GENETIC AND PHENOTYPIC CHARACTERISATION OF MORPHOLOGICAL TRAITS OF YANKASA SHEEP IN KADUNA STATE

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ABSTRACT
Variation in ordinal traits such as head profile, coat color, ear size, ear attitude and nominal attributes such as presence and absence of wattles and horn could be of tremendous assistance in generating breed interspecific variations among animal populations within the species. Thus, the aim of this study was to determine and document the genetic and phenotypic profiles of Yankasa sheep by generating the phenotypic and allelic frequencies of some morphological traits whose modes of inheritance are known. Five morphological traits which included head profile, ear attitude, horn, wattle and coat pigment were observed and categorized from 120 Yankasa sheep comprising 60 females and 60 males. The result showed that head profile of Yankasa sheep was mainly sub-convex (80%), ear size and attitude were medium (85%) and drooping (93.33%), respectively. The frequency of presence of wattle was 18.33%. Presence of horn was associated with rams (90%). Yankasa sheep were spotted with black (96.7%) and brown (3.33%). The gene frequency for the dominant alleles were 0.800, 0.933, 0.817, 0.976, 0.900 and 0.967 for head profile, ear attitude, wattle, horn in females, horn in males and coat pigment respectively. These values are quite higher than the expected Mendelian value of 0.75.
Key words: Yankasa sheep, morphological traits, genetic, phenotypic, characterisation

INTRODUCTION

The sheep is the fourth oldest domestic animal after the dog, cow and pig. Sheep belong to the Sub-Family Bovidae. The genus *Ovis* includes all sheep, while domesticated sheep belong to the species *Ovis aries*. Their original centre of domestication seems to be the Arlo Caspian steppes, including the area occupied by present day Iran and Iraq (Wamagi *et al*. 2013). The population of sheep in Nigeria is currently estimated at 33.9 million making up 3.1% of the world's total (FAOSTAT, 2011). Eighty percent of sheep in Nigeria can be found in the drier agro-climatic zones of the country where rainfall is low and limited to only about three or four months in the year, grasses are abundant but of low quality and water supply for livestock is available in only a few scattered water points across the region (Osinowo, 1992).

The diversity of gene pool, different climatic conditions within the country, free mating and natural selection have given rise to different local populations of sheep. Therefore, one would expect much differential adaptive development to be reflected in the morphology (Hall, 1991). According to Oseni *et al*. (2006), varied expression of qualitative traits may represent some adaptive mechanisms related to adaptation and survival in different ecological zones in the country. Hence, the need for the conservation of these unique genes for present and future use.

Animal populations have been classified and identified using qualitative traits. Many improved breeds are monotypic for most visible traits and have therefore made quantitative assessment easy to monitor over time (Salako, 2013). Variation in ordinal traits such as head profile, coat color, ear size, ear attitude and nominal attributes such as presence and absence of wattles and horn could be of tremendous assistance in generating breed interspecific variations among animal populations within the species.

The first step toward an efficient conservation strategy for cattle, sheep, and goat genetic resources is the proper characterization of the conservation value of the different breeds and their wild relatives (Taberlet *et al*., 2011). Studies on diversity and variability between sheep breeds on the basis of qualitative (morphological) traits have been extensively carried out on-station and on-farm in Southern Nigeria (Ozoje and Kadri 2001).

Therefore, the present study is aimed at determining and documenting the genetic and phenotypic profiles of Yankasa indigenous sheep by generating the phenotypic and allelic frequencies of some qualitative traits whose modes of inheritance are known. This will play a significant role in the prevention of extinction of these animal genetic resources, considering the fact that uncontrolled mating and geographical overlap are leading to the endangerment of breed purity; and potentially important ovine genetic materials are being at risk.

MATERIALS AND METHODS

The sheep were sampled from three Local Government Areas in Kaduna State namely; Igabi Ikara and Sabon-Gari. Kaduna State falls within the Guinea savanna agro-ecological zones (FAO, 2020). The animals were identified in the location based on the morphological descriptors of the breed. The six morphological traits observed were head profile, ear attitude, horn, wattle and coat pigment.

Statistical analysis were carried out using the PROC FREQ of SAS JMP (SAS, 2019) to compute the Chi-square values of the observed morphological traits. The distributions of the various traits were expressed in percentages. The frequencies of the recessive alleles were estimated using Hardy-Weinberg equilibrium (Falconer and Mackay, 1996) as shown below:

$q = \sqrt{m/M}$ Where, q = frequency of the recessive allele; m = observed number of animals exhibiting the particular recessive trait; M = total number of animals sampled. From q above, the frequencies of the dominant alleles were calculated as follows: $p = 1-q$ Where, p = frequency of the particular dominant allele.

