

Zoometrical index analysis of Nigerian indigenous goat populations

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Abstract

The study was conducted to assess the zoometrical index analyses of Nigerian indigenous breeds of goats. The sampled populations of goat included 100 from each of three populations of goat in Nigeria; Red Sokoto, West African dwarf (WAD) and Sahel to give a total of 300 animals. Nine body measurements were taken on these goats, which were used to estimate the ethnological indices and functional indices (as the zoometrical index) of the animals. There was significant effects ($p < 0.05$) of breeds on morphological traits of these animals. The functional and ethnological traits of these goat populations were significantly affected by breeds ($p < 0.05$) except pelvic and corporal. Based on the results of this study, Nigerian indigenous goats are medium-sized and their conformation corresponds to the meat type animals.

Keywords: Ethnology, functional, indigenous, population, zoometry

Introduction

Goat is one of the small ruminants that requires easy maintenance, it is prolific - can produce twins, even triplets and can give birth three times in two years. Goat market prospects are also very promising particularly among rural women. In Africa, goat population is about 171 million and 22 million in Nigeria, this represents about 31% of the world total (FAO, 1991). In Nigeria, there are three indigenous breeds of goats these are: Red Sokoto, West African Dwarf, and Sahel (Osinowo *et al.*, 1992). Ngere *et al.* (1984) reported that The Red Sokoto and Sahel breeds are predominantly found in Northern savannah and Sahel areas respectively, while the West African dwarf breed is common in the humid forest zone of southern Nigeria (Bayer, 1986). Nigerian indigenous goat breeds are primarily raised for meat; they have not been selected and improved for milk production.

The need for characterization of livestock breeds is a key to understanding their uniqueness and ability to thrive under various agrological climates. The phenotype of an animal is the resultant of

the genetics and its blending with the environment where it thrives (Banerjee, 2015). Phenotypic characterization is therefore an important step in a conservation program, for breed identification and classification in ways that farming communities could be related (Dossa *et al.*, 2007; Mwacharo *et al.*, 2006). The global plan of action for animal genetic resources recognizes that a better understanding of the characteristics of livestock breeds is necessary for guiding decision making in the development of farms and breeding program (FAO, 2007). Linear body measurements have become very useful in livestock research as alternative body measurements. In Nigeria, several studies have been conducted on analysis of morphological studies for characterizing indigenous goat genetic resources (Fajemilehin and Salako 2008; Yakubu *et al.*, 2010; Yakubu *et al.*, 2011; Okpeku *et al.*, 2011).

According to Salako (2006), indices estimated from various combinations of conventional and non-conventional body parameters not only provide superior guide to weight, but also served as indicators of

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type and function in domestic animals. Mwacharo *et al.* (2006) also stated that, with the introduction of indices from body measurements, objective assessment of body conformation from the stand point of type may be relatively easier. Esquivelzeta *et al.* (2011) reported two types of indices which are ethnological and functional indices. Ethnological indices give general information about livestock breed characteristics in terms of describing structure and proportions which are morphological characteristics of an animal while functional indices provide information about the type, aptitude and production performance of the animal. The calculation and analysis of the different indices give room for morphological classification of livestock breed particularly the ruminants (Esquivelzeta *et al.*, 2011). This study was conducted to describe the ethnological and functional indices of Nigerian indigenous breeds of goat.

Materials and methods

The study was conducted at three major small ruminant markets in Ibadan, Oyo state. These markets were Oranyan, Bodija and Akinyele. The study was also extended to households raising goats; these households were selected using snowball sampling technique. Nine body measurements were taken on 300 indigenous Nigerian breeds of goats (WAD, Red Sokoto and Sahel) of average ages of 25 – 30 months old using 100 individuals from each population. Meter rule was used to measure the height of the goats that is both the height at wither and at rump while other linear body measurements were taken using a measuring tape. The morphological measurements that were taken include body length, head length, head width, chest

depth, chest width, chest girth, wither height, rump length and rump width. The morphological traits measured were used to estimate the functional and ethnological indices of individual animals as reported by

Esquivelzeta *et al.* (2011):

Cephalic = Head Width / Head Length \times 100

Pelvic = Rump Width / Rump Length \times 100

Corporal = Body Length / Chest girth \times 100

Body index = Chest depth / Wither height \times 100

Transversal pelvic = Rump width / Wither height \times 100

Longitudinal pelvic = Rump length / Wither height \times 100

Length = Body length / Wither height

Cephalic, pelvic and corporal are ethnological indices; body index, transverse pelvic, longitudinal pelvic and length are functional indices.

