

1280 200001589



Blood Polymorphism in West African Breeds of Sheep

A. Missohou^{1*}, T.C. Nguyen², R. Sow³ and A. Gueye⁴

¹Service de Zootechnie-Alimentation, Ecole Inter-Etats des Sciences et Médecine Vétérinaire.~ (EISMV), BP 5077 Dakar, Sénégal; ²Laboratoire d'Analyses Génétiques pour les Espèces Animales (LABOGENA), INRA, 78352 Jouy-en-Josas, France; ³Institut National de Recherche Agronomique, Laboratoire de Hann, Dakar, Sénégal

*Correspondence

Missohou, A., Nguyen, T.C., Sow, R. and Gueye, A., 1999. Blood polymorphism in West African breeds of sheep. *Tropical Animal Health and Production*, 31(3), 175-179

ABSTRACT

This paper reports the blood groups and blood protein distribution in West African sheep breeds. About 100 animals of the Djallonke, Fulani and Touabire breeds were sampled for blood polymorphism analysis. Their blood groups were typed by haemolytic and agglutination reactions, and their blood proteins by starch gel electrophoresis. Almost all the loci analysed showed variability in the three breeds, with the Touabire and Fulani being closer to each other than to the Djallonke.

Keywords: blood groups, breed, haemoglobin, sheep, serum protein, transferrin

INTRODUCTION

In West Africa, two types of hairy thin-tailed sheep have been reported: the savannah and the forest types (Epstein, 1971). The savannah type in the tsetse fly-free area is large, long-legged and trypanosusceptible, while the dwarf forest type found in the humid zone is trypanoresistant. Bradley (1995) demonstrated an increasing introgression of trypanosusceptible blood into trypanoresistant cattle as a consequence of the increase in transhumance in recent decades due to drought and to farmers' preference for large animals.

Since genetic diversity is a basic requirement for animal improvement, it needs to be preserved through characterization and management. Blood groups and blood proteins have been used widely to characterize animal populations because of their polymorphism and their simple mode of inheritance. Moreover, they are supposed to be linked to productivity traits and environmental adaptation (Dally *et al.*, 1980; Vicovan and Rascu, 1989; Charon *et al.*, 1996). However, data on blood polymorphism in tropical African sheep are scarce and refer only to their haemoglobin types (Olusanya, 1975; Ndamukong, 1995).

This paper reports the distribution of blood groups and blood proteins in three West African breeds of sheep.

MATERIALS AND METHODS

Animals

Blood samples were collected from Senegalese Djallonke (dwarf forest type). Peul-peul (Fulani) and Touabire (Savannah type) breeds of sheep. The Fulani sheep were sampled in the Djoloff, located 250 km from Dakar in north Senegal, while the Djallonke animals were chosen in Kolda, south Senegal, about 500 km from the capital. The Touabire sheep, which originated from Mauritania, were sampled in Dakar market, where they are brought for sale.

Blood samples (5 ml) were collected from approximately 100 animals per breed. The animals were adults of both sexes and were chosen from different flocks. The blood samples were collected into sodium citrate and sent to the Laboratoire d'Analyses Génétiques pour les Espèces Animales (LABOGENA), Jouy-en-Josas. France, for analysis.

Blood typing and data analysis

The blood protein polymorphism was analysed by starch gel electrophoresis and by electrofocalisation in the case of haemoglobin (Nguyen and Bunch, 1980).

Six OEA (ovine erythrocyte antigen) systems were analysed by haemolytic and haemagglutination reactions as described by Nguyen (1972). Blood protein alleles were determined by direct counting; blood group 'allele' frequencies were calculated after Hardy-Weinberg equilibrium had been established at the transferrin and carbonic anhydrase loci.

RESULTS

Blood group polymorphism

The distribution of blood groups in the three sheep breeds is shown in Table 1. The observed allelic frequencies may be biased because of the low number of animals used. However, according to Nei (1978), the error is low in sample sizes of 100. Except for locus B, which was very polymorphic, all the other alleles were present in the three breeds at different frequencies. The differences between the Djallonke and Fulani sheep were statistically significant ($p < 0.05$) for alleles A^{ab} , C^{ab} , D^a and R , the Touabire sheep being intermediate.

Bloodproteins

TABLE I
OEA allele frequencies in West African breeds of sheep

Systems	Alleles	Frequencies		
		Djallonke	Fulani	Touabire
A	a	0.526	0.55	0.499
	b	0.087	0.035	0.068
	ab	0.025	0.001	0.021
B	b	0.03	0.181	0.161
	ab	0.005	0.027	0.108
	abe	0	0.022	0
	abi	0	0.023	0
	hi	0.020	0.051	0.148
	d	0.05	0.007	0.027
	di	0	0	0.046
	e	0.05	0.014	0.013
	ei	0	0	0.038
	i	0.025	0.079	0.020
	a	0	0.022	0
	a	0.005	0.045	0.071
	ab	0.005	0.056	0.063
D	a	0.529	0.341	0.471
M	a		0.99	0.975
R	r	0.326	0.44	0.408
Accordance with Hardy-Weinberg law ^a				
Tf: χ^2 : 4 df		4.64	3.25	4.92
CA: χ^2 : 1df		0.038	0.756	0.277

^aTf, transferrin; CA, carbonic anhydrase: df, degrees of freedom

Djallonke sheep in Cameroon (Ndamukong, 1995) but contradicts results obtained in the same breed in Nigeria by Olusanya (1975). Concerning transferrin, seven phenotypes (AA, CC, AD, AB, AC, AD and CD) were observed, the gene alleles being *TfA*, *TfB*, *TfC* and *TfD*. The pattern of distribution of the B and D alleles (respectively low and high in the Djallonke breed and medium in the other breeds) confirmed the results obtained in trypanosusceptible and trypanoresistant cattle by

