HAEMOGLOBIN GENOTYPE OF SOME NIGERIAN SHEEP

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ABSTRACT
This study investigated the haemoglobin genotype of Nigerian sheep. Two hundred animals comprising 46 Balami (20 males vs 26 females), 44 Uda (23 males vs 21 females), 63 West African Dwarf (30 males vs 33 females) and 67 Yankasa (35 males vs 32 females) reared at the Teaching and Research Farm of Federal College of Education, Pankshin were used for this study. Five millilitres of blood was obtained from each animals by jugular venipuncture and dispensed into bottles containing Ethylene Diamine Tetra Acetic Acid and analysed using cellulose acetate paper electrophoresis. Only a single band was observed and designated as AA based on the comparison with existing control giving rise to HbAA genotype and HbA gene frequency of 1.0 each. It is concluded that all the sheep breeds studied were homozygous for haemoglobin allele Hb A. The haemoglobin phenotype could therefore not be used as basis for selection.
Keywords: Sheep, breed, sex, haemoglobin, genotype

INTRODUCTION
Haemoglobin polymorphism in sheep was first described in 1955 (Cabannes and Serain, 1955; Harris and Warren, 1955). The characteristics of blood groups and biochemical polymorphism of blood protein in farm animals have been attracting geneticists interest in obtaining data for analysing genetic differences between gene pools (Darcan and Guney, 2001). Subsequent studies of Tucker (1971) and Agar *et al.* (1972) confirmed the different variants. Electrophoretic study of sheep haemoglobin showed that there are three main genotypes; HbAA, HbBB and HbAB (Miresan, 2003; Tapio *et al.*, 2003: Salako *et al*., 2007; Akinyemi, 2010). Haemoglobin types are genetically determined in a simple Mendelian manner, none being dominant (Evans *et al.,* 1958).
The alleles vary with breed (Harris and Warren, 1955; Evans *et al.,* 1958; Stormont *et al*., 1968). The Hb C appeared in anaemic sheep (Van Vliet and Huisman, 1964). A fourth allele, Hb D with electrophoretic mobility faster than Hb A, B and C was found to be characteristic of some Yugoslavian sheep (Vaskov and Efremov. 1967). Specific foetal haemoglobins, designated as Hb F have also been identified (Helm *et al*., 1958).
Akinyemi (2010) obtained a high frequency of Hb A in populations of Balami, Uda and Yankasa reared in the Northern Guinea Savannah zone of Nigeria, while Salako *et al*. (2007) reported a higher value of HbB in population of West African Dwarf sheep at low altitude in South-West Nigeria.
The discovery of genetic polymorphism demonstrated by proteins that differ electrophoretically furnishes information for the study of the genetics of the organism at all levels, i. e. molecular, cellular, or the entire organism. The knowledge obtained from the determination of genetic polymorphism from protein differences permits the study of protein evolution and thus the evolution of the organism. Qualitative genetic traits enable man to examine the effects of breeding systems on the frequencies of alleles where inbreeding and selection are practiced. It is assumed that the genes for quantitative traits behave in the same manner as the qualitative genes and thereby allow a monitoring of the shifts in gene frequencies of all genes where various breeding systems are used. The discovery of a qualitative gene trait that may serve as a genetic marker for a desirable combination of quantitative genes which will make for better animal production is possible as well as desirable. The objective of this study is to validate or otherwise previous findings (Salako *et al.,* 2007; Agaviezor *et al.*, 2013; Dafur *et al*., 2019) on Nigerian sheep haemoglobin as demonstrated by electrophorentic pattern. Study like this may not only add to store of knowledge but may provoke further studies on sheep selection and breeding.

MATERIALS AND METHOD

Location and climate

The research was carried out in Pankshin town (Figure 9), Jos Plateau. The Jos Plateau has been described by PADP (2000), WWF (2001) and Plateau State Government Organization (2004). It is a pear-shaped upland located in the middle of Nigeria between latitude $8^{o}$and 10^{0}north and longitudes 7^{0} and 11^{0} east, at an average attitude of 1,200m above sea level and reaches the highest peak in the Shere Hills where it stands at 1,766m.

Sheep used and management

The study sheep comprised 220 sheep (46 Balami, 44 Uda, 63 West African Dwarf sheep and 67 Yankasa) reared at Federal College of Education, Pankshin Research Farm. sheep were managed under the traditional free-range in the dry season. In the rainy season when arable crops were growing, animals were kept under semi-intensive management. Under this system, sheep were taken out for grazing by a shepherd from late morning till evening. Sometimes supplementary feeds (hay and household waste) were fed. In both systems, extensive and semi-intensive, no specialized form of housing was provided but their owner's compound or homestead and veterinary care was generally not provided.