RESULTS AND DISCUSSION

Distribution of morphological traits are reported in Table 1. The Chi-square (χ^2) values were significant ($P<0.05$) for all observed traits. The phenotypic frequencies reported for head profile were 20% and 80% for convex and sub-convex respectively. The Yankasa sheep may be regarded as archaic since the sub-convex head profile evolved before the convex head profile. The primitive sheep had a straight head profile while the sub-convex and convex were considered as variants which only evolved in the process of domestication through mutation (Salako, 2013). Ear attitude were 6.67% (Horizontal) and 93.33% (Drooping).

Table 1: Distribution of the observed Morphological traits of Yankasa Sheep

Trait	Phenotype	N	Freq. (%)	χ^2 value	LOS
Head profile		120		60.05	<0.0001*
	Convex	24	20		
	Sub-convex	96	80		
Ear attitude		120		29.39	<0.0001*
	Horizontal	8	6.67		
	Drooping	112	93.33		
Wattle		120		57.17	<0.0001*
	Present	22	18.33		
	Absent	98	81.67		
Horn(F)		60		8.77	0.0125*
	Absent	58	97		
	Scur/knob	2	3		
Horn(M)		60		19.50	<0.0001*
	Present	54	90		
	Scur/knob	6	10		
Coat pigment		120		10.17	0.0062*
	White and brown	4	3.3		
	White and black	116	96.7		

N = Number of Animals, Freq. = Frequency, % = Percentage, χ^2 = Chi-square, LOS = Level of significance $P<0.05$;

Presence and absence of wattle were 18.33% and 81.67% respectively. Salako, (2013) reported that the presence of the appendage is higher in primitive sheep implying from this study that the Yankasa sheep are archaic. The lower relative proportions of wattled condition could be attributed to the associated taboo (Yakubu *et al.*, 2010). The non-wattled sheep are normally used for religious sacrifices.

The sheep had 97% and 3% for absence of horn and presence of scur/knob in females and 90% and 10% for presence of horn and presence of scur/knob respectively in males. The results showed that presence of horn is associated with rams while absence of horn is associated with ewes in both breeds. The present result lend credence to the postulation that the inheritance of horns in this species is a sex-influenced character (Khan and Singh, 2002). The result of this study is in consonance with the report of Yakubu *et al.* (2010). The possession of horns could be advantageous in the tropics where temperature could get to the extremes. They are the only superficial areas with a major drainage of blood through the cavernous sinus, which, according to Robertshaw (2006), has been implicated in the control mechanism for thermal homeostasis.

The gene frequencies of the morphological traits are shown in Table 2. The frequencies of the dominant alleles were 0.800, 0.933, 0.817, 0.976, 0.900 and 0.967 for head profile, ear attitude, wattle, horn in females, horn in males and coat pigment respectively. These values were quite higher than the expected Mendelian value of 0.75. The present result on wattle points to the fact that it is at the risk of extinction. Hence, the need to take appropriate measures to conserve this unique gene in order to enhance its utilization in present and future livestock development programmes.

Table 2. Genetic profile of Yankasa sheep

Locus	Allele	n	Gene frequency
Head profile		120	
	Convex	24	0.200
	Sub-convex	96	0.800
Ear attitude		120	
	Horizontal	8	0.067
	Drooping	112	0.933
Wattle		120	
	Present	22	0.183
	Absent	98	0.817
Horn(F)		60	
	Absent	58	0.967
	Scur/knob	2	0.033
Horn (M)		60	
	Present	54	0.900
	Scur/knob	6	0.100
Coat pigment		120	
	White and brown	4	0.033
	White and black	116	0.967

n = Number of individuals; M = male; F = female.

CONCLUSION

The Yankasa sheep breed retained its native traits especially with regards to head profile, ear size, ear attitude, horn, wattle and coat pigment. The head profile showed more of the sub-convex variant. Ear attitude was basically medium and drooping respectively. The wattle gene was at the risk of extinction. The presence of horn was influenced by the sex of the animal, it was higher in males than females. The coat pigment was predominantly white and black. The gene frequency revealed a deviation from the Mendelian values of 0.25 for the recessive allele and 0.75 for the dominant allele.

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