TABLE II
Distribution of blood protein in West African breeds of sheep

Systems	Alleles	Allele frequencies		
		Djallonke	Fulani	Touabire
Transferrin	A	0.216	0.428	0.308
	G	0	0.041	0.030
	B	0.05	0.072	0.142
	C	0.110	0.139	0.126
	D	0.609	0.320	0.394
Haemoglobin	A	0	0	0.15
	B	1	1	0.985
Carbonic anhydrase	M	0.232	0.08	0.05
	S	0.768	0.920	0.95
Protein X	X	0.112	0.094	0.089

DISCUSSION

Although several sheep breeds have been described in West Africa (Doutressole, 1947; Epstein, 1971), little is known about the extent of genetic diversity between and within these breeds (Rege, 1994). In this paper, we analyse the value of blood groups and blood protein polymorphism in the genetic study of sheep breeds. The overall results showed significant differences between the Djallonke breed on the one hand and the Touabire and Fulani breeds on the other. In a spatial autocorrelation study, Ordas and Carriedo (1996) showed that the allele frequency differences among European sheep breeds were due to migration and genetic drift. This could support the existence of differences in the historic expansion into West Africa of Djallonke and the other breeds and is consistent with the classification of Epstein (1971). In fact, this author pooled the Touabire and Fulani breeds in the same group (the Savannah) while the Djallonke breed was classified as a forest type.

CONCLUSION

Analysis of the biochemical polymorphism in West African sheep breeds showed differences among breeds which reflected their historic expansion. However, this work needs to be continued on a greater number of breeds and with other markers (microsatellites). The relationship between clonal proteins and economically relevant

REFERENCES

- Braend, M. and Khana, N.D., 1968. Haemoglobin and transferrin type of some West African cattle. *Animal Production*, **10**, 129-134
- Bradley, D., 1995. *Genetic characterisation of cattle in West and Central Africa*, (Department of Genetics, Trinity College, Dublin 2, Annual report)
- Charon, K.M., Lipecka, C., Siudek, T. and Swiderek, W., 1996. Relationship between transferrin and globulin antigen polymorphism and sheep resistance to mastitis. *Journal of Applied Genetics*, **37**, 161-172
- Dally, M.R., Hohenboken, W., Thomas, D.L. and Craig, A.M., 1980. Relationships between hemoglobin type and reproduction, lamb, wool and milk production and health-related traits in crossbred ewes. *Journal of Animal Science*, **50**, 418-427
- Doutressole, E.G., 1947. *L'élevage en Afrique Occidentale Française*, (Larousse, Paris)
- Epstein, H., 1971. *Origin of the Domestic Animals of Africa ZZ*, (African Publishing Corporation, New York, London, Munich)
- Ndamukong, K.J.N., 1995. Haemoglobin polymorphism in grassland dwarf sheep and goats of the north west province of Cameroon. *Bulletin of Animal Health and Production in Africa*, **43** 53-56
- Nei, M., 1978. Estimation of average heterozygosity and genetic distance from a small number of individuals. *Genetics*, **89**, 583-590
- Nguyen, T.C., 1972. Les groupes sanguins des ovins 1. Relations entre les groupes sanguins des ovins et des bovins. *Annale de Génétique et de Sélection Animale*, **4**, 363-374
- Nguyen, T.C. and Bunch, T.D., 1980. Blood groups and evolutionary relationships among sheep (*Ovis aries*), domestic goat (*Capra hircus*) aoudad (*Ammotragus lervia*) and European mouflon (*Ovis musimon*). *Annales Génétique Sélection Animale*, **12**, 169-180
- Olusanya, S.K., 1975. Electrolyte concentration and haemoglobin types in the blood of Nigerian dwarf sheep. *Journal of the Nigerian Veterinary Medical Association*, **4**, 59-63
- Ordas, J.G. and Carriedo, J.A., 1996. Spatial autocorrelation of ovine protein polymorphisms in Europe. *Genetics, Selection Evolution*, **28**, 531-536
- Queval, R., 1982. Polymorphisme de la transferrine chez les bovins trypanosensibles et trypanotolérants de l'Afrique de l'Ouest. Répartition de fréquence des allèles. *Revue d'Élevage et de Médecine Vétérinaire Pays Tropicaux*, **35**, 373-380
- Rege, J.E.O., 1994. Indigenous African small ruminants: a case of characterisation and improvement. In: *Small Ruminant Research and Development*, Proc. 2nd Bi-annual Conference of the African Small Ruminant Network, 1992, (AICC, Arusha, Tanzania)
- Vicovan, G. and Rascu, D., 1989. Types of hdmoglobin in sheep related to environmental adaptation. *Archiva Zootechnica*, **1**, 33-44

(Accepted: 29 October 1998)

Polimorfismo sanguíneo en razas ovinas de África Occidental

Resumen - Este artículo estudia la distribución de proteínas plasmáticas y grupos sanguíneos en razas ovinas de África Occidental. Se obtuvieron muestras de sangre de alrededor de 100 animales de las razas Djallonke, Fulani y Touabire, con objeto de estudiar su polimorfismo sanguíneo. Los grupos sanguíneos se tipificaron mediante reacciones de hemólisis y aglutinación, y las proteínas sanguíneas mediante electroforesis en gel. Casi todos los loci analizados mostraron variabilidad en las 3 razas, siendo las razas Touabire y Fulani más parecidas entre sí que a la raza Djallonke.