BLOOD PROTEIN POLYMORPHISM IN MALABARI GOATS

Goat production in Kerala is centered mainly on its native breed "Malabari", a dual-purpose goat of North Kerala. The animals have predominant breed characteristics of white and a combination of white with black and brown. They are mostly long eared and horned with convex forehead and have rounded udders with funnel shaped pointed teats. There exist significant difference between populations of this breed with regard to traits of economic importance and hence the data obtained from any particular population cannot be extrapolated to the breed as a whole.

One way to study this genetic diversity is by the determination of genetic variability through polymorphism studies. Polymorphism in a population assures a pool of genetic variability, for if none exists, there would be no progress made through selection and breeding. This accentuates the need to study polymorphism between breeds as well as within breeds. Polymorphism studies can be undertaken at various levels, *viz.,* expressed protein studies to the genic level studies.

The protein variants have their use in the study of origin and evolution of breeds of livestock. These markers have proved to be useful for parentage determination and population analysis (Groselande *et al.,* 1990).

Blood samples of 300 Malabari goats belonging to three different goat populations, 100 each at Tanur, Thalassery and Badagara, formed the materials for the present study.

Sodium Dodecyl Sulphate Polyacrylamide gel electrophoresis (SDS PAGE) was used for visualising albumin and transferrin bands. Eight percent of the resolving gel and five percent of the stacking gel were used for the preparation of the SDS polyacrylamide gel. Tris-glycine electrophoresis buffer was used in the top and bottom reservoirs. Fifteen microlitres each of the serum samples were loaded in the wells and electrophoresed at 85 V for four hours. The gel was stained with Coomassie Brilliant Blue for 30 min and was destained overnight in destaining solution.

Native PAGE was employed for typing cerruloplasmin, amylase and carbonic anhydrase. Tris borate EDTA buffer was used in the top and bottom reservoirs. Fifteen microlitres of the serum was loaded in the wells and electrophoresed at 85 V for three hours. The allelic frequencies were estimated by the method of Nguyen *et al.* (1992).

On electrophoresis, transferrin variants showed distinct movement towards anodic end of the electrophoretogram revealing two electrophoretically distinct transferrin types. The fast moving one was designated as Tf^{A} and slow moving band was designated as Tf^{B} in accordance with the nomenclature of Trehan *et al*. (1981). Phenotypes Tf_{AA} and Tf_{BB} were represented by two bands each on the polyacrylamide gel, while phenotypes AB were represented by three bands. Faster band of Tf_{BB} corresponded with slower band of Tf_{AA}. Individual animals were found to possess either one or both the transferrin types. Transferrin AB phenotype could be observed in Tanur and Badagara populations, unlike in Thalassery population, where all the animals typed were of Tf_{AA} type. No Tf_{BB} phenotype could be detected in the present study. Out of the 100 animals studied in the Tanur area, 99 animals were of Tf_{AA} type and only one was of Tf_{AB}. In Thalassery all the 100 animals belonged to Tf_{AA} type. In Badagara, of the 100 animals studied, 95 were of Tf_{AA} while five belonged to Tf_{AB} type.

The gene frequency of Tf^{A} was high in Tanur and Badagara populations (0.995 and 0.974, respectively) while that of Tf^{B} was 0.005 and 0.026, respectively. In pooled population, gene frequency of Tf^{A} and Tf^{B} were 0.990 and 0.010 respectively. In the total population studied, a predominance of the Tf^{A} variant could be detected. The above finding is in

agreement with the observations of Fesus *et al.* (1983) who reported that majority of the goat breeds in the world have gene frequency of Tf^A more than that of Tf^B. Similar results in exotic breeds were given by Menrad *et al.* (1994) in Boer and improved Fawn goats and Canatan and Boztepe (2000) and Elmaci (2003) in hair goats of Turkey.

In contradiction to the present findings with regard to the gene frequency, predominance of Tf^B allele has been reported by Baruah and Bhat (1980) in Jamunapari and Barbari goats. As against the finding of only two alleles with regard to transferrin locus as evinced by the present study, many authors have reported the presence of more than two variants for transferrin alleles in goats, *viz.* Bhat (1987) in Pashmina goats, Kumar and Yadav (1988) in Jhakrana, Kutchi, Marwari and Sirohi goats and Pepin and Nguyen (1994) in West African goats.

In the present study, the transferrin locus was in Hardy-Weinberg equilibrium which is in agreement with Trehan *et al.* (1981), in Alpine, Sannen, Nubian, Alpine x Beetal and Sannen x Beetal cross breds.

Two bands each were observed for albumin in all the animals studied, a fast moving band designated as Al^F and a slow moving band Al^S, revealing absence of polymorphism at albumin locus. The study agrees with the findings of Shamsuddin *et al.* (1986) in Malabari goats. Two albumin variants in goats have already been reported by Tunon *et al.* (1989) in Spanish goat breeds, Vankan and Bell (1992) in Cashmere goats and Ertugrui and Akyuz (2000) in Angora goats, but with higher degree of polymorphism at the locus.

Single band could be observed for cerruloplasmin, amylase and carbonic anhydrase in all the animals studied, indicating absence of polymorphism at the three loci studied.

With regard to cerruloplasmin locus, similar findings were reported by Bhat (1986) in Jamunapari and Sirohi breeds, Bhat (1987) in Changthangi and Chegu breeds and Tunon *et al*. (1989) in Spanish goat breeds.

