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SURVIVABILITY OF LAMBS IN RELATION TO THEIR DAM'S HAEMOGLOBIN VARIANTS

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Abstract: A total of 65 Yankasa, 23 Uda and 16 Balami ewes were mated to 4 Yankasa, 3 Uda and 3 Balami rams in a diallel breeding pattern to produce 192 lambs within 9 genotypes, which were used to study survivability of lambs in relation to their dam's haemoglobin variants.Blood samples (5ml) were collected from 104 ewes and 10 rams through jugular venepuncture. Electrophoresis was carried out in a Shandon electrophoresis tank on cellulose acetate strips.Each of the 9 lamb genotypes had very high proportion of HbAB. The dam's haemoglobin type BB (HbBB) were only found in YK X YK, UD X UD, YK X UD, BL X YK and BL X UD lambs at birth and 90-Day. Survivability of lamb that were given birth to by dams with haemoglobin type AB (HbAB) is highest in the studied populations from birth to 360-Day. Lambs with HbAB should be selected for improved survivability of sheep in Northern Nigeria.

Keywords: Nigerian sheep, haemoglobin variants, electrophoresis, survivability

Introduction

Livestock breeds, including the domestic sheep (*Ovisaries*), have been characterized for variations in the major blood proteins and enzymes which are used as genetic markers. Such proteins are albumin (*Margetin and Malik, 1982*), ceruloplasmins (*Graetzeret al., 1964; Bhat, 1986*), vitamin D-binding protein (*Ibeagha-Awemu and Erhardt, 2004),* haemoglobin and transferrin *(Braend, 1972; Baruah and Bhat, 1980; Margetin and Malik, 1982; Bhat, 1986; Henkeset al., 1994; Di Stasio, 1997).* Some of the enzymes are amylase *(Bhat, 1986),* carbonic anhydrase *(Margetin and Malik, 1982),* malic enzyme, NADH diaphorase and catalase *(Tsunoda and Douge, 1990; Henkeset al., 1994).*

Many studies in sheep have already linked these markers to production traits and environmental adaptation *(Vicovan and Rascu, 1989; Charon et al., 1996; Salakoet al., 2007).* Information on blood proteins has also been extensively used for parentage control *(Francois et al., 1992)* and to study the genetic relationships among sheep breeds (*Buis and Tucker, 1983; Ordas and San Primitivo, 1986; Mwacharoet al., 2002).* However, the polymorphism of these important blood proteins had not being linked to survivability traits in the populations of sheep of Northern Nigeria (Balami, Uda and Yankasa sheep). Study of the influence of variations in haemoglobin genotype and its effect on survivability of different lamb genotype can help in selection of sheep on the basis of lambs with the best survival rate. This study was therefore aimed at monitoring the level of survivability of lambs in relation to their dam's haemoglobin variants.

Materials and Methods

This study was conducted at the Sheep Project Unit of Small Ruminant Research Programme (SRRP) of National Animal Production Research Institute (NAPRI), AhmaduBelloUniversity, Shika-Zaria. Three breeds of sheep that are found predominantly in Northern Nigeria were used for this study. They were Balami, Uda and Yankasa. A total of 65 Yankasa, 23 Uda and 16 Balami ewes were mated to 4 Yankasa, 3 Uda and 3 Balami rams in a diallel breeding pattern to produce 192 lambs within 9 genotypes.

Blood samples (5ml) were collected from 104 ewes and 10 rams through jugular venepuncture. The blood samples were placed in ethylene diamine tetra-acetic acid (EDTA) tubes to prevent coagulation and were transported in ice-pack to the Genetic and Breeding Laboratory, Department of Animal Science, University of Ibadan, Nigeria.

Red blood cells (RBCs) were prepared from the erythrocyte fraction of blood by centrifuging at 3000 rpm for 10 minutes at 4^{o}C. The supernatant was decanted leaving the sediment (RBCs). The RBCs were washed in saline (0.155M NaCl) three times and centrifuged at 3000 rpm for 5 minutes at 4^{o}C. The RBCs were lysed by using haemolysing reagent (0.3g EDTA; 2 ml potassium cyanate and 120 ml distilled water) to release haemoglobin. Subsequently, 0.5 ml of the haemolysing reagent was added to individual animal sample's sediment in a test tube to produce the haemolysates. Electrophoresis was carried out in a Shandon electrophoresis tank on cellulose acetate strips 34.5 x 150 mm with 0.26 M Tris buffer (pH 8.4) at both anode and cathode. The strips were ran for 40 minutes at a constant voltage of 350V according to the procedure described by *Riken (2006)* and *Akinyemi (2010).*

On separation, the strips were stained with Ponceau-S, later washed with 5% glacial acetic acid, and dried using filter paper. Interpretations were made based on the relative mobility of the haemoglobin bands towards the anode, with

haemoglobin AA (single band) being the fastest while haemoglobin BB (single band) was the slowest and haemoglobin AB (double band) having slow and fast bands (*Abdussamadet al., 2004; Riken, 2006; Akinyemi, 2010)* as shown in Plate I.

