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Phenotypic Differentiation of Koroji Sheep in Maiduguri

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Target Audience: *Animal Breeders, Academia, sheep industries*

Abstract

A total of 250 (70 males and 180 females) were used for characterization. This study evaluated phenotypic and morphometric characteristics of Koroji sheep. Effect of age, sex, correlation and overall summary statistics were analyzed. Some of the morphometric characteristics taken were; body weight (BW), body length (BL), height at wither (HW), chest circumference (CC), head length (HDL), head wide (HDW), ear length (EL), horn length (HNL), horn circumference (HNC), tail length (TL), rump wide (RW), rump length (RL), height at rump (HR), foreleg (FLG), hind leg (HLG), height at rump (HTR) and neck length (NL).Body weight was measured with measuring tape while the morphometric characteristic was measured with measuring tape. The data was analyzed using general Linear Model Procedure of SAS. The result revealed that age and sex had significant ($p<0.005$) effect on morphometric characteristics of Koroji sheep with males and older animals showing superiority over females and younger ones. The Coefficient of Variation (CV) ranged from 8.56- 33.63) with Horn Length having the highest (33.63) while HL had the lowest (8.56). Pearson correlation obtained between parameters varied in magnitude and direction ($p<0.05$-0.01: $r = -0.31$ to 0.97). It was concluded that sex and age should be considered when designing a selection and breeding programs for Koroji sheep.

Keywords: *Koroji, Phenotypic, Age, Sheep, Sex*

Description of Problem

The characterization of indigenous sheep breeds and breed diversity are essential for conservation of their genes sources and obtainment their elite flocks for breeding purposes as well as to meet future needs in (23, 11). A good description comparison or characterization based on morphological properties can provide to some extent a reasonable representation of the differences among the breeds, though not exhaustive, it serves as the foundation upon which deoxyribonucleic acid (DNA) analysis can be built (24). Knowledge of morphometric characteristics marks the first step in classification of FAnGR (7). Quantitative genetics provides a powerful framework for studying phenotypic evaluation and evolution of adaptive genetics (4, 22). Morphological and morphometric variation within a population can provide researchers with a wealth of information that can help in designing an effective conservation and improvement programme (19, 18). In Nigeria, sheep and goats constitute the sole domestic small ruminants (22). The common breeds of sheep include Balami, Yankasa, Uda, Koroji and West African Dwarf while the breeds of

goats are Red Sokoto, Borno white, Kano brown (4). Nigeria sheep population will not only have impact on management of these animals but also reduce misidentification by livestock traders and help in the conservation of genetic resources (24). Koroji breed are like Balami, thus, Koroji has good adaptation ability because it is found all over Northern Nigeria and West Africa. The Koroji breeds have longer neck compare to Balami and the ewe have a small and fine curvy horn. The Koroji ram have straight curvy horn. Koroji sheep is gradually replacing Balami sheep in the Northern Nigerian because of fast growth, adaptability to different environment, early maturity and body size (27). Koroji and Balami breeds are some things difficult to distinguish. There is limited information on Koroji sheep in Nigeria. Therefore this study was design to carry out phenotypic characterization of Koroji sheep.

Materials and Methods

Study Area

The study was carried out at Maiduguri metropolis. Maiduguri is the capital and the largest urban center of Borno State, North Eastern Nigeria. The state lies between latitude 11°32′ North and 11°40′ North and latitude 13°20′ East and 13°25′ East between the Sudan Savanna and Sahel Savanna vegetation zones, characterized by short rainy season of 3-4 months (June-September) followed by a prolonged dry season of about 8 months duration (5)

Management of Experimental Animal

The animals were managed under extensive management where they were subjected to the traditional extensive management system, with little or no provision for shelter in the day and night. They grazed during the day on natural pasture containing forages such as Northern Gamba grass (*Andropogon gayanus*), Stylo (*Stylosanthes gracilis*) and Leucaena (*Leucaena leucocephala*). Occasionally, supplements such as groundnut haulm, beans shell, cereal offal and crop residues were sometimes provided prior and/or after grazing of natural pastures. Adequate health care was virtually non-existent while uncontrolled breeding was the practice.