In contrast to the above findings polymorphism at cerruloplasmin locus were reported by Elmaci (2003) in hair goats of Turkey. But the frequency of the variant allele was very low (0.027).

The finding with regard to carbonic anhydrase polymorphism is in agreement with the observations of Casati *et al.* (1990) in Sarda breeds and Pepin and Nguyen (1994) in five breeds of goats viz. French Alpine, French Saannen, Guadeloupean Cresole, Guinean and West African Sahel.

Single band indicating absence of polymorphism at amylase locus is in agreement with the reports by Shamsuddin *et al.* (1986) in Malabari, Bhat (1987) in Changthangi and Chegu goats and Menrad *et al.* (1994) in German improved Fawn and Boer goats.

In contrast to the above findings, polymorphism at amylase locus was observed in Jamunapari and Sirohi goats (Bhat, 1986) and in Turkish hair goats (Elmaci, 2003). Two variants for amylase locus were observed by the above workers; the frequency of the variant allele was very low.

Summary

Malabari goat populations of Tanur, Thalassery and Badagara were studied for blood protein polymorphisms to investigate the similarities and differences between these populations. Two variants for transferrin (Tf^A and $Tf^{B)}$ were detected with a predominance of Tf^A in the population. All the goats from Thalassery population belonged to Tf_{AA} type. In the present study only two phenotypes as regards transferrin locus could be observed, (Tf_{AA} and Tf_{AB}) with the notable absence of Tf_{BB}. No polymorphism was observed for albumin, cerruloplasmin, amylase and carbonic anhydrase loci in all the animals tested.

References

Baruah, P. and Bhat, P. P. 1980. Note on the genetics of haemoglobin and transferrin polymorphisms in three breeds of Indian goats. *Indian J. Anim. Sci.,* **50**: 576-579

Bhat, P. P. 1986. Genetic markers in Jamunapari and Sirohi goat breeds. *Indian J. Anim. Sci.,* **56**: 430-433

Bhat, P. P. 1987. Genetic studies on biochemical polymorphisms of blood serum proteins and enzymes in Pashmina goats. *Indian J. Anim. Sci.* **57**: 598-600

Casati, M. Z., Gandini, G. C. and Leone, P. (1990). Genetic variation and

distances of five Italian native sheep breeds. *Anim. Genet.,* 21: 87-92

Canatan, T. and Boztepe, S. 2000. The polymorphisms of haemoglobin and transferrin in Turkish hair goat. *Indian Vet. J.* **77**: 966- 968

Elmaci, C. 2003. Some genetic markers in the native hair goats of Turkey. *Indian Vet. J.,* **80**: 223-225

Ertugrui, O. and Akyuz, B. 2000. Some blood protein polymorphisms in Angora goat breed (*Capra hircus*) raised in villages. *Veteriner Fackultesi Dergisi Ankara Universites.* **47** : 23-29

Fesus, L., Varkonyi, S. and Ats, A. (1983). Biochemical polymorphisms in goats with special reference to the Hungarian Native breed. *Anim. Blood Groups Biochem. Genet.,* 14: 1-6

Groselande,F., Aupetit,R.Y., Leebvere,J. and Merioux, J.G.1990. Essaid analyse des elations genetiques entrelos races bovines francaises a polymorphisme biochimique. *Genetique Selection Evolution,* **22**: 317-318

Kumar, S. and Yadav, B. R. 1988. Transferrin polymorphism in goat breeds of north-Western India. *Int. J. Anim. Sci.,* **3**: 97 – 100

Menrad, M., Muller, E., Stier, C. H., Geldermann, Gall, C. 1994. Protien polymorphisms in the blood of German Improved Fawn and Boer goats. *Small Rum. Res.,* **14**: 49-54

Nguyen, T. C., Morera, L., Llanes, D. and Leger, P. 1992. Sheep blood polymorphism and genetic divergence between French Rambouillet and Spanish Merino: role of genetic drift. *Anim. Genet.,* **23**: 325-332

Pepin, L. and Nguyen, T. C. 1994. Blood groups and protein polymorphisms in five goat breeds (*Capra hircus)*. *Anim. Genet.,* **25**: 333-336

Shamsuddin, A. K., Nandakumaran. B. and Mukundan, G. 1986. Genetic studies on haemoglobin albumin and amylase polymorphism in Malabari goats and its exotic cross breds. *Kerala J. Vet. Sci.* **17**: 1-6

Trehan, K. S., Nair, P. G. and Nair, K. G. S. 1981. Transferrin polymorphism in some exotic and Indian breeds of goat and their cross-breds. *Indian J. Anim. Sci.,* **51**: 48-55

Tunon, M. J., Gonzalez, P. and Vallejo, M. 1989. Genetic relationships between 14 native Spanish breeds of goat. *Anim. Genet*., **20**: 205- 212

Vankan, D. M. and Bell, K. 1992. Genetic polymorphism of plasma vitamin D – binding protein (GC) in Australian goats. *Anim. Genet.,* **23**: 457-462

K. A. Bindu[1], K. C. Raghavan[2] and K. V. Raghunandanan[3]

Centre for Advanced studies in Animal Genetics and Breeding
College of Veterinary and Animal Sciences
Mannuthy- 680 651, Thrissur, Kerala

❑

1. Associate Professor, CVAS ,Pookode, Wayanad
2. Professor & Head
3. Director (Retd.)