Data collected were subjected to PROCMEANS procedure of the SAS (2004) package.

Results and discussions

The result of the descriptive statistics of the morphological traits of the breeds of goat is presented in Table 2. The result showed relative high variability in terms of coefficient of variation (CV) ranging between 14.58% and 79.14% with the lowest obtained in longitudinal pelvic and body length and the highest CV obtained for body index. This implies variables with low CV have better accuracy of the test unlike variables with high CV as reported by (Acourele *et al.*, 2001). Pares and Jordana, (2008) reported high CV in a morphometric study conducted for adult bovine.

Table 1 : Descriptive statistics of morphological traits and zoometrical indices of indigenous goat populations

Variable (cm)	Mean	Standard deviation	Variance	Range	Coefficient of variance
Head width	20.90	8.51	72.50	35.20	40.74
Head length	25.80	8.50	72.30	44.60	32.95
Rump width	16.64	3.74	14.01	20.20	22.50
Rump length	20.45	5.10	26.10	44.00	24.97
Body length	51.26	7.73	59.72	41.50	15.07
Chest girth	62.91	10.33	106.68	96.60	16.42
Wither height	55.55	9.12	83.22	53.00	16.42
Transverse Pelvic	0.30	0.06	0.00	0.46	21.28
Longitudinal Pelvic	0.93	0.14	0.02	1.08	14.58
Length	0.93	0.14	0.02	1.08	14.58
Body Index	87.09	68.15	4644.94	798.50	78.26
Cephalic	0.80	0.19	0.04	0.88	23.77
Pelvic	0.84	0.18	0.03	1.05	21.77
Corporal	0.87	0.68	0.46	7.99	18.26

Table 2 shows the effects of breeds on morphological traits of the goats. There was significant effects ($p < 0.05$) of breeds on morphological traits of these animals. Red Sokoto goats had the widest head, Sahel goats had the widest rump; longest head, rump, body; highest value for chest girth and wither height. Generally, Sahel goat possesses the highest overall body linear measurements, followed by Red Sokoto and WAD displayed the lowest body linear measurements. This is an indication that Sahel goat is tallest and heaviest breed of goat in Nigeria compared to Red Sokoto and WAD. In previous studies, some body measurements such as wither height, body length, rump height, rump width and heart girth has been reported for WAD and Red Sokoto goats (Ozoje and Herbert, 1987;

Okepku *et al.*, 2011), and other small ruminant species (Sowande and Sobola, 2010; Popoola, 2015). Similar and close values were reported by Okepku *et al.* (2011) for wither height, body length and heart girth for WAD and Red Sokoto goats. Dossa *et al.* (2007) reported higher average values of 56.57 cm and 79.23 cm for wither height and body length respectively for Benin goat populations; Edilberto *et al.* (2011) reported lower average values of head length, head width, rump width, rump length, but higher average values for body length, heart girth and wither height for Cuban Creole goat. Based on results obtained for these measurements on Nigerian indigenous goats, these goats may be considered medium sized as reported by Devendra and McLeroy (1982).

Table 2: Effects of breeds on morphological traits of indigenous goat populations

Traits(cm)	Red Sokoto	Sahel	WAD	SEM(±)
Head width	26.69 ^a	23.88 ^b	11.41 ^c	0.74
Head length	29.99 ^b	31.13 ^a	15.50 ^c	0.74
Rump width	16.15 ^b	19.11 ^a	14.85 ^c	0.32
Rump length	18.79 ^c	23.01 ^a	19.85 ^b	0.44
Body length	50.98 ^b	55.75 ^a	47.16 ^c	0.67
Chest girth	65.20 ^b	69.15 ^a	54.02 ^c	0.90
Wither height	57.72 ^b	61.39 ^a	47.29 ^c	0.79

