

ABG -19

Evaluation of Extent of Admixture among Sheep Breeds in Nigeria Using Multiple Discriminant Analysis

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Abstract

A total of forty-six (46) Balami, thirty (30) Uda, thirty-six (36) Yankasa and thirty-seven (37) WAD sheep were sampled from Bauchi, Katsina, Nasarawa and Anambra States, respectively using multistage sampling method. The common morphological features of the different breeds were used to identify and ascribe sampled animals to a breed. Multiple discriminant analysis was carried out on the data obtained using the following equation $D = v_1X_1 + v_2X_2 + v_3X_3 + v_iX_i + a$. Euclidean as the distance measurement, single linkage, average linkage, and complete linkage were applied through R 2.13.0. Conformation to the features of West African Dwarf Sheep (WAD) and Yankasa was reported as 100%. However, Balami had 70.59% as its breed conformation. Conformation to the morphological features of Uda was recorded as 60%. The discriminant analysis provided maximum conformation to breed features for WAD and Yankasa sheep, but some substantial deviation from features of Balami and Uda breeds. Efforts should be made at conservation of the unique genetic resources of Balami and Uda sheep in Nigeria.

Keywords: Sheep, Balami, Uda, Yakasa, West African dwarf sheep

Introduction

The World Watch List for Domestic Animal Diversity (WWL-DAD) prepared by FAO (2000) defined a breed as either a homogenous, sub-specific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within the same species. Breeds of domestic animals in Nigeria and most parts of developing countries are known to mate indiscriminately among themselves because they are mostly reared extensively. Sheep breeds in Nigeria are known to be four: Balami, Uda, Yankasa and West African Dwarf (WAD). Many authors had reported admixtures among breeds of sheep in Nigeria (Traore *et al.*, 2008; Yakubu *et al.*, 2010; Yunusa *et al.*, 2013). Efforts at conservation of sheep genetic resources in Nigeria are needed. One of the means for conservation of sheep breeds in Nigeria is to re-establish the purity of the stocks. These sheep breeds are highly variable in both physical and biometric characters, and believed to have descended from common origin. Allocation of individual observations to the various known groups with their respective mean vectors and distinguishing characteristics has been a major concern for years. Various on-going researches will need to be focused to obtain the best function to ensure maximum separation. Also, reliable mathematical equation (discriminant functions) is needed for provision of maximum separation among the four known sheep breeds. Discriminant analysis is a mathematical approach that has been widely used in determining the relationships between different breeds of livestock (Ajayi *et al.*, 2012).

This study considered separation/classification of sheep into their respective groups based on their measured morphological traits by using discriminant analysis.

Materials and Methods

The study was carried out in four states of Nigeria namely, Bauchi, Katsina, Nasarawa and Anambra States. A total of forty-six (46) Balami (18 males and 28 females), thirty (30) Uda (5 males and 25 females), thirty-six (36) Yankasa (9 males and 27 females) and thirty-seven (37) WAD sheep (7 males and 30 females) belonging to three age groups: adults (≥ 24 months of age), yearling (12-23 months of age), and weaner (6-11 months of age) were sampled for the study using multistage sampling method. The common morphological features of the different breeds as described by Adu and Ngere (1979) were used to identify and ascribe sampled animals to a breed. Multiple discriminant analysis was carried out on the data obtained using the following equation $D = v_1X_1 + v_2X_2 + v_3X_3 + v_iX_i + a$; where, D = discriminant function; v = discriminant coefficient or weight for that variable; X = respondent's score for that variable; a = a constant; i = number of prediction variables. For the classification of Balami, Uda, Yankasa, and WAD sheep (the Euclidean as the distance measurement, single linkage were applied through R 2.13.0 (2016) statistical software.

Results and Discussion

Table 1 shows the re-distribution summary using discriminant function for sheep breeds. Conformation to the features of West African Dwarf Sheep (WAD) and Yankasa was reported as 100%. However, Balami had 70.59% as its breed conformation. Uda had 60% as the conformation rate to their morphological features. The result of discriminant analysis for breeds of sheep obtained in this study was in line with earlier report of Yakubu *et al.* (2010); Agaviezor *et al.* (2012) and Yunusa *et al.* (2013) on breeds of sheep in Nigeria. As stated earlier, morphometric measurements of WAD sheep and Yankasa were classified into distinct breeds. Yakubu *et al.* (2010) reported similar total conformation to the breed features for Red Sokoto goats (100%) and very slight deviations for West African Dwarf goats (99.4%). Agaviezor *et al.* (2012) reported 63.9% and 93.3% as conformation to breed features for Yankasa and WAD sheep, respectively. The possible reason for non-total conformation unto their distinct group classification of Balami and Uda sheep in this study may be due to indiscriminate mating among stocks of sheep because most smallholder farmers from which the sheep were sampled practiced extensive system of animal production. Also, it is of note that the two breeds of sheep (Balami and Uda) share some common feature like height and body weight (Adu and Ngere, 1979) which can increase the level of admixture among them. The 60% conformation rate of Uda sheep in this study is possibly because the breed is found in abundance in geographical locations where Yankasa sheep also thrive.

Table 1: Re-substitution Summary Using Discriminant Function

Breeds	Observations and percent classified into breeds				Total
	Balami	Uda	WAD	Yankasa	
Balami	70.59	29.41	0.00	0.00	100.00
Uda	40.00	60.00	0.00	0.00	100.00
WAD	0.00	0.00	100.00	0.00	100.00
Yankasa	0.00	0.00	0.00	100.00	100.00
Total	36.84	21.05	18.42	23.68	100.00
Priors	0.25	0.25	0.25	0.25	-

WAD = West African dwarf

Conclusion and recommendation

The discriminant analysis provided maximum conformation to breed features for WAD and Yankasa sheep, but some substantial deviation from features of Balami and Uda breeds. Efforts should be made at conservation of the unique genetic resources of Balami and Uda sheep in Nigeria.

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