PHENOTYPIC RELATIONSHIP BETWEEN BODY WEIGHT AND MORPHOMETRIC TRAITS OF GOATS IN KANO STATE, NIGERIA

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ABSTRACT
Morphometric traits are of great importance in the estimation of productivity and assessment of goat populations. Therefore, the study was conducted to identify the morphometric parameters and their relationship with body weight (BW) of goats in Kano State, Nigeria. A total of 374 goats were used for the study which consisted of four breeds (Red Sokoto, Kano Brown, Sahelian and West Africa Dwarf). The BW was measured in kilograms using a weighing scale and morphometric parameters such as BL, HC, TL, HH, HG, NL, EL, HL, WH, CL, CD, FL, GC, and GL using a measuring tape. The result of Pearson's correlation analysis for all the variables measured showed that relationship between BW and all the morphometric measurements were positive and significant (P<0.01%), indicating that the selection for BW might yield a corresponding positive result in other morphometric traits. The 'r' value ranges from low (0.11) to high (0.91) for BW/HC and BW/HG respectively. It is recommended that morphometric characteristics should be used to generate reliable information for goat discrimination.
Keywords: Phenotypic relationship, Correlation, Morphometric traits, Goat populations.

INTRODUCTION

Goat (*Capra hircus*) is thought to have been the first animal to be domesticated for economic purposes around 9000-10000 BC. It was brought by migrant pastoralists from Asia to Africa (Devendra & Mcleroy, 1988). There is hardly a climatic zone without goats. Immediately after domestication, physical differentiation into breeds and types began. Early physical changes affected the ears, horns, colour and hair type. These changes arose from natural mutation and from selection by goat keepers within the environment in which goats were reared, usually in relative isolation. Early goat keepers must have selected from the production characteristics which were appropriate to their needs. New blood probably entered goat populations when people migrated for economic reasons or in times of conflict. There is a huge range in size, colour, and hair type among modern breeds of goats (Peacock, 1996).

Oseni, *et al.* (2006) reported that morphometric measurements are among the data needed in characterization and establishment of breed standards in West Africa Dwarf goat production. As with the presence of horns, beard is a character included by an autosomal sex-dependant gene, it is dominant in males and recessive in females. Weight has been the pivot on which animal production thrives. The knowledge on weight assessment is very necessary because as far as an animal production management is concerned, weight assessment remains the backbone on which it is hinged. The knowledge of body weight of goats is important for a number of reasons; it is related to breeding (selection), feeding and health care (Thiruvenkadan, 2005).
Body measurements are important for the prediction of live weight, carcass weight and determination of certain body conformation traits that can be taken into consideration when selecting animals for genetic improvement.*Akpa, et al.* (2008) showed that there is positive correlation between increase in body parameters measured with weight gain.

MATERIALS AND METHODS

Location of the Study

This study was conducted in eight locations (Ungogo, Kumbotso, Dala, Kano Municipal, Wudil, Bebeji, Rimin Gado and Tofa) in Kano State. Kano State is located in the semi-arid area of North-western Nigeria. It has a population of 15,076,892 (NPC, 2006). Kano State is the commercial nerve Centre of Northern Nigeria. It is located between latitude $10^0$33' and $12^0$27' North of the equator and longitude $7^0$34' and $9^0$29' East of the Greenwich meridian and as such it is part of Sudan-Sahel vegetation zone

of Nigeria. Kano has a hot semi-arid steppe climate which exhibits a tropical wet-dry season with a mono-modal rainfall distribution (NIMET, 2021). Kano State occupies a total land area of about 42,582.8 km2 out of which 754,200 ha is being used for agricultural production while forest and grazing land occupy 75,000 ha. The pattern of animal rearing in the study location includes keeping both ruminant and non-ruminant animals