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Correlations between linear body measurements in indigenous goat populations are shown in Table 2. Correlations between head width and head length ($r = 0.81$) recorded highest correlation value; there were also high correlations between body length and chest girth ($r = 0.71$), head width and wither height ($r = 0.61$), head length and chest girth ($r = 0.67$), head length and wither height ($r = 0.69$), rump width and body length ($r =$

0.61). Head length was less correlated with rump length ($r = 0.05$). The positive correlations between these morphological traits obtained in the present study indicate that an increase in any one of the body measurement would result in a corresponding increase in the other traits. Similar results of phenotypic correlations among body measurements of goats have been reported in earlier studies (Yakubu 2009; Sowande *et al.*, 2010; Nafti *et al.*, 2014).

Table 3: Phenotypic correlation coefficients of morphological traits of indigenous goat populations

	Head width	Head length	Rump width	Rump length	Body length	Chest girth	Wither height
Head width		0.81	0.18	0.05	0.37	0.57	0.61
Head length			0.40	0.24	0.49	0.67	0.69
Rump width				0.46	0.61	0.55	0.47
Rump length					0.38	0.26	0.32
Body length						0.71	0.56
Chest girth							0.68
Wither height							

The functional and ethnological traits of Nigerian indigenous goat populations are presented in Table 4. Functional and ethnological traits of Nigerian indigenous goat populations were significantly affected by breeds ($p < 0.05$) except pelvic and corporal which are ethnological traits. On the bases of functional indices which provide information about the type, aptitude and production performance of an animal; WAD goats had highest transverse pelvic, longitudinal pelvic, length, body index, corporal and head index compared to Sahel and Red Sokoto goats. The transversal pelvic and longitudinal pelvic indexes also provided information about the aptitude of the animal, supporting the WAD as the best breed for meat production when compared to other breeds. Similar result was reported by Salako (2006) for a study on sheep. The length suggest that these breeds of goat to be long-shaped with WAD being the longest

breed, this reinforces the results obtained for calculation of body index which shows WAD goats to be longiline having the body index ((Body length / Heart girth) higher than 90, Red Sokoto and Sahel goats are breviline with body index value of less than 85 (Edilberto *et al.*, 2011). On the bases of ethnological indices which give general information in terms of describing structure and proportions of animal; the cephalic index for Red Sokoto goat is 0.9 indicating that the goat is brachycephalic that is short-headed because the width of the head predominated over the length.; the cephalic index for Sahel and WAD are 0.78 and 0.71 respectively, indicating that these goats are mesaticephalic (medium-headed) and dolicocephalic (long-headed - because the length of the head predominated over the width) respectively. Edilberto *et al.* (2011) reported that Cuban Creole goats and their crossbreeds are brachycephalic.

Similar finding was reported by Popoola (2015) for WAD sheep. The pelvic and

corporal indices show indicates the rump length predominating in relation to its amplitude.

Table 6: Effects of breeds on ethnological and functional traits of Nigerian indigenous goat populations

Traits(cm)	Red Sokoto	Sahel	WAD	SEM(±)
Transverse Pelvic	0.28 ^c	0.31 ^b	0.32 ^a	0.01
Longitudinal Pelvic	0.88 ^c	0.91 ^b	1.01 ^a	0.01
Length	0.88 ^c	0.91 ^b	1.01 ^a	0.01
Body Index	78.14 ^c	80.75 ^b	103.03 ^a	5.91
Cephalic	0.90 a	0.78 b	0.71 c	0.02
Pelvic	0.87	0.86	0.78	0.02
Corporal	0.78	0.81	1.03	0.06

^{a,b,c} means of different superscripts along the same row are significantly different (P<0.05)

Conclusion

Based on the results of this study it is concluded that Nigerian indigenous goats are medium-sized animals, their conformation corresponds to the meat type animal. Further studies can be conducted using more structural indices that will reveal potentials of these goats in terms of type and production performance which will serve the purpose for designing appropriate conservation, breeding, selection and sustainable utilization strategies for Nigerian indigenous goats.

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