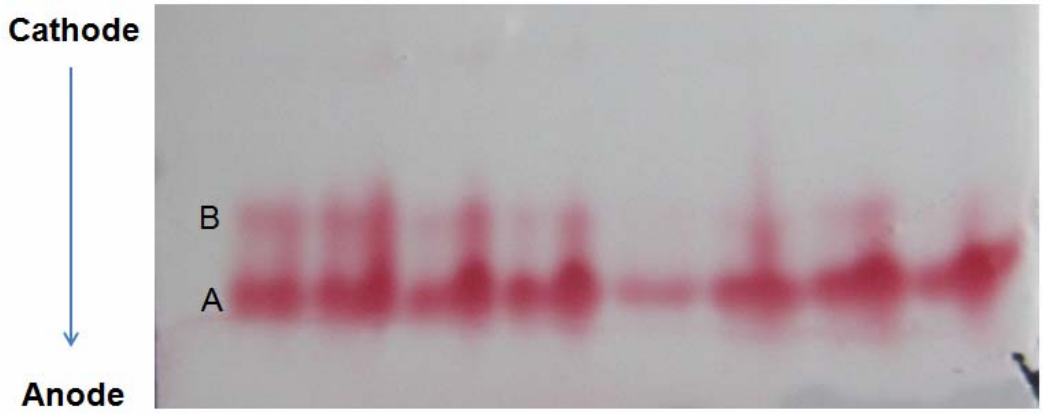

Plate I: Electropherogram of haemoglobin variants

Genotype frequency was calculated thus:

$$AA = \frac{\text{Number of AA}}{\text{Total number of samples}} \times 100$$

$$AB = \frac{\text{Number of AB}}{\text{Total number of samples}} \times 100$$

$$BB = \frac{\text{Number of BB}}{\text{Total number of samples}} \times 100$$

Results and discussion

Figures 1 to 4 show the distribution of dam's haemoglobin types within lamb genotype at birth, 90, 180 and 360-Days, respectively. Each of the 9 lamb genotypes had very high proportion of HbAB. The dam's haemoglobin type BB (HbBB) were only found in YK X YK, UD X UD, YK X UD, BL X YK and BL X UD lambs at birth and 90-Day (Figures 1 and 2). At 180 and 360-Day (Figures 3 and 4), HbBB were completely lost to mortality except for a very small proportion that were found only in YK X YK (8.0%) and UD X UD (16.67%) at 360-Day.

The abundance of HbAB in the populations of this study suggests a better adaptation of the haemoglobin type to the region. It also suggests that genotype HbAB is favoured through natural selection in ruminants of Northern Guinea savannah Zone of Nigeria. *Akinyemi (2010)* however reported higher frequency of HbBB in population of West African Dwarf sheep at low altitude (about 200m above sea level) in South West Nigeria (Forest Zone). However, lambs that were given birth to by dams with HbBB were unable to survive up till 360 days except for those of pure Yankasa and Uda lambs. *Evans et al*. (1958) had earlier suggested that allele A of haemoglobin type has a selective advantage at high altitudes because it constituted the most common allele in highland breeds of English and Scottish sheep. It has been established that the affinity of allele A for oxygen is 30 to 50% greater than allele B (*Chamley and Holland, 1969).*