Sample Collection

Four breeds of goat were used for the study. Each breed of goat represented a population, hence, the four populations considered in this study (Sahel goat, Kano Brown, Red Sokoto and West African Dwarf goat). The body weight and fourteen morphometric traits such as body length (BL), Head circumference (HC), Tail Length (TL), Hip Height (HH), Neck Length (NL), Ear Length (EL), Horn Length (HL), Wither Height (WH), Canon Length (CL), Chest Depth (CD), Face Length (FL), Gonadal Length (GL), Gonadal Circumference (GC) and Heart Girth (HG) were measured from 374 adults goat in eight locations in Kano state. The experimental animals were managed under semi-intensive system. The goat houses were made using corn stalk for fencing and thatched roofing for protection against heat and rainfall. There was no organized health care provision in terms of vaccination and deworming. They were allowed to roam in search of food and water alone with their kids.

Data Analysis

The Data from the morphometric traits were computed in excel and analyzed using SAS (2000) general linear model procedure to determine the relationship among the variable.

RESULTS AND DISCUSSION

RESULT

Tables 1a, 1b and 1c show the Pearson's correlation matrix for all the traits measured from all the four breeds of goats. The relationship between the BW and all the morphometric measurement were positive and significant except HC.

Table 2 shows the prediction of BW from the morphometric traits measured in the indigenous breeds of goats. The coefficient of determination was found to be 0.6749, which shows that the independent variable explains 67.5% of the total variation. Body length, hearth girth and wither height significantly (P<0.01%) predicted BW followed by difference while GC (P<0.05).

Table 1a: Pearson Correlation Matrix of the Morphometric Traits

	BW	BL	HG	WH	HH	HL	EL	CD
BW	--	0.50^{**}	0.91^{**}	0.62^{**}	0.51^{**}	0.21^{**}	0.45^{**}	0.31^{**}
BL	--	--	0.37^{**}	0.34^{**}	0.37^{**}	0.03^{ns}	0.37^{**}	0.25^{**}
HG	--	--	--	0.59^{**}	0.41^{**}	0.28^{**}	0.36^{**}	0.26^{**}
WH	--	--	--	--	0.74^{**}	0.31^{**}	0.38^{**}	0.17^{**}
HH	--	--	--	--	--	0.18^{**}	0.48^{**}	0.29^{**}
HL	--	--	--	--	--	--	-0.01^{ns}	0.07^{ns}
EL	--	--	--	--	--	--	--	0.48^{**}

ns= non-significant, **= highly significant (P<0.01), BW= body weight, BL= body length, HG= hearth girth, WH = wither height, HH= hip height, HL= horn length, EL= ear length, CD= chest depth

DISCUSSION

The positive correlation coefficients of morphometric measurements showed that body weight has positive and significant relationship with all the morphometric characteristics; The relationship between the variable measured showed a direct proportional relationship (an increase in any one can lead to an increase in body weight) while some had negative relationship. This could be used in the selection criteria for any breeding objectives in goat breeding where emphasis could be given on the positive and significant relationship against the variable with negative relationship. This result is similar to the report of Ogah, *et al.* (2013) for WAD goat breed, Adeyinka and Mohammed (2006) for Red Sokoto and Sahel goat breeds. Okpeku *et al.* (2011), also reported similar result for WAD and Red Sokoto breeds.

The estimation of body weight based on morphometric characteristics assessed in the indigenous goat breed revealed a coefficient of determination of 0.6749, indicating that the independent variable

accounted for 67.47% of the overall variation. BL, HG and WH significantly (P<0.01) predicted BW while GC was significantly different (P<0.05).