Phenotypic Differentiation of Koroji Sheep

A total of 250 (70 males and 180 females) koroji sheep were randomly sampled from the population for body characterization. The parameters measured were body weight (BW), body length (BL), height at wither (HW), chest circumference (CC), head length (HDL), head wide (HDW), ear length (EL), horn length (HNL), horn circumference (HNC), tail length (TL), rump wide (RW), rump length (RL), height at rump (HR), foreleg (FLG), hind leg (HLG), height at rump (HTR) and neck length (NL). The weight (Kg) was measured by using of weighing tape with model number WJ515 and the height measurement (cm) was done using a graduated measuring stick. This was achieved by placing the animals on a flat ground and held by two field assistants. The length and circumference measurements (cm) were carried out using a measuring tape and a wooden ruler. Measurements were done in the every morning before the animals were released for grazing throughout the period of morphometric measurement. All measurements were carried out by the same person, in order to avoid inter-individual variations as outline as described by (20).

Statistical Analysis

The data obtained were analyzed using General Linear Model Procedure of SAS (17). Means with significant differences were compared using Duncan Multiple Range Test (25). The fixed effects of sex and age on linear body measurements were analyzed using the linear model given as:

$Y_{ij}=\mu+ S_i + A_j + e_{ij}$

Where Y_{ij}= individual observation of each body traits;

μ = overall mean;

S_i = fixed effect of i^{th} sex (i = male, female);

A_j = fixed effect of j^{th} age (j < 1 year old, 2 years old, and > 2 years old)

eij=random residual error associated with record of each animal.

Data collected were also subjected to Pearson Correlation Analysis of the same software to determine the phenotypic correlation of values among the traits measured.

Result and Discussion

The results of effect of age are presented in Table 1. Age had significant ($p<0.005$) influence in all the parameters measured except Neck length (NL). The older animals had higher values for all the parameters. Increase in age had led to significant increase in all the parameters. This implied that as these animals increased in age, those parameters also increased. This result agreed with the results of some researcher (11, 7) who also reported a significant effect of age in Nigerian and Bergamsca sheep. The influence of age of the animals on phenotypic parameters can be attributed to the size and shape of the animals because it is expected to change with changing age of the animals. Many previous studies reported significant effects of environmental factors such as age, and herd on body weight in accordance with our results (12, 8, 3, 15).

The results of effect of sex on phenotypic characteristics of Koroji sheep are presented in Table 2. Sex had significant ($p<0.005$) effect on all the parameters except NL measured with males showing superiority over females in all parameters except for EL where the females were significantly ($p<0.005$) higher than males. In this study male showed superiority to female which concord with the report of (21) who reported the superiority of males over female sheep. These differences between male and female lambs were similar to those reported in lambs (9, 3) who reported that male lambs were heavier, taller and bigger in girth; more muscled but with less fat compared to heifers and female lambs both at weaning and post-weaning ages and in lambs (3).The superiority of males over females in this study might be due to testosterone secretion which is released in the male animals since testosterone is known to stimulate muscular development (12). Even though no significant ($p>0.005$) difference was obtain, RL and RW were higher in females than in males. This could be as a result of their well-developed pelvic girdle, an adaptive feature of female animals for conception and parturition Female animals require wide pelvic girdle to allow for easy pass of the fetus during parturition (2).

The results of summary statistic of phenotypic characteristics are presented in Table 3. The Coefficient of Variation (CV) ranged from 8.56-33.63. The highest CV was recorded in Horn Length (33.63) followed by BW (25.60) while the least was in HL1 (8.56). The high CV observed for Horn Length and BW suggest that there is more room for improvement of such traits (1)

The summary of statistics on phenotypic parameter of BW (37 - 92 kg), HW (68-100cm), CC (64-99 cm), HTR (60 – 92 cm), RL (13 – 28 cm) and HNL (10 - 47 cm) are high than the BW (71.056±0.67 kg), HW 76.01±0.58cm), HTR (73.58±0.53cm), RL (24.77±0.76cm), CC (79.40±0.64cm) of Balaam sheep reported by (24). The phenotypic parameters of Koroji sheep may give better result than Balami breed if good selection and breeding progammes could be observed.