Blood sample collection and analysis

Blood (5ml) was collected from each sheep by jugular venipuncture and dispensed into each of the sample bottles with ethylene diamine tetra-acetic acid (EDTA) for electrophoresis to determine haemoglobin genotype. Electrophoresis was carried out at the Central diagnostic laboratory of NVRI Vom. Two millilitres of blood sample were placed into a clean test tube, 5ml of cold saline was added and the diluents centrifuged at 4000 rpm for 10 – 15 minutes. The supernatant was discarded and the sample washed again three times. The sediment was re-suspended using 2ml of cold distilled water. When the lysate was well separated after standing, it was stored at refrigeration temperature until electrophoresis. The red cell lysate was then impregnated on a cellulose acetate paper which was placed in the electrophoresis tank using forceps and subjected to electrophoresis according to standard procedure described by Evans (1971). The tank was powered with the lid closed and sampled allowed to separate for about 10 – 15 minutes. The identification of the haemoglobin type was achieved by the position of bands along the electrophoretic substratum using Ponceau-S which was later washed with glacial acetic acid.

Data Analysis

Because only one allele (A) was detected, the haemoglobin genotype and gene frequencies was estimated thus; the genotype frequency AA = number of AA/total number x 100, while gene frequency = number of AA x 2/100.

RESULTS AND DISCUSSION

Table 1 depicts the genotype and gene frequency of sheep by breed and sex. At electrophoresis, only a single band was observed and designated as AA by comparison with existing control. This implied that all the sheep breeds (Balami, Uda, West African Dwarf and Yankasa) studied were homozygous for haemoglobin allele HbA. This gave rise to Hb AA genotype and HbA gene frequency of 1.0 each.

Only HbAA genotype was observed in sheep used for this study. This is in agreement with the report of Chuku and Uwakwe (2012) who also found only HbAA genotype in sheep in Port Harcourt, Nigeria and Dafur *et al.* (2019) who similarly reported only the Hb AA in all sheep breeds on the Jos Plateau. However, these findings contradict that of Salako *et al* (2007) who showed that HbBB predominates followed by HbAA and HbAB in both male and female sheep. The existence of only HbAA in this study could be an adaptive survivability feature. Different genotypes have been reported to exhibit selective advantages in different geographical regions (Ndamukong, 1995). This might have led to the fixation of HbAA in sheep of present study. FAO (1988) reported that carriers of HbAA demonstrated significant resistance against helminth infections. According to Distasio (1997), this could be due to better functional properties such as greater affinity to oxygen, higher Hb concentration and packed cell volume. Conversely, Mwacharo *et al.* (2002) found HbBB alleles fixed in Kwale, Makueni and Siaya sheep breeds of Kenya. Agaviezor *et al.* (2013) stated that there is indication that vegetation or climate changes affect Hb type. With homozygosity at the Hb locus, selection for improvement cannot be based on sheep genotype.

Table 1: Haemoglobin types and gene frequencies of four Nigerian Sheep Breed

Breed	N	Genotype frequency			Gene frequency	
		AA	AB	BB	A	B
Balami	46	46(1.00)	0(0)	0(0)	92(1.00)	0(0)
Female	26	26(1.00)	0(0)	0(0)	52(1.00)	0(0)
Male	20	20(1.00)	0(0)	0(0)	40 (1.00)	0(0)
Uda	44	44(1.00)	0(0)	0(0)	88(1.00)	0(0)
Female	21	21(1.00)	0(0)	0(0)	42(1.00)	0(0)
Male	23	23(1.00)	0(0)	0(0)	46(1.00)	0(0)
West African Dwarf	63	63(1.00)	0(0)	0(0)	126(1.00)	0(0)
Female	33	33(1.00)	0(0)	0(0)	66(1.00)	0(0)
Male	30	30(1.00)	0(0)	0(0)	60(1.00)	0(0)
Yankasa	67	67(1.00)	0(0)	0(0)	134(1.00)	0(0)
Female	32	22(1.00)	0(0)	0(0)	44(1.00)	0(0)
Male	35	35(1.00)	0(0)	0(0)	70(1.00)	0(0)

CONCLUSION AND APPLICATIONS

It is concluded that on the Hb AA genotype is exhibited in the Nigerian sheep used for the study, therefore, haemoglobin genotype cannot be used as the basis for selection of sheep for improvement.

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