except at 18 months of age. Although HDS had significant relationship with other measurements at 18 months it could be concluded that HDS contributes nothing towards the frame size of an animal since it is not correlated with HGT which has been reported to be the principal measurement that is best used to determine frame size (Spencers and Eckett, 1988).

The significant relationship between HDS and BLT found in this study is not unlikely because BLT measurement includes HDS. However, the very high relationships ($P \leq 0.01$) that exist between, HDS, STD to BLT indicate that either STD or BLT measurement is sufficient for length measurements. The breeder's choice would then depend on ease of measurement.

A marked occurrence in the results of this study is the predominance of highly positive and significant relationship between measurements especially at pre-weaning ages. The very high relationship between HTW and HGT indicate that absolute height and frame size were complementary. Selection for higher HTW at pre-weaning will lead to a better frame that is larger heart girth (HT) as the animals stabilise at post weaning and hence lead to better performance in beef production. This finding agrees with that of Nwosu *et al* (1985).

The result of this study indicates that selection for increased measurement in any of these linear measurements pre-weaning will significantly influence others more positively than post weaning when skeletal measurements are already stabilising (more than 60-75% matured) as reported by (Orheruata and Olutogun, 1994). The directional consistency of the correlation values in this study showed that increased skeletal stature generally will be associated with concomitant increase in other absolute body measurements except HDS at post weaning ages. The non-significant relationship that exist between height and length

measurement among N'Dama cattle at 30 months may be because at this age both measurements had reached an advanced stage of maturity which could therefore result to retardation in development of such measurements. But the highly significant relationship between circumference (HGT) and length measurement (BLT) at this age pre suppose that the total size of an animal is a function of length, height and circumference measurements which can best be reflected by HGT measurement. Raymond *et al* (1982) also noted such.

The implication of this study is that since beef animals are supposed to be robust animals with good conformation, it is necessary to select animals that can attain as much height as possible and at the same time have good frame size. Therefore selection of animals with high HTW would have a better frame size at post weaning age since HGT and BLT are significantly related ($P < 0.01$) to HTW. These measurements also best describe the conformation of an animal in terms of height, length and circumference.

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Table 1: MEAN (CM) AND STANDARD ERROR OF FIVE BODY LINEAR MEASUREMENTS OF N'DAMA CATTLE AT PRE WEANING AGES.

Measurements	Ages			
	Birth		6 Months	
	M (958)	F (878)	M (167)	F (169)
HDS	24.77±.07	24.47±0.7	45.45±.36	44.57±.36
STD	44.58±.17	44.13±.18	61.39±.44	60.50±.41
HTW	60.49±.12	59.50±.12	80.35±.38	79.17±.37
HGT	62.27±.11	61.39±.13	95.42±.61	95.40±.58
BLT	69.35±.19	68.60±.19	106.50±.75	104.73±.63

HDS = Head to Shoulder, STD = Shoulder to Taildrop;

HTW = Height at Withers; HGT = Heart girth, and BLT = Body Length.

M = Male,

F = Female

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Table 2: MEAN (cm) AND STANDARD ERROR OF FIVE BODY LINEAR MEASUREMENTS OF N'DAMA CATTLE AT POST WEANING AGES.

Measurements	Ages					
	12 months		18 months		24 months	
	M (115)	F (132)	M (98)	F (132)	M (56)	F (106)
HDS	53.32 ± .44	51.43 ± .50	59.85 ± .36	58.29 ± .36	64.41 ± .83	63.02 ± .42
STD	70.88 ± .56	69.12 ± .52	74.90 ± .52	74.70 ± .53	83.64 ± .75	82.62 ± .75
HTW	89.74 ± .45	87.76 ± .44	94.92 ± .47	93.81 ± .41	100.74 ± .53	100.69 ± .61
HGT	110.41 ± .72	109.10 ± .67	119.64 ± .86	117.13 ± .79	132.49 ± 1.19	128.34 ± .68
BLT	124.24 ± .76	120.61 ± .71	134.46 ± .83	133.02 ± .78	147.64 ± 1.24	145.79 ± .95
					159.85 ± 1.00	152.52 ± .63

HDS = Head to Shoulder; STD = Shoulder to Taildrop; HTW = Height at Withers;

HGT = Heart girth; and BLT = Body Length.

M = Male, F = Female

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Table 3: RELATIONSHIP BETWEEN FIVE BODY LINEAR MEASUREMENTS OF N'DAMA CATTLE AT PRE-WEANING AGES.

LINEAR MEASUREMENTS						
Linear Measurements	Age	HDS	STD	HTW	HGT	BLT
HDS	Birth		0.3	.18**	.26**	.38**
STD		0.2		.56**	.51**	.92**
HTW		.24**	.54**		.76**	.57**
HGT		.26**	.46**	.69**		.56**
BLT		.37**	.93**	.58**	.52**	
HDS	6 months		.39**	.46**	.53**	.73**
STD		.38**		.64**	.65**	.83**
HTW		.45**	.65**		.74**	.65**
HGT		.48**	.59**	.72**		.70**
BLT		.80**	.85**	.66**	.65**	

Correlations values above the diagonal at each age represent male N'Dama calves; those below the diagonal represent female N'Dama calves.

*P < 0.05 ** P < 0.01.

HDS = Head to shoulder; STD = shoulder to taildrop; HTW = Height at withers; HGT = Heart girth and BLT = Body length.

Table 4: PHENOTYPIC CORRELATION VALUES BETWEEN FIVE BODY LINEAR MEASUREMENTS OF N'DAMA CATTLE AT POST WEANING AGES.

LINEAR MEASUREMENTS						
Linear Measurements	Ages	HDS	STD	HTW	HGT	BLT
HDS	12 months		.23**	0.2**	0.16**	.72**
STD		.29**		.48**	.58**	.84**
HTW		.39**	.34**		.67**	.33**
HGT		.47**	.38**	.65**		.51**
BLT		.85**	.74**	.46**	.54**	
HDS	18 months		.35**	.27**	.32**	.76**
STD		.49**		.58**	.70**	.81**
HTW		.32**	.53**		.62**	.49**
HGT		.25**	.53**	.49**		.61**
BLT		.81**	.91**	.52**	.48**	
HDS	24 months		.34	.29	.28	.67**
STD		.39**		.49**	.57**	.87**
HTW		.19**	.38**		.65**	.46**
HGT		.28**	.45**	.40**		.56**
BLT		.74**	.86**	.39**	.49**	
HDS	30 months		.05	.24	.23	.59**
STD		.12		.54**	.39**	.85**
HTW		.29**	.08		.59**	.57**
HGT		.39**	.56**	.40**		.45**
BLT		.67**	.81**	.23**	.65**	

Correlation values above the diagonal at each age represent male N'Dama Cattle, those below the diagonal represent female N'Dama Cattle. * $P < 0.05$ ** $P \leq 0.01$

HDS = Head to shoulder; STD = Shoulder to taildrop; HTw = Height at withers;

HGT = Heart girth and BLT = Body length.