The phenotypic correlation of phenotypic parameters is presented in Table 4. The phenotypic correlation, body weight was moderately and highly (r_p) correlated with body parameters (0.36-0.98) except EL and

NL which showed negative correlation. The positive correlation observed in this study is in line with the reports (26) who suggest that those parameters that are positively correlated with each other are under the controlled by the same gene (pleiotropic), similarly it is an indication that any of these body dimension could serve as a predictor of body weight (26). This means that an improvement in one trait will lead to improvement in the other trait while negative correlation is the opposite (26). Generally, it was observed that body measurements had a moderate to high relationship with body weight of Koroji sheep. It was also confirmed by many researchers that, correlation coefficients may be affected by factors such as age, sex, season, feeding condition (14). So, the result could be different in in different breeds and environments which can affect the efficiency of body measurements in body weight prediction (6). The moderate to high positive phenotypic correlation coefficients observed between live traits are in consonant with the reports of some authors (23, 10, 3).

Table 1: Effect of age on Phenotypic Characteristics of Koroji sheep breed

TRAITS	<1YEARS	1 YEARS	>2YEARS	SEM
BW	41.72^{c}	58.90^{b}	72.92^{a}	6.81
BL	44.56^{b}	54.90^{a}	54.76^{a}	2.68
HW	72.33^{b}	84.72^{a}	88.61^{a}	3.33
CC	70.39^{c}	82.31^{b}	89.26^{a}	3.76
HDL	19.89^{b}	24.09^{a}	24.23^{a}	1.72
HDW	11.22^{b}	12.63^{a}	12.56^{a}	0.87
EL	21.22^{a}	18.36^{b}	21.26	1.40
TL	43.44^{b}	48.72^{a}	47.76^{ab}	3.15
RL	19.00^{b}	21.36^{a}	22.96^{a}	1.47
RW	15.56^{b}	17.55^{a}	18.34^{a}	0.98
HTR	65.11^{b}	76.18^{a}	79.96^{a}	3.14
FLG	47.78^{b}	57.55^{a}	58.65^{a}	2.73
HLG	57.44^{b}	66.63^{a}	68.88^{a}	2.27
NL	32.67	30.81	33.80	4.03
HNL	13.33^{b}	30.90^{a}	36.18^{a}	3.54
HNC	9.47^{b}	16.73^{a}	18.34^{a}	1.11
SC	22.17^{c}	30.63^{b}	35.50^{a}	2.90

SEM=Standard Error of Mean, Significant difference ($p<0.05$), abcd = Means in the same row bearing different superscripts differ significantly ($p<0.05$). body weight (BW), body length (BL), height at wither (HW), chest circumference (CC), head length (HDL), head wide (HDW), ear length (EL), horn length (HNL), horn circumference (HNC), tail length (TL), rump wide (RW), rump length (RL), height at rump (HR), foreleg (FLG), hind leg (HLG), height at rump (HTR) and neck length (NL)

Table 2: Effect of Sex Phenotypic Characteristics of Koroji sheep breed

TRAITS	MALE	FEMALE	SEM
BW	68.01[a]	53.08[b]	10.77
BL	54.76[a]	48.67[b]	3.77
HW	86.70[a]	79.67[b]	5.36
CC	86.64[a]	78.08[b]	6.04
HDL	24.02[a]	21.50[b]	2.28
HDW	12.94[a]	10.66[b]	0.86
EL	19.73[b]	22.66[a]	1.65
TL	47.79	45.66	0.04
RL	21.70	22.00	2.10
RW	17.79	18.33	1.43
HTR	77.29	73.75	5.27
FLG	57.64[a]	53.50[b]	4.02
HLG	67.08	63.91	3.94
NL	32.23	34.91	4.91

SEM=Standard Error of Mean, Significant difference ($p<0.05$), abcd = Means in the same row bearing different superscripts differ significantly ($p<0.05$) body weight (BW), body length (BL), height at wither (HW), chest circumference (CC), head length (HDL), head wide (HDW), ear length (EL), horn length (HNL), horn circumference (HNC), tail length (TL), rump wide (RW), rump length (RL), height at rump (HR), foreleg (FLG), hind leg (HLG), height at rump (HTR) and neck length (NL)

