Haemoglobin Polymorphism in Malabari Goats

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Abstract

Malabari Goat populations of Tanur, Thalassery and Badagara were studied for haemoglobin polymorphism. Two variants were observed for haemoglobin, Hb A and Hb B with a frequency of 0.987 and 0.012, respectively, suggestive of three phenotypes, viz. Hb AA, Hb AB and Hb BB, and indicating the predominance of Hb A in the pooled population. Hb B variant was observed only in the Thalassery population (gene frequency 0.038).

Key words: Polymorphism, Haemoglobin, Phenotype

Introduction

Goat production in Kerala is centered mainly on its native breed "Malabari", a dual-purpose goat of North Kerala. This breed is supposed to have originated centuries back by mixing of native feral goats with Arab, Surti and Mesopotamian goats along with the native goats of Western cost (Kaura, 1952). The breed owes its name to the area where they belong, extensively distributed in the Malabar area of Kerala. 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.

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

Materials and Methods

Three hundred goats, one hundred each belonging to three different centers of All India Co-ordinated Research Project on Malabari Goat Improvement, belonging to Tanur, Thalassery and Badagara centers of Kerala state were typed for haemoglobin using Vertical non-denaturing Polyacrylamide Gel Electrophoresis (PAGE).

Five milliliters of whole blood was collected aseptically from each animal in centrifuge tubes containing heparin (5000 IU/ml) as anticoagulant. The whole blood was centrifuged; cell pellets were collected and washed with normal saline. Gel slabs were made using eight percent acrylamide gel mix. Tris borate EDTA buffer was used in the top and bottom reservoirs. The cell pellet was diluted with distilled water (1:10). Fifteen microliters of the diluted cell pellet was loaded in the wells and electrophoresed at 100 V for three hours. The gel was stained with Coomassie Brilliant Blue for 30 minutes and was destained overnight. The allelic frequencies were estimated by the method of Nguyen et al. (1992).

Results and Discussion

On electrophoresis, the haemoglobin bands showed distinct movement towards anodic end of the electrophoretogram and two electrophoretically distinct haemoglobin variants were identified. The fast moving one was designated as Hb A while the slow moving one was HbB. Individual animals possessed either one or both the haemoglobins and were accordingly designated as HbAA, HbBB or HbAB. All the three haemoglobin phenotypes (HbAA, HbAB and HbBB) were observed in the present study. The haemoglobin pattern of animals belonging to three different centers is given in table 1.

Among 300 animals typed, 293 animals were of HbAA, six were of HbAB and only one of HbBB phenotype with a gene frequency of 0.987 and 0.012 with regard to HbA and HbB, respectively. The Chi-square test revealed that the population as a whole was not in Hardy-Weinberg equilibrium (Table 1).

Genotypic frequencies of 97.67, 2.00 and 0.33 per cent were observed for HbAA, HbAB and HbBB in

Table- 1. Phenotype frequencies and gene frequencies of haemoglobin variants in Malabari goats

Population	No. of animals	Pheneotype frequencies			Gene frequencies		Chi square
		HbAA	HbAB	HbBB	Hb^A	Hb^B	
Tanur	100	100	0	0	1	0	0.00
Thalassery	100	93	6	1	0.962	0.038	5.52*
Badagara	100	100	0	0	1	0	0.00
Pooled	300	97.67	2.00 (293)	0.33 (6)	0.987 (1)	0.012	24.73**

* $p \geq 0.05$ * * $p \geq 0.01$ Observed number in the parenthesis

Malabari goat population under study. All goats belonging to Tanur and Badagara were found to be of HbAA type with an allelic frequency of HbA as one. In Thalassery, the frequencies of HbA and HbB were found to be 0.962 and 0.038, respectively indicating a predominance of Hb A in the population. Similar findings have been reported by Bhat (1985) in Jamunapari goats.

In exotic breeds, a clear predominance of HbA variant over HbB has been established by Canatan and Boztepe (2000) and Elmaci (2003) in Turkish goats.

In the present study, no Hb BB phenotype could be observed in Tanur and Badagara goat populations. Shamsuddin et al. (1986) made similar findings in Malabari, Saanen halfbreds and Alpine halfbreds. The study conducted by Canatan and Boztepe (2000) in goats of Turkey, which revealed no Hb BB phenotype, is also in agreement with that of the present study. The absence was attributed to the inability of the animals of Hb BB phenotype to survive in rural regions of Toros Mountains. The authors also reported that the absence of Hb BB phenotype in Hb loci had a selective advantage.

The present work revealed that the pooled population under study was not in Hardy-Weinberg equilibrium. Significant deviations from Hardy-Weinberg equilibrium refer to a deficiency of heterozygous genotypes in the populations. Similar findings have also been reported by Menrad et al. (2002) in Pashmina goats.

Perusal of the literature available on haemoglobin polymorphism in Indian as well as exotic goat breeds showed predominance of Hb A variant as well as Hb AA phenotype in almost all the goat breeds.

The absence or negligible presence of HbB allele in goats, indigenous as well as exotic, may be indicative of either adaptive preference of Hb A allele to Hb B allele or species characteristic.

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