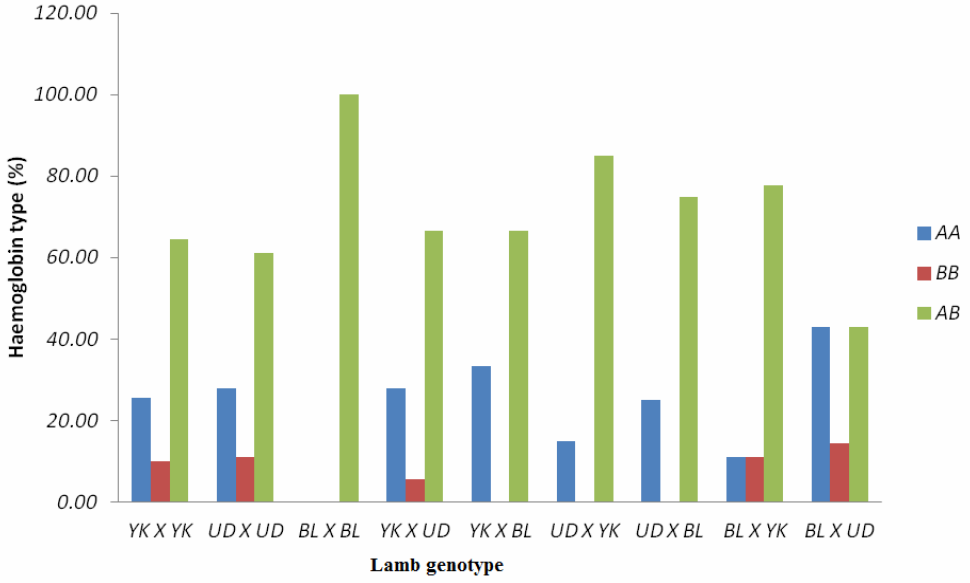

Figure 1. Distribution of dam's haemoglobin types within lamb genotype at birth

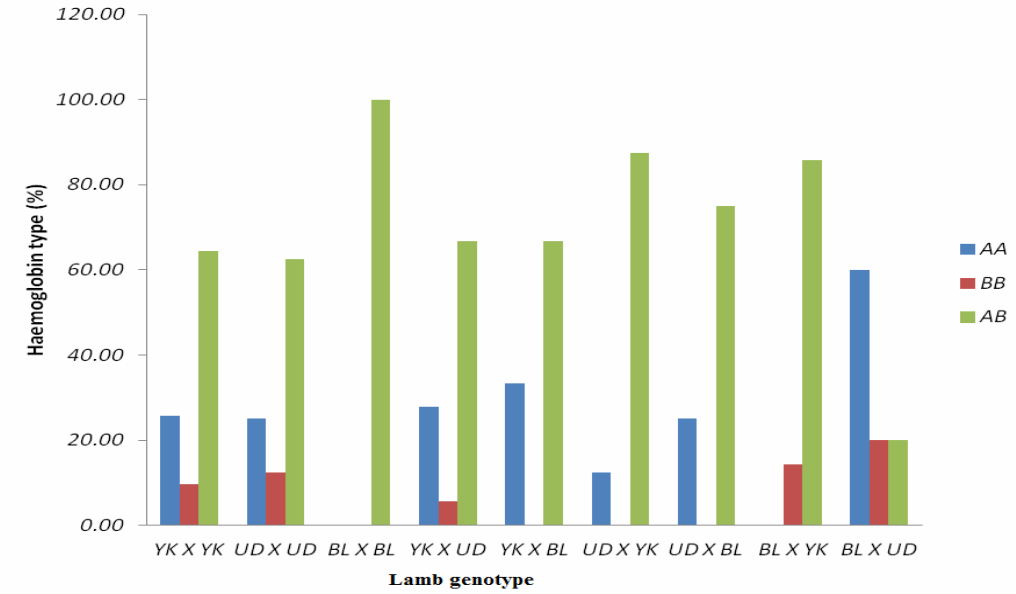

Figure 2. Distribution of haemoglobin types within lamb genotype at 90-days

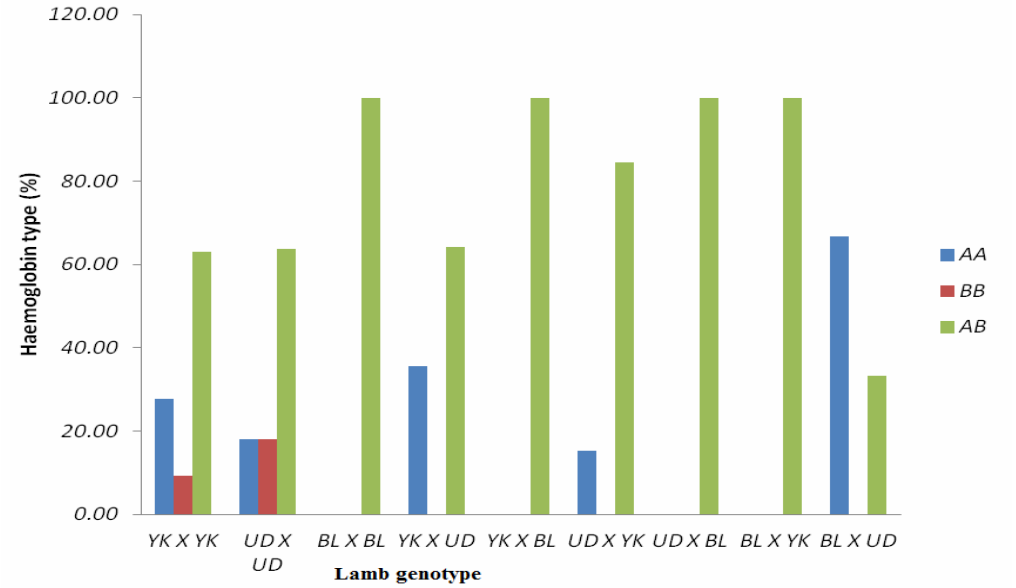

Figure 3. Distribution of haemoglobin types within lamb genotypes at 180-days

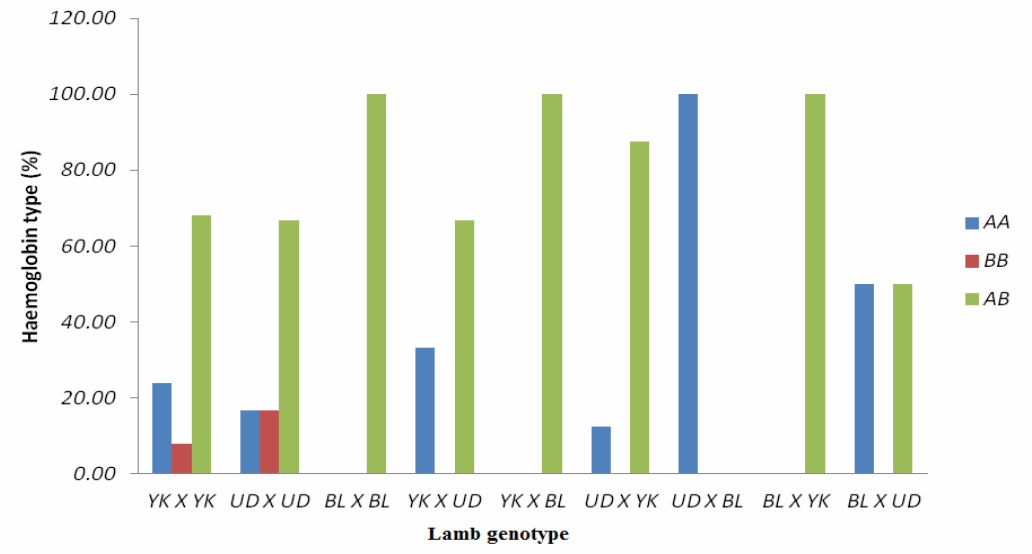

Figure 4. Distribution of haemoglobin types within lamb genotypes at 360-days

Conclusion and Recommendation

Survivability of lamb that were given birth to by dams with haemoglobin type AB (HbAB) is highest in the studied populations from birth to 360-Day. Lambs with HbAB should be selected for improved survivability of sheep in Northern Nigeria.

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Uticaj hemoglobin varijante majki na preživljavanje jagnjadi

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Rezime

Ukupno 65 jankasa, 23 uda i 16 balami ovaca su uparene sa 4 jankasa, 3 uda i 3 balami ovna u jednom dialelnom obrascu parenja i dobijeno je 192 jagnjadi u okviru 9 genotipova, koji su korišćeni za proučavanje preživljavanje jagnjadi u odnosu na hemoglobin varijante njihovih majki. Uzorci krvi (5ml) su prikupljeni od 104 ovce i 10 ovnova punktiranjem vratne vene. Elektroforeza je izvedena u Shandon rezervoaru za elektroforezu, na celuloza acetat trakama. Svaki od 9 genotipova je imao vrlo visok procenat HbAB. Tip hemoglobina majki BB (HbBB) je utvrđen samo kod jagnjadi YK x YK, UD x UD, YK x UD, BL x YK and BL x UD na rođenju i uzrastu od 90 dana. Preživljavanje jagnjadi koja su imale majke sa hemoglobin tipom AB (HbAB) je najviša u ispitivanim populacijama od rođenja do uzrasta of 360 dana. Jagnjad sa HbAB treba izabrati za poboljšanje preživljavanja ovaca u severnoj Nigeriji.

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