Table 3: Summary Statistic of Phenotypic Characteristics

Trait	Mean	Min	Max	CV
BW	64.19	37.00	92.00	25.60
BL	53.17	40.00	62.00	11.11
HW	84.86	68.00	100.00	9.55
CC	184.43	64.00	99.00	10.93
HDL	23.36	14.00	32.00	14.41
HDW	12.34	10.00	15.00	12.68
EL	20.50	16.00	26.00	12.91
TL	47.23	26.00	56.00	11.93
RL	21.78	13.00	28.00	13.44
RW	17.67	13.00	21.00	11.38
HTR	76.36	60.00	92.00	9.83
FLG	56.56	41.00	68.00	10.42
HLG	66.26	55.00	79.00	8.56
NL	32.93	21.00	69.00	21.11
HNL	30.23	10.00	47.00	33.63
HNC	16.14	7.00	20.00	23.27
SC	31.44	19.00	54.00	21.71

SEM=Standard Error of Mean, Significant difference ($p<0.05$), abcd = Means in the same row bearing different superscripts differ significantly ($p<0.05$) body weight (BW), body length (BL), height at wither (HW), chest circumference (CC), head length (HDL), head wide (HDW), ear length (EL), horn length (HNL), horn circumference (HNC), tail length (TL), rump wide (RW), rump length (RL), height at rump (HR), foreleg (FLG), hind leg (HLG), height at rump (HTR), (SC) Scrotal circumference and neck length (NL)

Table 5: Phenotypic Correlation of Koroji sheep

								HORN_	HORN							
BW	BL	HW	CC	HL	HW1	EL	L	_C	TL	SC	RL	RW	H_at_R	FL	HL1	NL
BW																
BL	0.77**															
HW	0.90***	0.85**														
CC	0.98***	0.80**	0.91***													
HDL	0.63**	0.63**	0.78**	0.67**												
HDW	0.63**	0.52**	0.62**	0.61**	0.67**											
EL	-0.19	-0.39*	-0.25*	-0.21	-0.31*	-0.29*										
HNL	0.82**	0.71**	0.86**	0.84**	-0.31*	0.65**	-0.31*									
HNC	0.79**	0.79**	0.82**	0.81**	-0.15	0.65**	-0.15	0.90***								
TL	0.35*	0.43*	0.36*	0.81**	-0.36*	0.25*	-0.36*	0.47**	0.46**							
SC	0.74**	0.71**	0.78**	0.75**	-0.21	0.46**	-0.22	0.75**	0.72**	0.43*						
RL	0.52**	0.41*	0.53**	0.50**	0.04	0.37*	0.04	0.63**	0.55**	0.36*	0.54**					
RW	0.51**	0.51**	0.66**	0.55**	-0.05	0.44*	-0.05	0.71**	0.59**	0.41*	0.58**	0.71**				
HTR	0.80**	0.77**	0.87**	0.83**	-0.09	0.47*	-0.09	0.77**	0.81**	0.32*	0.77**	0.42*	0.49**			
FLG	0.69**	0.77**	0.84**	0.72**	-0.14	0.48*	-0.14	0.63**	0.75**	0.18	0.65**	0.23	0.38**	0.89**		
HLG	0.81**	0.78**	0.90***	0.83**	-0.05	0.52**	-0.05	0.81**	0.82**	0.30*	0.75**	0.54**	0.59**	0.92***	0.85**	
NL	-0.10	0.02	-0.01	-0.12	0.20	0.12	0.21	-0.04	0.08	-0.01	-0.06	-0.16	-0.08	0.04	0.20	0.06

Significant (P>0.05); ** highly significant (P>0.01)*, SEM=Standard Error of Mean, Significant difference (p<0.05), abcd = Means in the same row bearing different superscripts differ significantly (p<0.05) body weight (BW), body length (BL), height at wither (HW), chest circumference (CC), head length (HDL), head wide (HDW), ear length (EL), horn length (HNL), horn circumference (HNC), tail length (TL), rump wide (RW), rump length (RL), height at rump (HR), foreleg (FLG), hind leg (HLG), height at rump (HTR), (SC) Scrotal circumference and neck length (NL)

Conclusion and Applications

1. The study showed that age and sex had effect on phenotypic parameters of Koroji sheep.
2. The statistics summary of phenotypic parameters and coefficient of variation (CV) of Koroji sheep showed showed high CV values of some parameters; BW, Horn L and Horn C, which could be explore for improvement of sheep in developing countries like Nigeria.
3. BW showed positive correlation with all the phenotypic parameters except EL and NL showed negative correlation. The positive correlated phenotypic parameters could be used for improvement, because improvement in one will lead to improvement in the other phenotypic parameters.
4. This study will aid in future selection and improvement of sheep in Nigeria.

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