Table 1b: Pearson Correlation Matrix of the Morphometric Traits

	CL	HC	NL	GL	GC	TL	FL
CL	--	0.06^{ns}	0.36^{**}	-0.02^{ns}	0.20^{*}	0.24^{**}	0.38^{**}
HC	--	--	0.35^{**}	-0.37^{**}	-0.04^{ns}	-0.13^{ns}	-0.33^{**}
NL	--	--	--	-0.06^{ns}	0.26^{**}	0.26^{**}	0.11^{ns}
GL	--	--	--	--	0.31^{**}	0.19^{ns}	0.59^{**}
GC	--	--	--	--	--	0.46^{**}	0.18^{ns}
TL	--	--	--	--	--	--	0.18^{**}

ns= non-significant, **= highly significant (P<0.01), *= significant (P<0.05) difference, CL= Canon length, HC= head circumferences, NL= neck length, TL= tail length, FL= face length, GL= gonadal length, GC= gonadal circumference

Table 1c: Pearson Correlation Matrix of the Morphometric Traits

	BW	BL	HG	WH	HH	HL	EL	CD
CL	0.43^{**}	0.32^{**}	0.45^{**}	0.50^{**}	0.33^{**}	0.29^{**}	0.40^{**}	0.28^{**}
HC	0.11^{ns}	0.20^{**}	0.01^{ns}	0.38^{**}	0.53^{**}	0.05^{ns}	0.27^{**}	-0.18**
NL	0.45^{**}	0.24^{**}	0.44^{**}	0.63^{**}	0.52^{**}	0.28^{**}	0.37^{**}	0.21^{**}
GL	0.19^{ns}	-0.20^{ns}	0.23^{*}	-0.00^{ns}	-0.09^{ns}	0.21^{ns}	-0.13^{ns}	0.39^{**}
GC	0.30^{**}	-0.16^{ns}	0.36^{**}	0.39^{**}	0.09^{ns}	0.26^{**}	-0.06^{ns}	0.05^{ns}
TL	0.29^{**}	0.11^{ns}	0.32^{**}	0.28^{**}	0.00^{ns}	0.07^{ns}	0.27^{**}	0.14^{ns}
FL	0.35^{**}	0.11^{ns}	0.39^{**}	0.12^{ns}	0.10^{ns}	0.24^{**}	0.19^{**}	0.58^{**}

ns= non-significant, **= highly significant (P<0.01), *= significant (P<0.05) difference, BW= body weight, BL= body length, HG= hearth girth, WH = wither height, HH= hip height, HL= horn length , EL= ear length, CD= chest depth, CL= Canon length , HC = head circumferences , NL= neck length, TL= tail length, FL= face length, GL= gonadal length, GC= gonadal circumference.

Table 2: Prediction of Body Weight from Morphometric Traits of Goats

Y	Intercept A	Estimate B	Parameter X	Significance LOS
Body Weight	-81.11	0.92	BL	**
		1.08	HG	**
		0.02	WH	**
		0.02	HH	Ns
		-0.27	HL	Ns
		0.26	EL	Ns
		-0.02	CD	Ns
		-0.13	CL	Ns
		0.02	HC	Ns
		-0.04	NL	Ns
		0.10	GL	Ns
		0.24	GC	*
		0.16	TL	Ns
		0.14	FL	Ns

ns = non-significant, **= highly significant (P<0.01), *= significant (P<0.05), LOS= least of significant, BW= body weight, BL= body length, HG= hearth girth, WH = wither height, HH= hip height, HL= horn length, EL= ear length, CD= chest depth, CL= Canon length, HC= head circumferences, NL= neck length, TL= tail length, FL= face length, GL= gonadal length, GC= gonadal circumference

The results indicated that body weight exhibited the highest coefficient of determination, with heart girth following behind, while wither height showed the lowest determination, which contrasts with the findings of Dankoli *et al*. (2021). Additionally, incorporating more body measurements into the prediction equation significantly enhanced the R^2 value.

CONCLUSION

The importance of phenotypic or morphological characterization of indigenous goat's genetic resources cannot be over emphasized. The result showed the presence of wide morphological and phenotypic variations within and among the indigenous breeds of goat population in various studied locations of Kano state.

Among the unique traits are the BW, BL, HW, HL. It is recommended that morphometric characteristics should be used to generate reliable information for goat discrimination due to their morphological differences

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